

**MALNUTRITION AND QUALITY OF LIFE AMONG OLDER
PERSONS IN KANDY DISTRICT, SRI LANKA: A MIXED
METHOD STUDY**

**HEWARTNE DASSANAYAKEGE WIMALA THUSHARI
DAMAYANTHI**

**THESIS SUBMITTED IN FULFILMENT OF THE
REQUIREMENTS OF THE DEGREE OF DOCTOR
OF PHILOSOPHY**

**FACULTY OF MEDICINE
UNIVERSITY OF MALAYA
KUALA LUMPUR**

2017

UNIVERSITY OF MALAYA
ORIGINAL LITERARY WORK DECLARATION

Name of Candidate: Hewaratne Dassanayakege Wimala Thushari Damayanthi

Matric No: MHA 140047

Name of Degree: Doctor of Philosophy

Title of Project Paper/Research Report/Dissertation/Thesis ("this Work"):

Malnutrition and Quality of Life among Older Persons in Kandy District, Sri Lanka:
A Mixed Method Study

Field of Study: Medicine (Nursing Sciences)

I do solemnly and sincerely declare that:

- (1) I am the sole author/writer of this Work;
- (2) This Work is original;
- (3) Any use of any work in which copyright exists was done by way of fair dealing and for permitted purposes and any excerpt or extract from, or reference to or reproduction of any copyright work has been disclosed expressly and sufficiently and the title of the Work and its authorship have been acknowledged in this Work;
- (4) I do not have any actual knowledge nor do I ought reasonably to know that the making of this work constitutes an infringement of any copyright work;
- (5) I hereby assign all and every rights in the copyright to this Work to the University of Malaya ("UM"), who henceforth shall be owner of the copyright in this Work and that any reproduction or use in any form or by any means whatsoever is prohibited without the written consent of UM having been first had and obtained;
- (6) I am fully aware that if in the course of making this Work I have infringed any copyright whether intentionally or otherwise, I may be subject to legal action or any other action as may be determined by UM.

Candidate's Signature

Date:

Subscribed and solemnly declared before,

Witness's Signature

Date:

Name:

Designation:

MALNUTRITION AND QUALITY OF LIFE AMONG OLDER PERSONS IN KANDY DISTRICT, SRI LANKA: A MIXED METHOD STUDY

ABSTRACT

Malnutrition among older persons is a multi-dimensional problem. It predisposes the older persons to increased risk of hospitalisation, disability and mortality; and decreased quality of life (QoL). However, little is known about malnutrition and QoL among older persons in community settings in Sri Lanka. Therefore, this study aimed to investigate the malnutrition and QoL among community-dwelling older persons in Sri Lanka. A mixed methodology approach was used in two phases. A cross sectional design was done in the first phase. Seven divisional secretariats in Kandy district were selected using multi-stage sampling. The nutritional status was assessed using the Mini Nutritional Assessment- Short Form (MNA-SF). Quality of life was assessed using Euro 5D 3L index and visual analogue scale. Demographic data and factors associated with malnutrition were recorded using a standardised questionnaire. Physical activity was measured using International Physical Activity Questionnaire. Depression was assessed using Geriatric Depression Scale. Data analysis was done using Complex sample logistic regression. The second phase was a qualitative design. Fifteen focus group discussions were conducted among the purposefully selected malnourished older persons to explore the factors of malnutrition. Thematic analysis was executed in data analysis to identify the themes on factors related to malnutrition. The response rate of phase 1 was 76.85% (n=999). Majority of the respondents were females (71.9 %) with mean age 72.29 years (95% confidence interval: 70.59, 73.98). The prevalence of malnutrition, at risk of malnutrition and well-nourished were 12.5%, 52.4% and 35.1%. Alcohol consumption (aOR: 4.06, 95% CI: 1.17, 14.07), hypertension (aOR: 1.71, 95% CI: 1.02, 2.89) and age (aOR:1.06., 95% CI: 1.01, 1.11) had increased odds for malnutrition. For every additional number of person living with the older person, there

was 9% reduced odds of being malnutrition (aOR: 0.91, 95% CI: 0.85, 0.97). The mean QoL score was 0.44 (95% CI: 0.42, 0.46). Age (β -0.02, 95% CI: -0.02,-0.01) and higher physical activity (β : 0.10, 95% CI: 0.02, 0.19) showed significant association with QoL. The qualitative phase explored factors influencing malnutrition identified four main themes: factors affecting dietary patterns, factors affecting food choices, health status and psychological challenges. These themes appear to confirm the influencing factors identified from the quantitative data. The various psychological challenges reported serve to highlight not only the physical but also psychosocial factors that can influence nutrition status. The prevalence of malnutrition in Sri Lankan community-dwelling older persons is similar to international figures. Early identification of at risk of malnourished older persons is crucial. Our results are useful for the planning of intervention programs to improve the nutritional status and quality of life among older persons in the community settings.

Key words: community-dwelling, older persons, malnutrition, quality of life,
Sri Lanka

MALNUTRISI DAN KUALITI HIDUP ANTARA WARGA TUA DI DAERAH KANDY, SRI LANKA :KAJIAN *MIXED METHOD*

ABSTRAK

Malnutrisi di antara warga tua adalah masalah multi-dimensi. Malnutrisi mendedahkan warga tua kepada risiko kemasukan hospital, kecacatan dan kematian; dan mengurangkan kualiti hidup. Akan tetapi, pengetahuan tentang malnutrisi dan kualiti hidup antara warga tua di penetapan komuniti di Sri Lanka adalah kurang. Oleh kerana itu, kajian ini bertujuan untuk malnutrisi; dan juga kesan malnutrisi ke atas quality hidup antara warga tua di penetapan komuniti di Sri Lanka. Kajian gabungan telah dijalankan dalam dua fasa. Fasa pertama menggunakan reka kajian keratan rentas. Kajian ini dijalankan di tujuh divisi secretariat di daerah Kandy menggunakan pensampelan multi-peringkat. Status nutrisi dinilai dengan menggunakan *Mini Nutritional Assessment-Short Form (MNA-SF)*. Kualiti kehidupan dinilai dengan indeks *Euro 5D 3L* dan skala *visual analogue*. Soal selidik standard telah digunakan untuk rekod data demografi dan factor-faktor yang berhubungkait dengan malnutrisi. Aktiviti fizikal dan kemurungan dinilai dengan menggunakan soal selidik *International Physical Activity* dan skala *Geriatric Depression* masing-masing. Analisa *Complex sample logistic regression* telah dilaksanakan. Fasa kedua adalah reka kualitatif. Lima belas perbincangan kumpulan fokus dijalankan di antara warga tua malnutrisi yang dipilih untuk menyelidik factor-faktor malnutrisi. Analisa tematik dilakukan untuk mengenalpasti tema factor-faktor berkaitan dengan malnutrisi. Kadar respon fasa pertama ialah 76.85% (n=999). Majoriti responden adalah wanita (71.9 %) dengan purata usia 72.29 tahun (95% *confidence interval*: 70.59, 73.98). Kelaziman malnutrisi, risiko menghadapi malnutrisi dan nutrisi baik adalah 12.5%, 52.4% dan 35.1%. Penggunaan alkohol (aOR: 4.06, 95% CI: 1.17, 14.07), hipertensi (aOR: 1.71, 95% CI: 1.02, 2.89) dan usia (aOR:1.06., 95% CI: 1.01, 1.11) didapati meningkatkan

kemungkinan untuk menghadapi malnutrisi. Kemungkinan untuk menghadapi malnutrisi berkurang 9% untuk pertambahan setiap seorang yang tinggal bersama warga tua (aOR: 0.91, 95% CI: 0.85, 0.97). Majoriti warga tua mempunyai kualiti kehidupan yang rendah (81.9%). Penggunaan gigi palsu (aOR: 0.49, 95% CI: 0.27, 0.91), warga tua muda (aOR: 0.01, 95% CI: 0.001, 0.03) dan warga tua pertengahan (aOR: 0.07, 95% CI: 0.01, 0.34) dilindungi daripada kualiti kehidupan yang rendah, manakala warga tua yang mengambil diet vegetarian meningkatkan kemungkinan kualiti kehidupan yang rendah (aOR: 2.17, 95% CI: 1.66, 4.02). Skor purata QoL adalah 0.44 (95% CI: 0.42, 0.46). Umur (β 0.02, 95% CI: 0.02, 0.19) menunjukkan hubungkait yang signifikan dengan QoL. Fasa kualitatif meneroka faktor-faktor mempengaruhi malnutrisi telah mengenalpasti empat tema: faktor mempengaruhi cara pengambilan diet, faktor mempengaruhi pemilihan makanan, status kesihatan dan cabaran psikologikal. Tema tersebut mengesahkan faktor-faktor yang mempengaruhi malnutrition telah dikenalpasti dari data kuantitatif. Pelbagai cabaran psikologikal bukan sahaja menumpukan perhatian pada faktor fizikal, malahan faktor psikososial yang boleh mempengaruhi status malnutrisi. Kelaziman malnutrisi di kalangan warga tua di komuniti Sri Lanka adalah sama dengan angka antarabangsa. Mengenalpasti risiko malnutrisi antara warga tua dengan awal adalah amat penting. Keputusan kajian ini berguna dalam perancangan untuk program intervensi supaya mempertingkatkan status nutrisi dan kualiti kehidupan antara warga tua di penetapan komuniti.

Keywords: Penetapan komuniti, warga tua, malnutrisi, kualiti hidup, Sri Lanka

ACKNOWLEDGMENTS

First and foremost, I would like to express my sincere gratitude to my supervisors Associate Prof. Dr. Khatijah Lim Abdullah and Associate Prof. Dr. Foong Ming Moy who have supported me throughout my thesis journey with patience, enthusiasm and knowledge. Also, I extend my sincere gratitude to Associate Prof. Samath D. Dharmarathna for the continuous support of my Ph.D study and research. Without their proper guidance, this thesis would hardly have been completed.

Besides my supervisors, I would like to thank Dr. Pathmawathi Subramaniam for her encouragement and insightful comments at the initial stage of my study. My sincere thanks goes to the Vice Chancellor of University of Peradeniya, Sri Lanka and the Dean of the Faculty of Allied Health Sciences for granting me the study leave to pursue my Ph.D study abroad. It is a pleasure to thank authorities of National Center for Advanced Studies in Humanities and Social Sciences, Sri Lanka for financially support in my post graduate study. I would like to thank all my friends in University of Malaya who made my stay in Malaysia memorable. I thank all of my colleagues in the Department of Nursing Sciences, Faculty of Allied Health Sciences, University of Peradeniya who supported me in various ways. Also, I would like to show my appreciation to all the participants of my study for giving me enormous support during data collection. Their support helped me a lot to make this study possible. Last but not the least, my deep and sincere gratitude goes to my dearest family for their continuous and unparalleled love, help and support. I am grateful to my dearest parents, in-laws, brother and sisters for encouraging me to explore new directions in my life. I am forever indebted to my husband, son and daughter for their sacrifice, understanding and love throughout my journey and I dedicate this milestone to them.

TABLE OF CONTENTS

Abstract	iii
Abstrak	v
Acknowledgments	vii
Table of Contents	viii
List of Tables	xix
List of Figures	xx
List of Abbreviations	xxi
List of Appendices	xxii
CHAPTER 1: INTRODUCTION	1
1.1 Introduction	1
1.2 Background	4
1.3 Problem statement	5
1.4 Research questions	8
1.5 Study objectives	8
1.5.1 General objective	8
1.5.2 Specific objectives	9
1.6 Significance of the study	9
1.6.1 Nursing service	9
1.6.2 Public health services	10
1.6.3 Further research	10
1.7 Definitions of terms	11
1.7.1 Older persons	11
1.7.2 Nutritional status	11
1.7.3 Malnutrition	11
1.7.4 Factors associated with malnutrition	12
1.7.5 Quality of Life	12
1.7.6 Factors associated with Quality of Life	12
1.8 Outline of the thesis	13

1.9 Summary	14
CHAPTER 2:LITERATURE REVIEW	15
2.1 Introduction	15
2.2 Search strategy	15
2.3 Overview of the ageing population	16
2.4 Ageing in Sri Lanka	17
2.5 Perspectives of ageing	21
2.5.1 Physical changes	22
2.5.1.2 Skeletal system	23
2.5.1.3 Muscles	23
2.5.1.4 Nervous system	24
2.5.1.6 Vascular system	25
2.5.1.7 Respiratory system	26
2.5.1.8 Gastro intestinal system	26
2.5.1.9 Urinary system	27
2.5.1.10 Reproductive system	28
2.5.1.11 Endocrine system	29
2.5.1.12 Immune system	29
2.5.2 Psychological changes	29
2.5.3 Social changes	31
2.5.4 Aging and nutrition status	33
2.6 Malnutrition among older persons	34
2.7 Measurements of assessing malnutrition in older persons	35
2.7.1 Anthropometric measurements	35
2.7.1.1 Standing height	35
2.7.1.2 Knee height	36
2.7.1.3 Arm span	37
2.7.1.4 Body weight	37
2.7.1.5 Body Mass Index (BMI)	38
2.7.1.6 Mid Upper Arm Circumference (MUAC)	39
2.7.1.7 Calf Circumference (CC)	39

2.7.1.8 Hand Grip Strength (HGS)	40
2.7.2 Biochemical measurements	42
2.7.2.1 Serum albumin	42
2.7.2.2 Serum lymphocyte counts	43
2.7.3 Clinical assessment	43
2.7.4 Dietary assessment	45
2.7.4.1 Twenty-four hour diet recall	45
2.7.4.2 Seven day food record	45
2.7.4.3 Food frequency questionnaire	46
2.7.5 Nutritional status assessment questionnaires	47
2.7.5.1 Malnutrition Screening Tool (MST)	48
2.7.5.2 Mini Nutritional Assessment (MNA)	48
2.7.5.3 Short Nutritional Assessment Questionnaire (SNAQ)	49
2.7.5.4 Malnutrition Universal Screening Tool	50
2.7.5.5 Nutrition Risk Screening 2002 (NRS- 2002)	51
2.7.5.6 Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN)	51
2.7.6 Selection of instruments for the current study	54
2.8 The prevalence of malnutrition among older persons	55
2.8.1 Global	56
2.8.2 South East Asia	61
2.8.3 Sri Lanka	61
2.9 Factors associated with malnutrition among older persons	64
2.9.1 Socio demographic	64
2.9.1.1 Age	64
2.9.1.2 Sex	65
2.9.1.3 Level of education	66
2.9.1.4 Marital status	67
2.9.1.5 Income	67
2.9.1.6 Living conditions	68
2.9.2 Physiological	68

2.9.2.1 Tooth loss	68
2.9.2.2 Wearing dentures	69
2.9.2.3 Chronic diseases	69
2.9.3 Psychological	70
2.9.4 Lifestyle	71
2.9.4.1 Physical inactivity	71
2.9.4.2 Usage of medication	71
2.9.4.3 Betel chewing	72
2.9.4.4 Smoking	72
2.9.5 Dietary	73
2.10 Effects of malnutrition on older persons	74
2.11 Quality of Life	77
2.11.1 Measurement of Quality of Life	80
2.11.1.1 MOS 36-item short-form health survey (SF-36)	81
2.11.1.2 Health Utilities Index ² (HUI ²) and Health Utilities Index ³ (HUI ³)	81
2.11.1.3 EuroQol-5D (EQ-5D)	82
2.11.1.4 World Health Organization's Quality Of Life assessment	82
2.12 Factors associated with Quality of Life among older persons	83
2.12.1. Socio demographic	84
2.12.2 Physiological	85
2.12.3 Psychological	86
2.12.4 Lifestyle	87
2.12.5 Dietary	88
2.13 Conceptual Framework of the study	88
2.14 Summary	90
CHAPTER 3: METHODOLOGY	91
3.1 Introduction	91
3.2 Research design rationale	91
3.2.1 Mixed method research approach	91
3.2.2 Philosophical rationale for mixed method approach	92
3.2.3 Selecting a research design for the current study	95

3.2.3.1 Timing	96
3.2.3.2 Weighing	96
3.2.3.3 Mixing	97
3.2. 4 Mixed method design in the current study	98
3.3 Stages of the study design	100
3.4 Phase I: Quantitative	102
3.4.1 Study design and study area	102
3.4.2 Study participants	103
3.4.3 Inclusion and exclusion criteria	103
3.4.4 Sample size calculation	103
3.4.5 Sampling method	104
3.4.8.1 Measurement of Nutritional status	108
3.4.8.2 Geriatric Depression Scale (GDS)	111
3.4.8.3 International Physical Activity Questionnaire (IPAQ): Short Form	112
3.4.8.4 Euro QOL Five Dimension Questionnaire (EQ-5D-3L)	113
3.4.9 Pilot study	114
3.4.10 Study procedure	114
3.4.11 Data management	115
3.4.11.1 Data coding	115
3.4.11.2 Data entry	117
3.4.11.3 Data cleaning	117
3.4.12 Data analysis	118
3.4.12.1 Sample weight calculation	118
3.4.12.2 Descriptive analysis	119
3.4.12.3 Univariate analysis	119
3.4.12.4 Multivariate analysis	120
3.5 Phase II	120
3.5.1 Study design and study area	120
3.5.2 Study participants	121
3.5.3 Inclusion and exclusion criteria	121
3.5.4. Sample size calculation	121

3.5.5 Sampling method	122
3.5.6. Reflexivity	122
3.5.7 Ethical clearance and consent	123
3.5.8 Study instruments	123
3.5.9 Pilot study	123
3.5.10 Focus Group Discussions	124
3.5.11 Rigor and trustworthiness	124
3.5.11.1 Credibility	124
3.5.11.2 Transferability	126
3.5.11.3 Dependability	126
3.5.11.4 Confirmability	126
3.5.12 Study procedure	127
3.5.13 Data analysis	131
3.6 Summary	134
CHAPTER 4: RESULTS (QUANTITATIVE)	135
4.1 Introduction	135
4.2 Response rate and sample weight	135
4.3 Descriptive characteristics of participants	138
4.3.1 Socio demographic characteristics	138
4.3.2 Physiological factors	139
4.3.3 Psychological factors	140
4.3.4 Lifestyle factors	140
4.3.5 Dietary factors	141
4.3.6 Anthropometric measurements	142
4.4 Prevalence of malnutrition	143
4.5 Factors associated with malnutrition and risk of malnutrition (univariate analysis)	144
4.6 Factors associated with malnutrition and risk of malnutrition (multivariate analysis)	146
4.7 Quality of Life	147
4.7.1 Total Quality of Life	147

4.7.2 Quality of Life by domain and Gender	147
4.9 Summary	149
CHAPTER 5: RESULTS (QUALITATIVE)	151
5.1 Introduction	151
5.1 Demographic characteristics	151
5.2 Identified themes and subthemes	151
5.2.1 Factors affecting dietary patterns	153
5.2.1.1 Loss of appetite	153
5.2.1.2 Physical work/activity	158
5.2.1.3 Routine	160
5.2.1.4 Food preparation	164
5.2.1.5 Gender roles	168
5.2.1.6 Eating with others	170
5.2.2 Factors affecting food choices	172
5.2.2.1 Knowledge	172
5.2.2.2 Taboos	174
5.2.3 Health status	174
5.2.3.1 Diseases	174
5.2.3.2 Restrictions	176
5.2.4 Psychological challenges	177
5.2.4.1 Mood change	177
5.2.4.2 Family issues	178
5.2.4.3 Loss of spouse or children	179
5.2.4.4 Acceptance	180
5.3 Summary	181
CHAPTER 6: DISCUSSION	182
6.1 Introduction	182
6.1 Descriptive characteristics	182
6.1.1 Socio demographic factors	182
6.1.1.1 Gender	182
6.1.1.2 Age	183

6.1.1.3 Ethnicity	184
6.1.1.4 Marital status	184
6.1.1.5 Living arrangement	185
6.1.1.6 Number of people living with	185
6.1.1.7 Educational status	186
6.1.1.8 Income	186
6.1.1.9 Medical history	186
6.1.2 Physiological factors	187
6.1.2.1 Tooth loss	187
6.1.2.2 Use dentures	187
6.1.3 Psychological factors	187
6.1.4 Lifestyle factors	188
6.1.4.1 Physical inactivity	188
6.1.4.2 Use of medication	188
6.1.4.3 Betel chewing	188
6.1.4.4 Alcohol consumption	189
6.1.4.5 Smoking	189
6.1.5 Dietary factors	190
6.1.5.1 Eating/swallowing difficulties	190
6.1.5.2 Food allergy	190
6.1.5.3 Loss of appetite	190
6.1.5.4 Vegetarian diets	191
6.2 Anthropometric, MNA and Quality of Life measurements	192
6.2.1 Weight	192
6.2.2 Height	193
6.2.3 Mid Upper Arm Circumference	193
6.2.4 Calf circumference	194
6.2.5 Handgrip strength	194
6.2.6 Body Mass Index	195
6.2.7 Mini Nutritional Assessment	195
6.3 Prevalence of malnutrition	196

6.3.1 MNA- SF	196
6.3.2. Body Mass Index	198
6.3.3. Mid Upper Arm Circumference	199
6.3.4. Calf Circumference	199
6.3.5. Handgrip Strength	200
6.4 Factors associated with malnutrition among older persons	200
6.4.1 Socio demographic	200
6.4.1.1 Age	200
6.4.1.2 Sex	201
6.4.1.3 Education level	202
6.4.1.4 Marital status	202
6.4.1.6 Living conditions/ number of people living with	204
6.4.2 Physiological	205
6.4.2.1 Tooth loss and dentures	205
6.4.2.2 Diseases conditions	206
6.4.3 Psychological	206
6.4.4 Lifestyle	207
6.4.4.1 Physical activity	207
6.4.4.2 Medication usage	208
6.4.4.3 Betel chewing	208
6.4.4.4 Alcohol consumption	209
6.4.5 Dietary	210
6.4.5.1 Food allergy	210
6.4.5.2 Eating/swallowing difficulties	211
6.4.5.3 Loss of appetite	211
6.4.5.4 Vegetarian diets	212
6.5 Quality of Life among older persons	213
6.5.1. Mobility	215
6.5.2. Self-care activities	216
6.5.3. Usual care	216
6.5.4. Pain/discomfort	217

6.5.5. Anxiety/depression	217
6.6. Factors associated with Quality of Life among older persons	218
6.6.1. Socio demographic	218
6.6.1.1 Age	218
6.6.1.2 Gender	219
6.6.1.3 Marital status	219
6.6.1.4 Income	219
6.6.1.5 Level of education	220
6.6.2. Physiological	220
6.6.2.1 Chronic diseases	220
6.6.2.2 Tooth loss and dentures	221
6.6.4.1 Physical activity	222
6.6.4.2 Alcohol consumption	223
6.4.5 Dietary	223
6.4.6 Nutritional status	224
6.7 Integrating quantitative and qualitative findings	224
6.8 Limitations and strengths of the study	226
6.8.1 Limitations	226
6.8.2 Strengths	228
6.9 Summary	228
CHAPTER 7: CONCLUSION	230
7.1 Introduction	230
7.2 Prevalence and factors associated with malnutrition and at risk of malnutrition	230
7.3 Factors associated with Quality of Life	231
7.4 Factors associated with malnutrition perceived by malnourished older persons	231
7.4 Recommendations	231
7.4.1 Nursing service	231
7.4.2 Public health services	234
7.4.2.1 Malnutrition screening	234

7.4.2.2 Educational programs	235
7.4.2.3 Food subsidies	235
7.4.3 Religious activities	236
7.4.4 Legal implementations	236
7.4.5 Further research	237
7.5 Summary	238
References	239
List of Publications and Papers Presented	283
Appendix	282

LIST OF TABLES

Table 2.1 Clinical signs and nutritional deficiencies	44
Table 2.2: Characteristics of selected screening and assessment tools	53
Table 2.3: Prevalence of malnutrition and at risk of malnutrition of older persons in various countries using various measures	58
Table 3.1: Sample size estimation using different factors	104
Table 3.2: Sample size selection in multi stage sampling	105
Table 3.3: Study variables and instruments	107
Table 3.4: Coding of variables	115
Table4.1: Final weight of elders	137
Table 4.2: Socio demographic characteristics of participants	138
Table 4.3: Physiological factors	140
Table 4.4 Psychological factors	140
Table 4.5: Lifestyle factors	141
Table 4.6: Dietary factors	142
Table 4.7: Anthropometric measurements and Body Mass Index	143
Table 4.8: Prevalence of malnutrition by MNA, BMI, MUAC, CC and HGS	144
Table 4.9: Crude odds ratio (95% CI) of nutritional status according to associated factors in multinomial logistic regression	145
Table 4.10: Factors associated with risk of malnutrition and malnutrition	146
Table 4.11 Factors associated with Quality of Life (Univariate and multivariate)	148
Table 5.1 Themes and subthemes regarding older persons' views of nutritional status	152

LIST OF FIGURES

Figure 2:1: Crude Death Rate in Sri Lanka	18
Figure 2:2 Demographic transition of Sri Lanka	19
Figure 2:3 Population Pyramid of Sri Lanka by 2010	20
Figure 2:4 Projected dependency ratios, 2001-2081	21
Figure 2:5 World regions grouped by WHO (Jaba, Balan, & Robu, 2013)	57
Figure 2:6: Conceptual framework	89
Figure 3.1:A Framework for Research—the Interconnection of Philosophical Worldviews, Design, and Research Methods	93
Figure 3.2: Decision tree for mixed method approach	95
Figure 3.3: Mixing categories adapted from Creswell (2008)	97
Figure 3.4: The sequential mixed methods design	99
Figure 3.5: The visual model for sequential mixed methods procedure	101
Figure 3.6 Multi-stage sampling process in the current study	106
Figure 4.1 Flow chart of responses	136

LIST OF ABBREVIATIONS

BMI	Body Mass Index
CC	Calf circumference
cm	Centimetre
EQ5D3L	Euro 5D 3L
FFQ	Food Frequency Questionnaire
FGD	Focus Group Discussions
GDS	Geriatric Depression Scale
HGS	Handgrip strength
IPAQ	International Physical Activity Questionnaire
Kg	Kilogram
MNA	Mini Nutritional Assessment
MUAC	Mid Upper Arm Circumference
OR	Odds Ratio
QoL	Quality of Life
WHO	World Health Organization

LIST OF APPENDICES

Appendix A: Computer generated random sampling	2847
Appendix B: Ethical approvals	288
Appendix C: Information sheet and consent form	290
Appendix D : Socio Demographic Questionnaire	292
Appendix E: Mini Nutritional Assessment Tool	297
Appendix F: Geriatric Depression Scale	299
Appendix G: International Physical Activity Questionare	301
Appendix H: Euro 5D-3L Questionnaire	305
Appendix I: Interview Guide	307
Appendix J: Interview guide translation	312
Appendix K: Permissions to use questionnaires	313
Appendix L: Nvivo outputs	315

CHAPTER 1: INTRODUCTION

1.1 Introduction

The elderly/older persons are defined differently around the world depending on cultural and socio-economic preferences. The developed countries conventionally consider persons over 65 years of age as elderly (Quail, Wolfson, & Lippman, 2011). The World Health Organization (WHO) follows the chronological age 60 years to define elderly (WHO, 2002).

The proportion of the world's older persons population is increasing and has become a global phenomenon (Hallaj, 2015). By year 2030, the world is likely to have one billion older persons accounting for 13% of the total population (Chen, Bai, Huang, & Tang, 2007a). Moreover, the WHO highlights that older persons are the fastest-growing age group worldwide and the proportion of the world's population over 60 years will be doubled from about 11% to 22% between 2000 and 2050 (WHO, 2015). The reason behind the phenomenon is the demographic shift comes with major health and socio-economic concerns such as an increase in life expectancy, advancements in health care, and changes in the traditional family structure (King & Pappas-Rogich, 2011; Madeira et al., 2016).

As people age, they may experience worsening health, suffering from illnesses; chronic pain, depression, sleep disorders, osteoporosis, congestive heart failure, diabetes, and geriatric syndromes including pressure ulcers, incontinence, falls, and delirium which have a huge impact on the confidence and dignity of elderly people (Chen et al, 2010). Nutrition plays an important role in health even among older persons, and balanced

nutrition is very essential in maintaining an active healthy life (Donini, Neri, De Chiara, Poggiogalle, & Muscaritoli, 2013; Hallaj, 2015; Simsek, Meseri, Sahin, & Ucku, 2013). Evidence suggests that older persons are at risk of malnutrition due to aging process itself which associates with a decline of a number of physiological functions that can impact nutritional status. These functions include reduced lean body mass, decrease in basal metabolic rate, decreased gastric secretion of digestive juices and changes in the oral cavity, sensory function deficits, changes in fluid and electrolyte regulation and chronic illness (Brownie, 2006).

Malnutrition generally concerns both under nutrition and over nutrition (Jahansons et al, 2009). The WHO (2000) stated that “malnutrition is the cellular imbalance between supply of nutrients and energy, and the body’s demand for them to ensure growth, maintenance, and specific functions”. It is an imbalance between nutritional intake and need (Giovannelli et al., 2015). Stratton et al.(2003) as cited in Lochs et al (2006) further defined malnutrition as a state of nutrition in which a deficiency or excess (or imbalance) of energy, protein and other nutrients causes measurable adverse effects on tissue/body form (body shape, size and composition) and function, and clinical outcome (Lochs et al., 2006). The term ‘malnutrition’ and ‘under nutrition’ tend to be used interchangeably in the literature. In the present study, ‘malnutrition’ will be used in reference to under nutrition. European Nutrition for Health Alliance (2005) describes that malnutrition may be seen as the antithesis to good nutrition or ‘well-nutrition’. Accordingly, good nutrition implies eating the appropriate nutrients, in the right proportions, being able to maintain normal tissue function, repair and renewal on a daily basis (European Nutrition for Health Alliance, 2005).

Malnutrition among older persons can be defined as ‘faulty or inadequate nutrition status’. It is a multidimensional concept incorporating physical and psychological elements characterized by insufficient dietary intake, poor appetite, muscle wasting and weight loss (Chen, Schilling, & Lyder, 2001). Further, malnutrition has been identified as a common complication among older population which increases with age due to low calorie intake, for different reasons, such as diseases, medical side effects, depression, and poor dental status (Sparre-Sørensen & Kristensen, 2016).

Malnutrition among the older persons increases their vulnerability and is often associated with negative adverse health outcomes such as increases the risk of morbidity, mortality, poor wound healing, delayed recovery from surgery, prolong length of stay in hospitals, higher hospital readmission rates, premature death (Amarya, Singh, & Sabharwal, 2015; Boulos, Salameh, & Barberger-Gateau, 2016a; Lee, Tsai, & Wang, 2015; Sparre-Sørensen & Kristensen, 2016). Further, malnutrition slows economic growth and causes for poverty by losing productivity from poor physical health, poor cognitive development and increasing health care cost (Vanderwee et al., 2010). Moreover, malnutrition risk is linked to a poorer Quality of Life among older persons (Rasheed & Woods, 2014).

Quality of Life is “the individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concern” (WHO, 1995). Quality of Life among older persons has become important public health issue due to demographic changes of ageing population (Cao et al., 2016). Further, QoL of this population is different from the other age groups (Netuveli & Blane, 2008). Evidence showed that various factors affect the QoL of older persons. They can be mentioned as socioeconomic, demographic

characteristics, and lifestyle factors (Galiana et al., 2016; Rajasi et al., 2016; Somrngthong, Hongthong, Wongchalee, & Wongtongkam, 2016; Uchmanowicz, Panaszek, Uchmanowicz, & Rosińczuk, 2016).

1.2 Background

Estimates of the prevalence of malnutrition differs significantly according to methods of assessment and across the healthcare settings considered (Cereda et al., 2016). According to a recent systematic review, prevalence of malnutrition assessed by the Mini Nutritional Assessment across different healthcare settings, is relatively low in community living older persons (3.1%) compared to the other settings: outpatients (6.0%), home-care services (8.7%), hospital, (22.0%), nursing homes (17.5%), long-term care(28.7%) and rehabilitation/ sub-acute care (29.4%) (Cereda et al., 2016; Vanderwee et al., 2010). The recent studies in the Indian and Spanish communities reported 29.4% and 14.3% of community dwelling older persons as malnourished respectively (Lahiri, Biswas, Santra, & Lahiri, 2015; Madeira et al., 2016).

The risk of malnutrition increases with age and many factors are contributing it including physiological, pathological and psychological conditions of older persons (Krzyminska-Siemaszko et al., 2015). However, malnutrition is not exclusively determined by the ageing process (Madeira et al., 2016). Based on the ‘refined conceptual-theoretical-empirical structure framework of malnutrition among elderly’, it is precipitated by loss, dependency, loneliness and chronic illnesses (Chen et al., 2007a).

Considering all the above, including older persons as a group at risk, prevalence of malnutrition and identifying possible predictors it is very crucial for health professionals and older persons care givers to improve malnutrition and plan personalized interventions (Madeira et al., 2016). European Nutrition for Health Alliance (2005) also has identified the low awareness of this malnutrition situation among health and social care professionals. Scholars suggest that nutritional assessment should be part of every geriatric evaluation in order to identify malnutrition and to initiate nutritional treatment (Koren-Hakim et al.). Further, evidence-based knowledge is essential to develop effective prevention strategies in community-dwelling older persons (van der Pols-Vijlbrief, Wijnhoven, Schaap, Terwee, & Visser, 2014).

Regarding Quality of Life of this population, is an important in the assessment of treatment outcomes and improve care (King et al., 2016). Exploring Quality of Life among older persons may helpful in planning and organization of health services, and implementation of initiatives for the populations studied (Paiva, Pegorari, Nascimento, & Santos, 2016).

1.3 Problem statement

Sri Lanka is a low-middle income country undergoing rapid epidemiological and nutritional transitions (Rathnayake, Wimalathunga, Weech, Jackson, & Lovegrove, 2015). Despite its low level of per capita income, Sri Lanka has achieved extraordinary success in social, health and educational outcomes except nutritional outcomes (Rajapaksa, et al, 2011). With the improvement of life expectancy, Sri Lanka is expected to experience rapid growth of its elderly population. The current proportion of the elderly (persons aged 60 years or above) in the Sri Lankan population is around

12.3% and is further increasing (Annual Health Bulletin, 2012). It is projected to more than double by year 2040 to 25% of its population (De Silva 2007).

When considering nutritional status of older persons, it has attracted less interest nationally. Rathnayake et al. (2015) found that the prevalence of malnutrition among institutionalized older persons in Sri Lanka was 30%. According to Fernando and Wijesinghe (2010), the prevalence of malnutrition among institutionalized older persons in Kandy district was 59.1%. Further, in 2011, Jayalath and Kumara conducted a cross sectional study in a hospital in Kandy district and reported that prevalence of malnutrition among hospitalized older persons differed according to their co-morbid conditions. The estimated prevalence of malnutrition among older persons varied from 21% to 66.66% accordingly (Jayalath & Kumara, 2011).

A growing malnourished older person's population in any country carries great social, economic, and public health implications. It has become a global challenge for health care professionals by increasing the prevalence of non-communicable diseases, and mortality rate. The malnutrition has consequences for decreasing Quality of Life correlated with diseases and mortality (Chen et al., 2001).

A recent study done by Rathnayake and Siop (2015) reported that living alone, poor family income, presence of chronic kidney diseases were associated with poor self-rated health of older persons living in a rural community Sri Lanka. The same study showed the QoL of its participants was in moderate level. However, as QoL differs due to measurements used and the various populations across different cultures, further studies are needed to explore Quality of Life and its associated factors among community-dwelling older persons in Sri Lanka (Lin, Lin & Fan, 2013; Pan, Chahal, & Ward, 2016).

The epidemiology of malnutrition in the older persons has been intensely studied in various settings (Krzyminska-Siemaszko et al., 2015). However, in Sri Lanka, general data on the prevalence of malnutrition and its associated factors among community-dwelling older persons is scarce and not well documented. Prevalence rates are essential to understand the degree of malnutrition in order to create nutrition policies (Vanderwee et al., 2010). Fernando and Wijesinghe (2010) suggested the further studies from other settings in the country to verify the prevalence of malnutrition among older persons population in Sri Lanka. Also, various intervention programs are available for other vulnerable groups such as children, pregnant and lactating mothers to enhance their nutritional status in order to achieve good quality of life. However, the need of such programs throughout the life cycle including older persons has become a crucial point in the community health setting in Sri Lanka (De Silva & Indralal, 2006).

Rathnayake et al. (2015) highlighted the necessity of having research studies on risk factors associated with under nutrition in different older population to determine suitable interventions to combat malnutrition in this population. They further highlighted an urgent need to implement nutritional intervention as part of geriatric care in Sri Lanka. Accordingly, understanding of the factors related to the nutritional status among older persons is required in order to develop an effective intervention on nutrition to improve Quality of Life (McNaughton et al, 2012). Further, it is very crucial to explore malnutrition among older persons at the earliest possible stage before any severe consequences have set in and to prevent malnutrition for overall health enhancement (Dale & Söderhamn, 2015).

Based on the above problem, this study aimed to determine the prevalence malnutrition in a representative community-dwelling elderly population in Sri Lanka, associated factors of malnutrition, the Quality of Life and its associated factors among older persons and to explore the factors associated with malnutrition among malnourished older persons.

1.4 Research questions

The following are the research questions of this study.

1.4.1 What is the prevalence of malnutrition among community-dwelling older persons in Sri Lanka?

1.4.2 What are the factors associated with malnutrition among community-dwelling older persons in Sri Lanka?

1.4.3 What is the level of Quality of Life among community-dwelling older persons in Sri Lanka?

1.4.4 What are the factors associated with Quality of Life among community- dwelling older persons in Sri Lanka?

1.4.5 What are the factors associated with malnutrition perceived by malnourished older persons in Sri Lanka?

1.5 Study objectives

1.5.1 General objective

The general objective of the study was to determine factors related to malnutrition and Quality of Life among community-dwelling older persons in Kandy District, Sri Lanka.

1.5.2 Specific objectives

The specific objectives of the study are:

- a. To determine the prevalence of malnutrition among community-dwelling older persons in Sri Lanka
- b. To determine the factors associated with malnutrition among community-dwelling older persons in Sri Lanka
- c. To determine the Quality of Life among community-dwelling older persons in Sri Lanka
- d. To determine the factors associated with Quality of Life among community-dwelling older persons in Sri Lanka
- e. To explore factors influencing malnutrition among malnourished community-dwelling older persons in Sri Lanka

1.6 Significance of the study

The significance of the study is described under the categories of nursing service, health administration and further researches.

1.6.1 Nursing service

Early detection is very important in health care. The results of the study can be used to identify the risk group for malnutrition as well as the malnourished older persons in the community. It helps better understanding of nutritional status and factors related to malnutrition and Quality of Life of older persons. This new knowledge serves as an important foundation for nutrition research development and will guide appropriate

interventions to decrease both malnutrition and at risk of malnutrition and improve the Quality of Life of the older persons. In these ways, this study benefits Sri Lankan nurses.

1.6.2 Public health services

Results of the study may be benefited to the public health sector in Sri Lanka to promote holistic policies and elderly care programs in the community. The research conducted on these factors associated with malnutrition among community-dwelling older persons, is important for understanding how malnutrition and at risk of malnutrition evolves and provides an overall understanding of nutritional status among older persons which is especially useful for developing appropriate interventions such as promote health promoting behaviours including healthy food consumption or nutritional behaviours. The study further helps health administrators to plan appropriate interventions to improve QoL of older persons in Sri Lanka.

1.6.3 Further research

The contribution of this study would be of interest to researchers especially in community nursing and geriatric nursing. This research can be used as a foundation for further research in a diverse older person's population and settings to assess the factors affecting malnutrition and QoL among older persons and developing nutrition interventions in improving nutritional status of the older persons and thereby QoL.

1.7 Definitions of terms

1.7.1 Older persons

Older persons refers to persons over 60 years of age (WHO, 2002). In this study elderly refers to persons aged 60 and over residing in Kandy district, Sri Lanka.

1.7.2 Nutritional status

Nutritional status refers to the extent to which nutrients are ingested and absorbed to meet metabolic needs (Moorhead, et al, 2014). In this study nutritional status is measured by using Mini Nutritional Assessment questionnaire (MNA) and anthropometric measurements including Body Mass Index (BMI), Calf circumference (CC), Mid Upper Arm Circumference (MUAC), and Handgrip Strength (HGS).

1.7.3 Malnutrition

The World Health Organization defines malnutrition as “the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions”(European Nutrition for Health Alliance, 2005). In this study it is measured using Mini Nutritional Assessment questionnaire. A total score below 7 (out of 14) is considered malnourished, a score between 8- 11 is at-risk of malnutrition.

1.7.4 Factors associated with malnutrition

Factors associated with malnutrition refer to factors that have been identified as influencing factors for malnutrition/nutritional status. In this study factors associated malnutrition are referred to socio demographic (age, gender, marital status, level of education, financial status and living condition), physiological (tooth loss, use of dentures and chronic diseases), and psychological (depression), lifestyle (physical activity, usage of medication, betel chewing, cigarette smoking, and alcohol consumption) and dietary factors (vegetarian habit, eating/swallowing difficulties, food allergy, and loss of appetite).

1.7.5 Quality of Life

World Health Organization defines Quality of Life as “individual perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations and standards and concern”. In the current study, it is measured using EQ- 5D-3L questionnaire.

1.7.6 Factors associated with Quality of Life

Factors associated with Quality of Life refer to factors that have been identified as influencing factors for Quality of Life. In this study factors associated with QoL are referred to socio demographic (age, gender, marital status, level of education, literacy, financial status and living condition), physiological (tooth loss, use of dentures and chronic diseases), and lifestyle (physical activity, and alcohol consumption) and dietary

factors (vegetarian habit). In addition, nutritional status measured by MNA and BMI are included.

1.8 Outline of the thesis

This thesis is divided into 7 chapters to facilitate understanding and clarity of the research study.

This chapter presents an introduction and background information about the study before providing the problem statement and significance of the study. It also outlines and explain the main aims of the thesis. Operational definitions conclude this chapter.

Chapter Two provides general background information on malnutrition among older persons, a literature review of prevalence of malnutrition among older persons, measurements of nutritional status among older persons, related factors. Socio demographic, physiological, psychological, life style and dietary factors are discussed. Qualitative approaches to explore factors related to malnutrition among older persons are mentioned. At the end of the chapter, the conceptual framework of the study is displayed.

The methodology of the study is described in chapter three. The philosophical basis of the research and methods used are described in this chapter. It also describes the setting and characteristics of the studied older persons, sampling frame, and methods of data analysis. Ethical concerns are explored and a pilot study was conducted to ensure reliability and validity of the research instrument.

Chapter Four reports the results of the quantitative phase of the study. Descriptive results including demographic results are presented. Results related to research question 1, 2, 3, 4 and 5 are presented.

Chapter Five reports the results of the qualitative phase of the study. It explores factors related to malnutrition among malnourished older persons based on the focus groups.

Chapter Six presents the discussion of the results of the study. Both phase one and phase II are discussed. At the end of the chapter six, integration of quantitative and qualitative findings is presented.

Chapter Seven, the last chapter presents the conclusions of the findings and recommendations.

1.9 Summary

In this chapter, introduction and the problem statement are discussed. Research questions, aim, objectives and the significant of the study are mentioned. Then, the definitions of terms are presented with their operational definitions. The outline of the thesis was presented at the end of the chapter. Related to the research objectives, literature review will be carried out in the next chapter: chapter two.

CHAPTER 2:LITERATURE REVIEW

2.1 Introduction

This chapter presents an overview of aging and nutritional status among older persons. The chapter begins with a brief description of the search strategy used to retrieve the relevant articles. It provides a critical review of existing literature related to this. The prevalence and factors related to nutritional status/malnutrition are described under the relevant sub topics. Then, the conceptual framework for the study will be presented. The majority of the literature review consists of quantitative approaches. The fewer studies focused on qualitative approaches related to malnutrition among older persons are reviewed in this chapter.

2.2 Search strategy

Literature search was done both manually in the libraries and online in a number of indexing data bases. Manual search was done using the library catalogues and searching through the title pages of available print journals. Online searches were performed in the data bases included in HINARI and University of Malaya library. The databases contained within these two included (MEDLINE), Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Embase. Search engines such as Google and Google Scholar were also used to retrieve relevant literature. The inclusion criteria of the current literature review were those which were written in English. Articles which were written in non-English were excluded for reviewing.

The key words used in the online literature search were ‘aging’, ‘elderly’, ‘older persons’ ‘nutritional status’, ‘malnutrition’, ‘undernutrition’, ‘nutritional assessment’, ‘Quality of Life’, ‘depression’, ‘physical activity’ and ‘factors related to nutritional status’. These were used in different combinations. Boolean logic (operators) (AND, OR), quotation marks, brackets, supplementary tools (* or \$ or ?) were used appropriately. The relevant articles were reviewed and relevant information were extracted considering the study objectives and methodology. Key studies using quantitative, qualitative and mixed method approaches were critically reviewed.

2.3 Overview of the ageing population

Aging is a regular change in various physiological, pathological, social, and psychological conditions of the human being (Amarya et al., 2015). It is a continuous and dynamic and unavoidable process (Simon Schreck, 2014). Amarya et al. (2015) defined ‘ageing’ demographically as the growth of the aged population (60+ years) in proportion to the total population over a period of time. Chronological age of 65 years were considered as a cut off for older persons by most of the developed countries. However, United Nations accepted the chronological age of 60 years as a cutoff of ‘elderly’ or older population and is widely used in many Asian countries (Copur, 2015; Amarya, et al. 2015). WHO further highlights that older persons are the fastest-growing age group worldwide and the proportion of the world's population over 60 years will double from about 11% to 22% between 2000 and 2050 (WHO, 2015). The absolute number of people aged 60 years and over is expected to increase from 605 million to 2 billion over the same period (WHO, 2015). Factors contributing to this demographic change include an increase in life expectancy, advancements in health care, and changes in the traditional family structure (King & Pappas-Rogich, 2011).

2.4 Ageing in Sri Lanka

Sri Lanka is a developing country undergoing rapid epidemiological transition. It is a multi-ethnic and multi-religious country with diverse socio-cultural traditions. According to Department of census and statistics (2014), Sri Lanka consists of mainly Sinhalese (74.9%), Sri Lankan Tamils (11.2%), Indian Tamils (4.2%), Sri Lankan Moor (9.2%) and others (0.5%). The majority of them were Buddhists (70.2%) while other religions such as Hindu, Islam and Christians were 12.6%, 9.7% and 7.4% respectively. Population is based on urban, rural and estate were 18.3%, 77.3% and 4.4% correspondingly.

Sri Lanka is currently facing the challenge of ageing. According to the World Bank report (2012), the percentage of older population (age 60 and over) in Sri Lanka is expected to increase from 12.5% to 16.7% in 2021. As mentioned in the same report, one out of every four in Sri Lanka is expected to be an older person by year 2041. As a result of declining mortality and fertility rates, and increasing life expectancy, Sri Lanka is experiencing this growing trend in population ageing. The declining mortality rates is attributed by various social welfare programmes implemented by the Sri Lankan Government such as: free health care services; free education, also from primary to tertiary level; and subsidised food distribution programs for needy ones (Vithana, Linhart, Taylor, Morrell, & Azim, 2014). As depicts in the Figure 2:1, mortality rate declines from year 1945. Starting year 1940, the death rate declined from 20% to 6.0%.

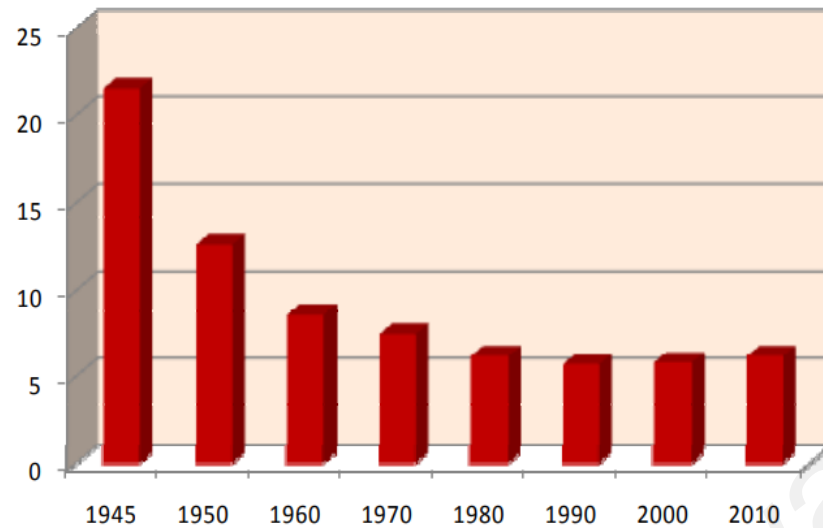


Figure 2:1: Crude Death Rate in Sri Lanka

(Department of Census and Statistics, Sri Lanka, 2012)

The main reason behind the declining fertility rate is the effectiveness of family planning programs. This program motivated people to use various family planning methods (Fernando, 1980; Perera, Mwanri, Seneviratne, & Fernando, 2013). The following Figure 2:2 shows this demographic transition due to declining of mortality and fertility rates.

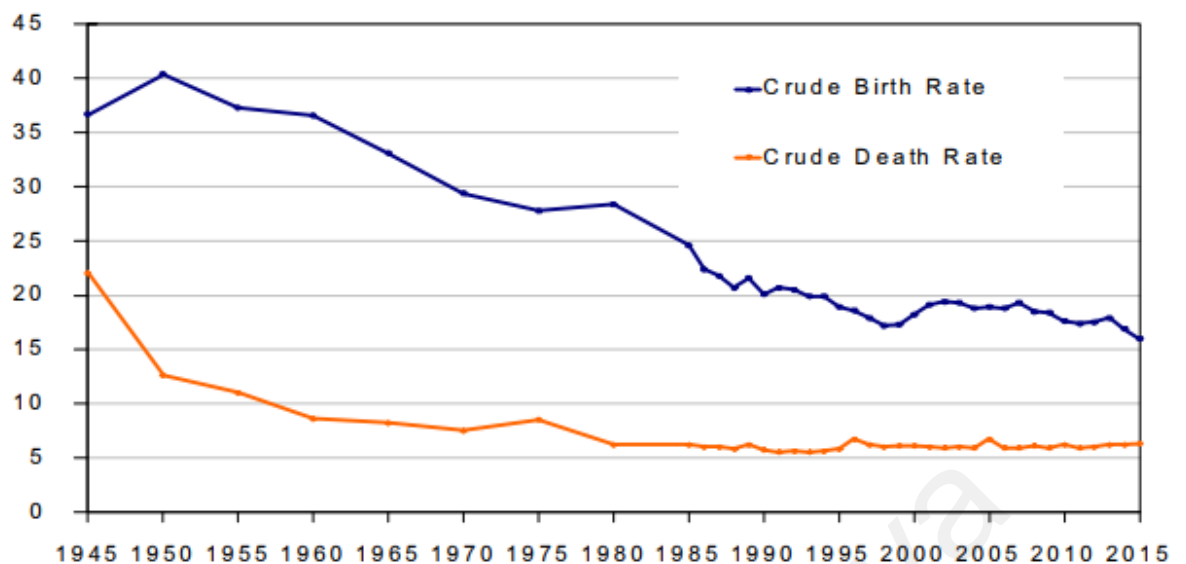


Figure 2:2 Demographic transition of Sri Lanka (Department of Census and Statistics, Sri Lanka, 2012).

The Department of Census and Statistics, Sri Lanka (2016) reported that there was an increase of life expectancy for both males and females in year 2012 compared to year 2001. In year 2012 life expectancy is 72.0 years for males and 78.6 for females. It was 68.8 years in males and 77.2 years in females in year 2001. This is mainly due to one of the achievements of Universal Health Coverage in Sri Lanka (de Silva, Ranasinghe, & Abeykoon, 2016).

Hence, the age structure has been changed during last few decades. It is expected to further change as showed in Figure 2:3.

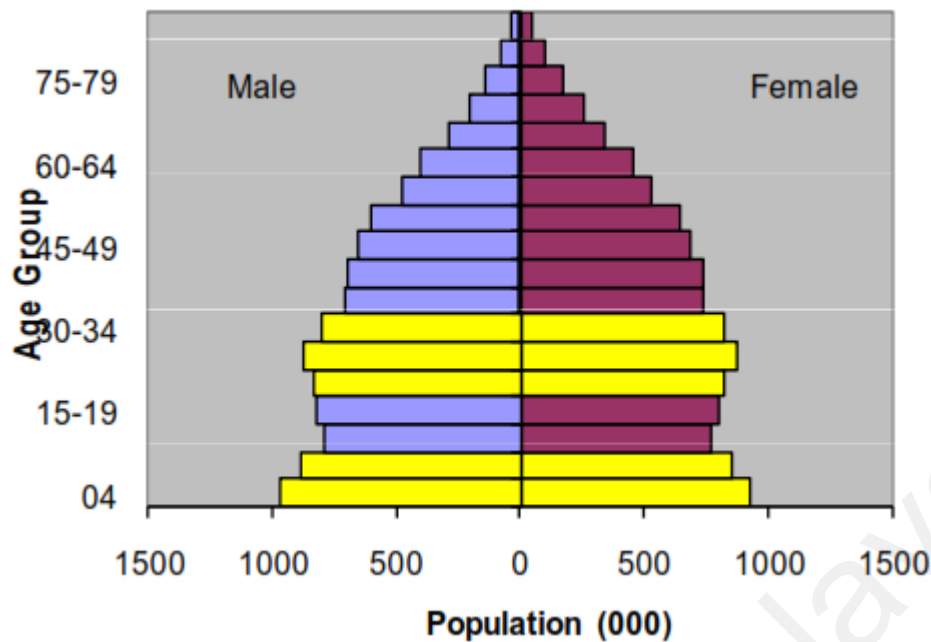


Figure 2:3 Population Pyramid of Sri Lanka by 2010

Considering the above figure, it is very obvious the increasing of the older population in Sri Lanka. This situation mainly affect the socio economic development of Sri Lanka. Labour markets shortage, sustainability of pensions, higher cost for social services, higher cost of health care are some of the economic challenges faced by Sri Lanka. Increase in dependency ratio directly affect the social development of the country.

Dependency of the aged is defined as the number of people over 60 years of age among hundred persons of the age group of 15-59 years (*World Population Ageing* 2013). According to the Figure 2:5 on projected dependency ratio in Sri Lanka, old age dependency has increased dramatically. It may pressure on the economically active population in Sri Lanka.

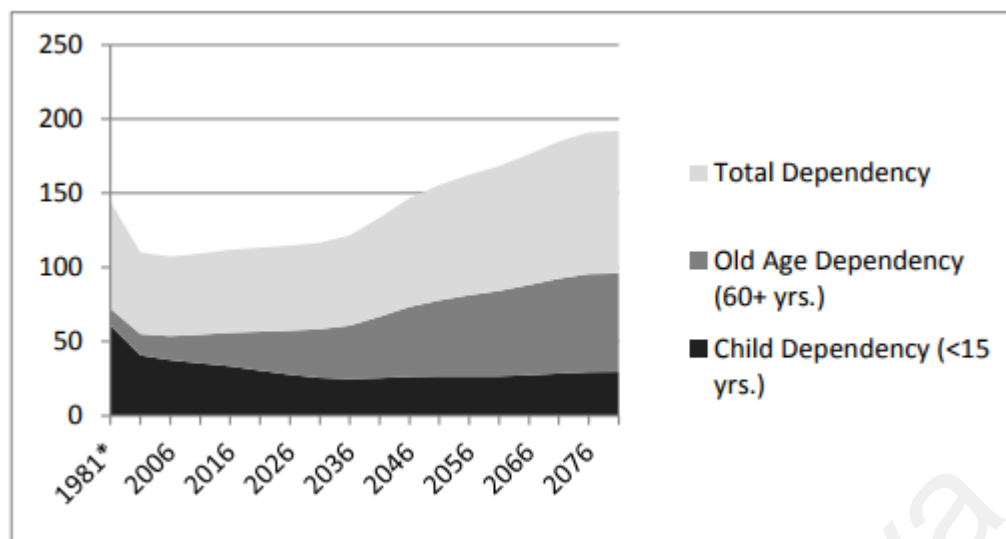


Figure 2:4 Projected dependency ratios, 2001-2081 (World Bank Report, 2012)

With this rapid ageing projection, the prevalence of non-communicable disease increased considerably (*Annual Health Bulletin*, 2015).

2.5 Perspectives of ageing

Ageing has been described in various perspectives: biological; humanistic and scientific (Simon Schreck, 2014). In clinical field, both human and scientific perspectives of aging is considered in assessing, treating, establishing research agendas and advocating for the elderly who needs care (Simon Schreck, 2014). Many of the above theories interact with each other in a complex way (Jin, 2010). Therefore, the widely used biological theory is considered as a base in describing aging in the current study.

Considering biological perspective, Meilaender (2011) mentioned aging as a normal stage of life in which our bodies begin to function less effectively, making us more vulnerable to disease. Arking (2004) described that aging involves multiple deleterious biological events that accumulate in different tissues over time and gradually reduce an

organism's state of maintenance and function. As summarized by Jin (2010), modern biological theories of aging in humans can be mainly categorized into two: programmed and damage or error theories. According to the programmed theories, aging follows a biological timetable. It continues the mechanism which regulates childhood growth and development depending on changes in gene expression that affect the systems responsible for maintenance, repair and defence responses (Jin, 2010) . The damage or error theories include wearing out of cells and tissues, rate of oxygen basal metabolism, accumulation of cross-linked proteins damages cells and tissues, slowing down bodily processes result in aging (Jin 2010). These dynamic mechanisms affect physical, psychological, and social changes(Jin, 2010) of human beings. The changes are described below in detail.

2.5.1 Physical changes

Aging causes various changes in body systems, which have important consequences on health and physical functions.

2.5.1.1 Skin

The skin, hair, and nails change with age. Age-related changes in the epidermis can be mostly seen in sun exposed areas of the body. Because of the decreasing of moisture ability of epidermis the appearance of elderly become dry and rough. The rate of cell turnover also declines. Because of the slowing down of regeneration of melanocytes, darkly pigmented areas called lentigo senilis (age spots) can be seen (Miller, 2009). As collagen decreases and arranges disorderly, the dermis losses its thickness resulting in skin of the elderly become wrinkling and sagging. With age, the fat cell layer of the

hypodermis becomes thinner resultant in protecting from trauma. Greying of the hair, hair loss, and baldness are widely seen among elderly due to sex-linked, genetic, and racial factors. Considering nails, they grow more slowly and become hard, thick, and brittle (Miller, 2009).

2.5.1.2 Skeletal system

This is a universal age-related change. Due to a gradual loss of calcium from bone, changes in skeletal system can be seen specially declining bone strength. As cartilage surfaces become rough in joint areas, it reduces flexibility and the cushioning effect of normal cartilage. This causes the pain and joint movement restriction. Because of changes of cartilages in intervertebral discs with age, body flexibility is reduced. Loss of overall height is another change in the skeletal system specially related to vertebrae. This is due to the compression of spinal discs and loss of height (Tabloski, 2014). Osteoporosis, arthritis, including osteoarthritis and rheumatoid arthritis, gouty, arthritis, osteomalacia, Paget's disease, are some of the age related skeletal system disorders.

2.5.1.3 Muscles

Declining muscle strength, muscle atrophy, decrease in muscle mass and weakness (sarcopenia) can be considered as age-related changes in muscles (Marieb & Hoehn, 2013). These affect changes in elderly movement, posture, stabilizing joints, heat production, excitability, contractility, extensibility, and elasticity (Saxen et al. 2014).

Muscle Cramps, Myasthenia Gravis, Polymyalgia Rheumatica, Bursitis, are commonly seen among elderly as muscular disorders in aging.

2.5.1.4 Nervous system

Elderly people show specific age related changes in the nervous system. With age, loss of neurons can be observed. Due to that, changes in transmission efficiency also can be seen with aging. Sleep patterns also altered with aging reducing the quality and efficiency of sleep. Tremors are the widely and easily seen age related nervous system disorder. These tremors can be seen primarily in the head, neck, face, and limbs. Parkinsonism which is a group of symptoms involving abnormal movements, including slowness of voluntary movement is also an age related disorder. As the nervous system is one of the major integrating systems of the human body, changes in the system interrupts thinking, reasoning, and other cognitive processes and body movements.

2.5.1.5 Sensory systems

Numerous changes in sensory functions can be observed among elderly. Vision (sight), audition (hearing), gustation (taste), olfaction (smell), tactile (touch), vestibular (balance), and kinesthetic (“muscle sense”) are the major concerns of sensory system. With aging various changes of these sensors can be seen. Decreased visual acuity, light and dark adaptation, increased sensitivity to glare, significant loss of peripheral vision is common in aging. Cataract is more common and causes impaired vision of elderly as an age related visual disorder. Glaucoma is the second most common cause of blindness especially among elderly. Age-related macular degeneration interrupts the visual path of elderly. Subtle changes in hearing progress gradually with age. With aging, the pinna in the outer ear loses its flexibility. In the external ear canal, drying and thinning of tissues can be seen. Due to these reasons, probability of ear wax accumulation increases resultant in hearing impairments (Weinstein, Sirow, & Moser, 2016).

2.5.1.6 Vascular system

Cardio vascular changes are somewhat complicated to describe as due to 'normal aging' or 'pathological' changes (Strait & Lakatta, 2012). However, some changes can be observed due to aging. They are: increase in fatty tissues in the outermost layer of the heart muscle, increase in the thickness of the left ventricular wall, increase in collagen and elastin tissues in the heart and arteries, decreased efficiency in contractile strength of the heart muscle and decreased maximum heart rate, stroke volume, cardiac output, ejection fraction and oxygen uptake, accumulation of lipofuscin, thickening and sclerosis of the valve flaps of the heart, decreased number of pacemaker cells, loss of muscle cells in the A-V node and the bundle of His, an increase in fatty fibrous tissue, increased elastic collagen-type tissue in all parts of the conduction system, thickened and stretched veins and less efficiently functioning valves in the veins and calcified, less elastic coronary arteries.

In addition, some age related functional changes also can be seen due to aging such as requiring a slightly longer rest period between heart beats, slight arrhythmias, decline in cardiac output, increase in atrial fibrillation, changes in arteries and veins, decreases blood volume as it relates to a lower plasma volume. Arteriosclerosis and Atherosclerosis, Hypertension are commonly seen age related disorders of cardio vascular system.

2.5.1.7 Respiratory system

There are various age related changes can be seen in the respiratory system. Calcification of the laryngeal and tracheal cartilage occurs, resulting in a stiffening of those structures, altering the structure of alveoli, Presbylaryngis which is an aging changes in voice pitch caused by thinning or aging of the vocal cords, skeletal changes such as calcification of the costal (rib) cartilages, osteoporosis, and weakened respiratory muscles, lose strength and endurance of muscles responsible for inhalation and exhalation and decreased effectiveness of the oxygen–carbon dioxide exchange are some of the age related changes in the respiratory system. Chronic Obstructive Pulmonary Disease, Chronic Bronchitis, Emphysema, Pulmonary Tuberculosis, Pneumonia and Lung Cancer are some of the age related respiratory system disorders (Sharma & Goodwin, 2006).

2.5.1.8 Gastro intestinal system

When considering age related changes in gastro intestinal system, slowing of the process of digestion, reduction of efficient are marked. In the mouth, tooth enamel and dentin gradually wear down, making teeth more susceptible to cavities. Delayed emptying of food into the stomach can be seen due to weaker smooth muscle of the oesophagus and lessened sphincter motility. With age a slight decrease in gastric emptying is seen. Decreased hydrochloric acid is another age related changed widely seen in the stomach. There appears to be decreased digestive enzyme secretions which may affect the absorption of some nutrients. Delay movement and expulsion of material from the large intestine, contributing to constipation can be seen due to both decreased anal sphincter tone and muscle tone. With aging, the size and blood floor of the liver

and decrease. Gallstones may tend to increase in the gallbladder with age (Brown, Levine, & Zenilman, 2011).

Xerostomia (dry mouth), Dysphagia (difficulty swallowing), Dental caries, Periodontal disease are few common age related disorders of the mouth. Cancer of the esophagus, Gastroesophageal reflux disease, Hiatal hernia can be mentioned as age related disorders of the oesophagus. Gastritis, Gastric (peptic) ulcer are related to disorders of stomach with age. Age-Related Disorders of the Small Intestine is comparatively low. Appendicitis, diarrhoea, Constipation, Diverticulosis and diverticulitis, Cancer of the colon and rectum, Hemorrhoids are age related disorders of large intestine. Cirrhosis can be widely seen among males than females as an age related disorder of liver. Gallstones are a disorder of gall bladder with age.

2.5.1.9 Urinary system

Age related changes can be seen in kidneys, ureters, the bladder, and the urethra. Anatomical changes of the structures of the urinary system can be observed due to aging. They are decreasing kidney size, increase in glomerular sclerosis, decline in the number of cells of the renal tubules, an increase in tubular diverticula, becoming blood vessels in the kidneys smaller and thicker, and atherosclerotic changes occur that reduce blood flow through the kidneys and decrease GFR, lose tone and elasticity of the ureters, bladder, and urethra and decline in bladder capacity causing retained in the bladder after voiding (Weinstein & Anderson, 2010).

Some of the functional changes of the urinary system with aging are decreasing renal blood flow, declining Glomerular filtration rate, decreasing ability to concentrate urine, changes in acid–base balance in the blood and regulating sodium and potassium levels may become more difficult (Tabloski, 2014). Urinary Tract Infections, Cystitis (Lower Urinary Tract Infection), Pyelonephritis (Upper Urinary Tract Infection), Acute Glomerulonephritis, Benign Prostatic Hyperplasia, Urolithiasis, Urinary Incontinence, renal failure are some of the age related disorders of the urinary system.

2.5.1.10 Reproductive system

With age, the reproductive capacity diminished and finally ceased among women. The following changes are widely seen among elderly women: the occurrence of the climacteric, culminating in the menopause, the cessation of menstrual flow, thinning and greying of pubic hair, a loss of subcutaneous fat and elastic tissue in the external genitalia, which shrink slightly, thinning of the vaginal walls, which also become drier and less elastic, decreases in blood flow and in the amount of vaginal lubrication produced may cause sexual intercourse to be uncomfortable or even painful, decreases in size and weight of the ovaries and uterus, decreased secretion of estrogen, loss of some elasticity of the ligaments supporting the ovaries and uterus, diminished muscle and glandular tone, skin is less elastic, resulting in a loss of firmness and sagging of the breasts and other body tissues (Miller, 2009). Atrophic Vaginitis, Pelvic Organ Prolapse (Cystocele, Rectocele, and Prolapsed Uterus) is widely seen age related disorders of female reproductive system. Producing fewer viable sperms, decrease motility of sperms, changes in the amount and consistency of the seminal fluid, diminishing ejaculatory force, decreasing in testosterone levels, increasing in the size of prostate gland which leads to compress the urethra are the major age related changes of male reproductive system.

2.5.1.11 Endocrine system

The endocrine system is so complex and interrelated. Therefore, it is difficult to describe the changes of the system with age. However, atrophy of tissues and a decreased rate of secretion of the pituitary gland, thyroid gland, parathyroid gland, adrenal (suprarenal) glands, pancreas, pineal gland, thymus gland, and gonads are obvious with age.

2.5.1.12 Immune system

Immunosenescence refers to age-related changes that occur in the immune system and result in a decrease in immune functioning. Among the changes related to immune system, aging changes in skin and mucous membranes reduce the effectiveness of the immune system's first line of defence; the thymus gland decreases in size and activity and is eventually unable to supply enough new T cells to deal with antigens invading the body, so that older adults may then be more vulnerable to infection and disease; age-related changes result in a reduction of immune responsiveness in both innate and acquired immunity; in cell-mediated immunity there is some decline in T cell function.

2.5.2 Psychological changes

Psychological changes with age affect the adaptive capabilities, including memory, intelligence, and how individuals cope with their own aging. There are several psychological changes due to aging. Some of these changes may be for the better, and others are not (Glisky, 2007).

Age changes of cognition are not uniform to all older persons as the brain structure and functions are not uniform to all individuals. Attention and memory are the main cognitive functions affected by aging. With the declining of cognitive functions, language processing and decision making may also be affected by age. In addition, perception is also considered as a cognitive function which affected by aging (Glisky, 2007).

American Psychological Association (APA) mentioned that some natural body changes associated with aging may increase a person's risk of experiencing depression. The mortality rate of older persons suffering from depression is higher than that of older persons satisfying their old life (APA). In addition to that, feelings of hopelessness and isolation are some widely seen psychological changes with aging. Health and Places Initiative (2014) pointed out that rates of dementia increased with aging; however, it is increased dramatically after 85 years of age. This report further described that dementia, depression, and anxiety are the most common mental health problems for older adults worldwide and cause for worsening chronic medical problems, physical limitations, and decline in sexual functioning (Atiq, 2006). van Gool et al. (2003) reported that depression significantly increased the associations between pathology and subsequent impairment in a longitudinal study. Further Onishi et al. (2006) mentioned that depressive mood in older persons was often associated with handicaps. The loss of hope and morale, as well as memory loss and reduction of physical activity were highly correlated with depression.

In addition to the above information, some studies pointed out that dealing with losses also causes many psychological issues among older persons. When advancing age, older individuals lose many things including losses of spouses, friends, relatives, roles,

functions, and independence (Atiq, 2006). In contrast, individuals with a firm sense of self can adapt to the situations as they have wide range of coping skills and multiple sources of personal meaning. However, these losses contribute to increased dependency and anticipation and fear of dependency and physical illnesses. Further, facing to an impending death is another psychological challenge for older persons (Ellershaw & Ward, 2003). This can be quite overwhelming conditions for individuals who have poor ego function. Atiq (2006) pointed out that tailored, individualized, flexible approaches are essential in reducing most of the psychological problems.

However, some research findings reported that older persons are not as anxious, depressed or fearful as they might have been expected (Kunzmann, Little, & Smith, 2000). Using cross-sectional (N = 516) and longitudinal (N = 203) samples from the Berlin Aging Study (age range 70-103 years), these authors reported that age was not a cause of decline in subjective well-being. In line with this finding, Dittmann-Kohli (2008) also reported that older persons were more positive about self and life than the younger persons in their study. The older persons in this study changed their standards, becoming more self-accepting. They valued more highly what is already given and still available. They did not maintain high expectations for life realization and self-development.

2.5.3 Social changes

It is well documented that older persons need some basic requirements and skills in their day to day life to live independently (Arokiasamy, 1997). Economy is very important in this aspect. Their employment, retirement and income are very crucial in maintaining daily opportunities and competences. Both males and females face this issue as

increased participation of women in the labour force (Arokiasamy, 1997). Working is an important element of personal identity construction. It contributes to the construction of the social being, since mankind is produced and reproduced by working (Alvarenga, Kiyon, Bitencourt, & Wanderley, 2009). Because of that when an individual gets retirements, it affects their mental structure manifesting feelings and symptoms like anxiety, depression, irritability, and general dissatisfaction (Alvarenga et al., 2009). Chronological age is considered for retirements and ability to work is not a basic for retirement. Therefore, it leads to loss of the role as a worker or producer, and as an income provider resulting in loss of status, self-esteem (Arokiasamy, 1997).

Older persons meet their financial obligation through pensions, savings, provident funds or any other income. However, in some countries like Sri Lanka, pensions are received by less than one-fifth of the old people and only one-third of the labour force participates in pension scheme. The majority of informal sector workers lack of such coverages (*Sri Lanka Addressing the Needs of an Aging Population* 2008). Due to these financial instability, older persons delaying seeking health care especially reluctance to seek care for visual, hearing and dental problems. Some of them change their living styles, and drop out of social groups especially when they face transportation problems as a consequence of financial constraints (Arokiasamy, 1997).

Another social factor which affect economy is increasing life expectancy. Although it looks good, it provides number of challenges to the society including health care and social care. The society needs to care of older persons with chronic illnesses and with lower capacity to carry on activities of daily life (Lindgren, 2016).

Changing residential environment is another social change of older persons (Burns, Lavoie, & Rose, 2012). Neighbourhood and the home are considered as key elements in social life of older persons as it provides a number of identity markers to the older ones. It is a comfort to them and an emotional value, strengthened by personal feelings about family, relationships with friends, neighbours. However, in some situations, they have to move to be with their children due to failing health, frail and mobility impaired changing their home environment (Arokiasamy, 1997). Not only children's homes but the other residential institutions are some places where older persons have to move. When older person is forced to change residence to another home or to a nursing home, where environmental pressures increase, it affects an overload or excessive stress that can lead to physical and spiritual imbalance (Runcan, 2012). Leaving behind their own life habits and own environment is a traumatic event for them as they are extremely attached to those things.

2.5.4 Aging and nutrition status

The above mentioned several physiological, psychological and social changes of aging affect the nutritional status of elderly in various ways.

Decreasing in gastric acid secretion and saliva production directly affect the peristalsis and constipation (Rémond et al., 2015). Tooth decay leading to loss of teeth badly affects the food intake especially chewing foods (Furuta & Yamashita, 2013). Dysfunction of thirst regulation is another change associated with aging directly affecting nutrition among them. Almost all the less function of sensory changes affects nutrition. For instance, vision effects on making and ingestion of meals. Smell and taste are very important in maintaining good appetite. All of these changes are result in reducing food intake and leading to malnutrition among elderly. Moreover, changes in

urinary system may affect the acid base balance of the elderly and as a result of that nutritional status. Dysfunctions of endocrine system due to aging affect the whole body regulations of the elderly (Cai, Mcneilly, Luttrell, & Martin, 2012).

Psychological changes in aging also directly affect the nutritional status of elderly. For instance, depression, low cognition or loneliness cause for the less interest and living. It leads to fewer intakes of foods and finally resulting in malnutrition.

Life does change with age (Charles & Carstensen, 2010). Social changes of aging also affect the malnutrition of elderly in various ways. For instance, retirement of the elderly may affect in financial issues for purchasing foods, and routine dietary practices. After retirements, most of the elderly lose the strong social networks they had. It may directly effects on the cognitive status of them.

2.6 Malnutrition among older persons

The definition of malnutrition differs among institutions, disciplines and cultures. The terms ‘malnutrition’ and ‘under nutrition’ is used interchangeably in the literature (Chen et al., 2001). The World Health Organization defines malnutrition as ‘the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions’ (European Nutrition for Health Alliance, 2005). Malnutrition is an overall term, encompassing: (1) under nutrition resulting from insufficient food intake; (2) over nutrition caused by excessive food intake; (3) specific nutrient deficiencies and (4) imbalance because of disproportionate intake (Keller, 1993). However, malnutrition among elderly population is under-recognized and under-treated (European Nutrition for Health Alliance, 2005).

Therefore, it is very important to assess nutritional status in this vulnerable population in order to identify people with malnutrition and at risk of malnutrition, to determine the causes of them in order to correct those (Barcelo et al., 2013).

2.7 Measurements of assessing malnutrition in older persons

There are various indicators that are utilized to assess the nutritional status of older persons: (1) anthropometric measurements of body composition; (2) biochemical measurements; (3) clinical assessment and (4) measurement of dietary intake (Knox et al., 2003). In addition, various types of questionnaires on nutritional assessment can also be used to assess nutritional status of elderly (Green & Watson, 2006).

2.7.1 Anthropometric measurements

Anthropometric measurements can be used to assess information on body size, distribution of body fat, and lean body mass (WHO, 1995). They are relatively simple, and inexpensive. They can be used in assessing nutritional status in laboratory, clinical and community settings (Jamaiyah et al., 2008). The widely used anthropometric measurements to assess nutritional status of older persons are described below.

2.7.1.1 Standing height

Standing height is the length from the bottom of the feet to the top of the head when standing (Galiana et al., 2016; Somrongsong et al., 2016). It is used in assessing the risk of malnutrition as well as obesity, estimating basal metabolic rate and determining drug doses (Madden & Smith, 2016). Standing height can be measured using electronic portable height measurers. The person needs to be able to stand steady and upright,

unaided. Shoes must be removed. Then, the person is asked to stand up straight, looking straight ahead with the Frankfurt plane horizontal. The arms should be relaxed at the sides, legs need to be straight and close together, feet must be flat with the heels almost together (Hickson & Frost, 2003).

However, it is well studied that loss of height can be seen with increasing age especially in populations with mobility limitations, bed-bound people, individuals with contracture, people with advanced arthritis, paralytic conditions or amputations. In addition, standing height is difficult to measure in the older persons as a result of increasing spinal curvature with age (Rajasi et al., 2016; Schilp, Wijnhoven, Deeg, & Visser, 2011). Weakness of erector spinae muscle and reduction of water content within the intervertebral disk further decrease the height of older persons (Hwang et al., 2009). Therefore, many a studies suggested estimated height to be calculated from a range of different body measurements, including knee height and arm span (Madden & Smith, 2016).

2.7.1.2 Knee height

Generally, the length of long bones in the arms and legs does not reduce with age. Hence, knee height can be used as an indirect measurement of height in older persons (Karadag et al., 2012). Knee height is used for the estimation of height people who find it difficult to stand in an upright. This measurement can be made with a sliding caliper when the patient is sitting or lying down. The patient needs to hold knees and ankles at 90° angles, when taking the measurement (Frid, Thors Adolfsson, Rosenblad, & Nydahl, 2013). When measuring knee height, the sliding caliper is placed under the heel of the foot and the movable blade adjusted with a light pressure approximately 3

cm behind the knee. The shaft of the calliper is held parallel to the tibia and across the malleolus. Based on Chumlea et al as mentioned by Frid et al. (2013), height is calculated as follow.

Height (cm) for men = $(2.03 \times \text{knee height}) - (0.04 \times \text{age}) + 64.19$

Height (cm) for women = $(1.83 \times \text{knee height}) - (0.24 \times \text{age}) + 84.88$

However, this method cannot be used for patients with lower limb ambulation. (Frid et al., 2013). Also, Lin et al. (2013) pointed out that ethnicity must be considered in knee height estimation.

2.7.1.3 Arm span

Arm span measurement is valid and reliable and can be used as a substitute for height in the elderly as there is a high correlation between arm span and height among elderly persons (Jamir, Kalaivani, Nongkynrih, Misra, & Gupta, 2013; Nygaard, 2008). Arm span is from sternal notch to the tip of the middle finger when the person is in sitting or recumbent position. This measurement can be used to assess the height of older persons whose measuring height is difficult such as wheelchair users or bedridden and persons with various disease conditions including osteoporosis, leg amputations, or stroke (Nygaard, 2008). However, because of joint stiffness of older persons, arm span reduces the accuracy of measurements (Uchmanowicz et al., 2016).

2.7.1.4 Body weight

Body weight is another anthropometric measurement which can be used to assess nutritional status. However, body weight represents the sum of all body compartments (fat-free mass and fat mass). It does not differentiate the fat and fat-free mass.

Therefore, measuring body weights gives inaccurate findings related to changes in alterations in muscle, fat, water or a combination of these. Hence, this measurement provides limited information related to actual nutritional status (Madden & Smith, 2016).

2.7.1.5 Body Mass Index (BMI)

BMI is calculated as weight in kilograms (Kg) divided by height in meters (m) squared. According to the WHO (1995), following values were used to determine the nutritional status of elderly. Although many scholars suggested the separate BMI cut off values for Asians, WHO expert consultation agreed that the WHO BMI cut-off points should be retained as international classifications as Asian populations have different associations between BMI, percentage of body fat, and health risks than do European populations ("Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies," 2004).

$\leq 18.5 \text{ kg/m}^2$	Underweight/under nutrition
$18.5 - 24.9 \text{ kg/m}^2$	Normal
$\geq 25 \text{ kg/m}^2$	Over weight
$25-29.9 \text{ kg/m}^2$	Pre obese
$> 30 \text{ kg/m}^2$	Obese

BMI is commonly used indicator of malnutrition as it is cheap and relatively easy to use (Bahat et al., 2012; Daniels, 2009). However, it has some limitations in using for older persons. Generally, weight considers both fat and fat-free mass. But, fat-free mass progressively lost with aging. Therefore, weight in BMI cannot differentiate fat and fat-free mass. Also, measuring height is not suitable for older persons due to shrinkage,

vertebral collapse, and measurement problems. Hence, BMI is unreliable for older persons (Price, Uauy, Breeze, Bulpitt, & Fletcher, 2006).

2.7.1.6 Mid Upper Arm Circumference (MUAC)

Mid-Upper Arm Circumference (MUAC) is a simple measurement which can be used in nutritional evaluation. It is an indicator of protein and energy reserves of an individual (Benítez Brito et al., 2016). Mid-upper arm circumference (MUAC) has been identified as alternative measures for determining thinness in older persons (Portero-McLellan et al, 2010). It is a valid measurement which can be used to assess nutritional status of older population also. It can be measured by taking the circumference at the midpoint between the acromial process of the scapula and olecranal process of the elbow of the non-dominant arm when the forearm is hanging relaxed at the side. Less than 21 cm is selected as an indicator of under nutrition (WHO, 1995). However, there is insufficient evidence on cut off points of MUAC in various populations (Tang et al, 2013).

2.7.1.7 Calf Circumference (CC)

Calf circumference is considered as the most sensitive measures of muscle mass in older persons (WHO, 1995). It, has been found to be very useful for evaluating health and nutritional statuses of this population (Faller, Melo, Versa, & Marcon, 2010). It is a reliable measurement which can be used in community surveys as well as hospital settings (Paiva et al., 2016; Portero-McLellan et al., 2010).

When measuring CC, the participant is asked to sit in a chair with the knee and corresponding ankle keep bent to a 90⁰ angle. The researcher kneels beside the lateral side of the calf and a loop of measuring tape is placed around the calf. The

circumference of the widest point of calf is measured. When the largest circumference is located, by moving the loop up and down the calf, the tape is pulled snugly around the calf. This measurement is recorded to the nearest 0.1cm. Each measurement of circumferences is taken as three consecutive readings and average is used as the final reading (Fernando & Wijesinghe, 2010).

The two categories of CC are used to assess nutritional status as < 31 cm and ≥ 31 cm. As anthropometric measures are differences among populations, lacking of reference values for CC is a limitation for Asian studies. Recently, Daniels (2009) pointed out the importance of having worldwide studies from different nations and countries to obtain better reference values of CC.

2.7.1.8 Hand Grip Strength (HGS)

Hand grip strength is another anthropometric measurement widely used in assessing nutritional status of older persons (Silveira, de Sousa, Stringhini, Freitas, & Melo, 2014). It is a noninvasive, simple and quick method which can be used to assess nutritional status in clinical and epidemiological studies (Garcia, Meireles, Führ, Donini, & Wazlawik, 2013). HGS is measured using handgrip dynamometer, a portable and rather inexpensive, and which does not require skilled technicians (Longworth et al., 2014). This measurement is repeated 3 times on both hands, each with at least 15 seconds recovery between each effort. Right or left hand dominance can be noted. All readings are recorded in kilogram. The highest reading can be chosen for the analysis (Moy, Darus, & Hairi, 2015). Due to weakened muscles, loss of natural teeth and movement coordination, elderly people face difficulties in the eating process. Hand Grip Strength can be used to directly assess the muscle weakness which related to the eating

process. Kiesswetter et al. (2013) reported that HGS deteriorated significantly from the well-nourished to the malnourished group of elderly people. A recent study conducted by Springstroh, Gal, Ford, Whiting, and Dahl (2016) revealed that HGS was weakly associated with nutritional risk among community-dwelling elderly. Using HGS, elderly could be classified as malnourished when their HGS was below the tenth percentile (Garcia et al., 2013; Schlussek, dos Anjos, de Vasconcellos, & Kac, 2008).

There are few limitations of using HGS as a screening method. Subject cooperation is highly required when taking the measurements. Some groups of patients or conditions, such as pain, sedation, comatose status, osteoarticular diseases, confusion or neurological and/or cognitive impairment or critical illness significantly affect the HGS measurements (Pietersma, de Vries, & van den Akker-van Marle, 2014). Also, the cut off points for the identification of risk of malnutrition by HGS are not reliable between studies (De Luca d'Alessandro, Bonacci, & Giraldi, 2011).

When considering all the above anthropometric measurements, all of them are non-invasive. The measurements can be taken quickly than the other measurements. However, these measurements cannot be used to identify nutrient deficiencies or small changes in the proportions of fat mass or fat free mass of the body. Anthropometric measurement such as standing height is impractical to take as some of the older persons are unable to stand straight. Importantly, a single anthropometry measurement cannot be used to assess the nutritional status.

2.7.2 Biochemical measurements

Biochemical measurements are used in the nutritional assessment to gain valuable information in the determination of an individual's nutritional status and to identify any nutrient deficiencies or excesses (Boosalis & Stiles, 1995). They are very useful in detecting early changes in nutrition before any clinical sign appears. Serum levels of total cholesterol and albumin and total lymphocyte counts are used to assess nutritional status among older persons (López-Contreras, Torralba, Zamora, & Pérez-Llamas, 2012).

2.7.2.1 Serum albumin

Serum albumin is identified as a key nutrient that is significantly related to general health among older persons (Moriya et al., 2010). It can be used as the sole markers of nutritional status among elderly (Jun et al., 2016). It has the vital roles in maintenance of osmotic pressure which may influence tissue tolerance (Iizaka et al., 2011). However, serum albumin is not suitable for the older persons having inflammatory conditions such as hepatic failure, burns, sepsis, trauma, post-surgery states and cancer due to deterioration of liver function. Further, in non-inflammatory states such as starvation, this measurement cannot be used as a marker for malnutrition (Rodrigues, Oliveira, Vargas, Moreira, & EF, 2012). In addition, there are some controversial points related to serum albumin as a measure of nutritional status of older persons. Impaired physical functions affects serum albumin concentrations in older persons. Posture-related effects such as supine, sitting, standing and moderate exercise on serum albumin levels have been reported (Kuzuya, Izawa, Enoki, Okada, & Iguchi, 2007). This is due to variations in hydrostatic and oncotic pressures with changes in body positions (Yoshimoto et al., 2017).

2.7.2.2 Serum lymphocyte counts

The lymphocyte count is known to decrease in a poor nutritional status, especially because of protein energy malnutrition. As malnutrition induces immunological changes, a drop in serum lymphocyte count can be seen. Therefore, total serum lymphocyte count has been identified as a useful indicator of the nutritional status and appropriate for assessing malnutrition of older persons (Omran & Morley, 2000; Shrouts, 1993). Nishida & Sakakibara (2010) reported that low lymphocyte count ($<1500/\text{mL}$) was most frequently found in 35% of the underweight women who additionally had lost weight in the past 3 months. An increased amount of weight loss led to a higher prevalence of low lymphocyte counts.

Biochemical measurements can be very useful in objectively assessing the nutritional status of older persons. However, these measurements are costly when using in large sample sizes. Also, invasiveness should be considered. A review suggested that these type of measures provide integrated measures reflecting their absorption and metabolism after consumption. Also, values cannot be accepted as they may be affected by disease conditions and homeostatic regulation (Kaaks, Ferrari, Ciampi, Plummer, & Riboli, 2002).

2.7.3 Clinical assessment

Clinical assessments are also a crucial method of nutritional assessment. Clinical assessment mainly includes a physical examination to identify signs of or contributors to malnutrition (Knox et al., 2003). Clinical assessments can reveal certain nutritional deficiencies which cannot be detected by the other methods such as dietary and biochemical. Table 2.1 shows some examples of clinical signs and symptoms related to

nutritional deficiencies. A variety of clinical signs indicate various nutritional deficiencies. However, as most clinical signs for nutritional deficiency are non-specific, clinical assessment alone cannot be used to assess nutritional status of the older persons (Shrivastava, Shrivastava, & Ramasamy, 2014).

Table 2.1 Clinical signs and nutritional deficiencies

(adapted from (Ahmed & Haboubi, 2010))

System	Sign or symptom	Nutritional deficiency
Skin	Dry scaly skin	Zinc/essential fatty acids
	Follicular hyperkeratosis	Vitamin A, C
	Petechiae	Vitamin C, K
	Photosensitive dermatitis	Niacin
	Poor wound healing	Zinc, vitamin C
	Scrotal dermatitis	Riboflavin
Hair	Thin/depigmented	Protein
	Easy pluckability	Protein, zinc
Nail	Transverse depigmentation	Albumin
	Spooned	Iron
Eyes	Night blindness	Vitamin A, zinc
	Conjunctival inflammation	Riboflavin
	inflammation	Vitamin A
Mouth	Keratomalacia	
	Bleeding gums	Vitamin C, riboflavin
	Glositis	Niacin, piridoxin, riboflavin
Neck	Thyroid enlargement	Iodine
Abdomen	Parotid enlargement	Proten
	Diarrhoea	Niacin, folate, vitamin B12
	Hepatomegaly	Protein
Extremities	Bone tenderness	Vitamin D
	Joint pain	Vitamin C
	Muscle tenderness	Thiamine
Neurological	Tetany	Calcium, magnesium
	Parasthesia	Thiamine, Vitamin B12
	Ataxia	Vitamin B12
	Dementia	Vitamin B12, niacin
	Hyporeflexia	Thiamine

2.7.4 Dietary assessment

The evaluation of nutritional patterns of the older persons can be conducted using various dietary assessment methods such as twenty four hour dietary recall method. The widely used dietary assessment methods are presented in this chapter.

2.7.4.1 Twenty-four hour diet recall

Twenty-four hour diet recall is a commonly used dietary assessment method in older persons (Wyka, Biernat, Mikołajczak, & Piotrowska, 2012). It considered the all food consumed by a person in last 24 hour period. (Ahmed & Haboubi, 2010) . It is easy to administer and the burden of the respondent is minimal.

However, there are few disadvantages of 24 hour recalls. The first one is that it does not give the detail of person's typical dietary intake. The person's cognitive impairments also affect the recalling. The third disadvantage is that it relies heavily on a person's ability to remember his or her intake. Therefore, this is unlikely to be a suitable method for older persons.

2.7.4.2 Seven day food record

Food records containing all food and drink consumed for 7 days for is another dietary assessment method which is very helpful in eliminating day-to-day variations (Ahmed & Haboubi, 2010). The older person is asked to complete a seven-day open ended (unstructured) estimated diet record. Then, he or she need to fill in what they ate and drank with estimated portion sizes during the day in a diary (Johansson, 2008). Among the dietary assessment methods, food records have often been considered as the "gold

standard" as they can provide relatively accurate quantitative information on consumption (Eysteinsdottir, Thorsdottir, Gunnarsdottir, & Steingrimsdottir, 2012).

However, this method is not suitable for people who are having difficulties in writing down the foods and beverages consumed or in describing the portion sizes. Especially, for older persons, it is difficult for them to complete diet records. Moreover, it is costly as it needs coding and processing of collected information (Ortega, Perez-Rodrigo, & Lopez-Sobaler, 2015).

2.7.4.3 Food frequency questionnaire

This is a type of dietary assessment tool widely used in epidemiological studies investigating the relationship between dietary intake and disease or risk factors. It is very helpful to identify dietary intake over a particular time period (Eysteinsdottir et al., 2012). There are three main components of these questionnaires to be filled out: (1) list of foods; (2) frequency of consumption and (3) the portion size consumed.

Various method can be used to collect information from the participants such as self-administered, on paper or web-based, or interview administered either face-to-face or by telephone (Perez Rodrigo, Aranceta, Salvador, & Varela-Moreiras, 2015). However, it is not suitable for individual dietary assessment but for groups (Ahmed & Haboubi, 2010). Also as the process of filling the questionnaire is long and heavy reliance on long-term memory, it is very difficult for older persons and they may be fatigue and become bored (Adamson et al., 2009).

Considering all above dietary assessment methods, there are some limitations to be noted. Johansson (2008) highlighted that high social desirability, great eating restraint, a history of dieting, being overweight, eating disinhibition, body image, depression, anxiety, fear of negative evaluation may be related to misreporting. Most of the above methods are memory dependent. Therefore, they are not suitable for older persons as some aspects of memory change with aging. Also, they may not have good skills in estimating portion sizes. Bias in recording is very crucial as older persons may think of good or bad foods. Possible over-reporting of healthy foods may occur.

2.7.5 Nutritional status assessment questionnaires

Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN) by (Keller, 2006), Nursing Nutritional Assessment developed for use in a hospital environment by McCall and Cotton (2001), Ayreshire Nutritional Screen Tool developed for use in a day hospital setting (Mackintosh & Hankey, 2001) and Mini Nutritional Assessment (MNA) by Vellas et al. (1999) are some of the nutritional assessments tools developed for older population. Neelemaat, Meijers, Kruizenga, van Ballegooijen, and van Bokhorst-de van der Schueren (2011) identified quick-and easy screening tools such as Malnutrition Screening Tool (MST), Short Nutritional Assessment Questionnaire (SNAQ) and Mini-Nutritional Assessment Short Form (MNA-SF) and more comprehensive malnutrition screening tools as Malnutrition Universal Screening Tool (Agrawal et al.) and Nutritional Risk Screening 2002 (NRS-2002). Phillips et al (2010) also found nutritional assessment tools for use in community-dwelling elderly and subjected to validity and/or reliability testing. They are Mini Nutritional Assessment-Short Form (MNA-SF), Malnutrition Universal Screening Tool (Agrawal et al.), Nutrition Screening Initiative (NSI), which includes the

DETERMINE Checklist and Level I and II Screen, Australian Nutritional Screening Initiative (ANSI), Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN I and SCREEN II), Short Nutritional Assessment Questionnaire (SNAQ), and Simplified Nutritional Appetite Questionnaire (SNAQ). Characteristics of widely used nutritional screening and assessment tools used in research studies are shown in Table 2.2 and described in detail.

2.7.5.1 Malnutrition Screening Tool (MST)

The MST was developed specially for hospitalized adults. It is considered as a valid, quick and easy screening tool (van Bokhorst-de van der Schueren, Guaitoli, Jansma, & de Vet, 2014). It has been identified as an assessment method which has a good sensitivity and specificity when applied to the general hospitalised population (Shaw et al., 2015). It consists of two components: unintentional weight loss and appetite to identify adult acute patients at risk of malnutrition during hospital admission (Nor Azian, Suzana, & Romzi, 2014). Further, MST has been considered as a reliable questionnaire for identifying risk of malnutrition in the residential aged care setting rather than community settings (Isenring, Bauer, Banks, & Gaskill, 2009).

2.7.5.2 Mini Nutritional Assessment (MNA)

The mini-nutritional assessment (MNA), has been designed specifically and validated for older persons. It has a full version of 18 questions and a short-form screening version (MNA-SF) of six questions (Slee, Birch, & Stokoe, 2015). The full MNA includes 18 questions under four sub sections: anthropometry (body mass index, weight loss, mid-upper arm and calf circumference), general state (medications, mobility,

presence of pressure ulcers, lifestyle, and presence of psychological stress or neuropsychological problems), dietary assessment (loss of appetite, autonomy of feeding, quality and number of meals, fluid intake) and self-perception about health and nutrition. The total score ranges from 0 to 30 points. Well nourished, malnutrition and at-risk of malnutrition are defined by MNA score > 24 , MNA 17 to 23.5 and MNA < 17 , respectively (Guigoz, 2006).

The short-form of the MNA has been developed and validated against the MNA full version. It is a valid and reliable measurement which can be used in clinical and community settings. It consists of six items: questioning declined food intake and weight loss during the last three months, mobility, psychological stress or acute disease, neuropsychological problems and BMI (Vandewoude & VanGossum, 2013). MNA-SF to classify patients into three nutritional risk categories: well-nourished, at risk, and malnourished considering its score >7 , 8-11 and <12 respectively (Kaiser, Bauer, Ramsch, et al., 2009). It is used for initial screening of nutritional status (Koren-Hakim et al.). Also, it remains the gold-standard for ambulatory living older persons and those living in long-term care facilities (Sieber, 2006a).

2.7.5.3 Short Nutritional Assessment Questionnaire (SNAQ)

SNAQ can be described as an easy, short, valid and reproducible questionnaire for early detection of hospital malnutrition. It is a valid and reproducible measurement (Kruizenga, Seidell, de Vet, Wierdsma, & van Bokhorst-de van der Schueren, 2005). SNAQ score is calculated based on: unintentional weight loss ($>3\text{kg}$ during the last month), decreased appetite over the last month and use of supplemental drinks or tube feeding over the last month. Based on its score, patients can be divided into three

categories: well nourished, moderately malnourished and severely malnourished (Vandewoude & VanGossum, 2013). However, evidence suggested that SNAQ malnutrition screening tool is valid for the hospital outpatient population (Neelemaat et al., 2008).

2.7.5.4 Malnutrition Universal Screening Tool

The MUST was developed in different groups of hospitalized and community dwelling patients, both adults and older persons: in adult medical, surgical, and orthopaedic patients its validity to screen/assess nutritional status was found to be good. In contrast, the validity of the tool in an elderly population was only fair.

MUST is basically utilised in all hospitals and care homes (Slee et al., 2015). It is easy and quick to perform and contain of three domains: BMI, weight loss over time and an acute disease parameter for those expected to have a significantly diminished food intake for >five days (Sieber, 2006a). MUST classify nutritional status into three groups: a score of 0 indicated low risk, usual care; a score of 1 e medium risk, observe; a score of 2 or more-high risk of malnutrition. However, in MUST, BMI <22 is considered underweight and at an increased risk of malnutrition (Sieber, 2006b). However, MUST has been identified as the most valid in the evaluation of the risk for malnutrition in the older persons upon admission to the hospital (Poulia et al., 2012) and there is a need to evaluate the cost effectiveness of its implementation (Nor Azian et al., 2014).

2.7.5.5 Nutrition Risk Screening 2002 (NRS- 2002)

This tool was developed in a population of newly admitted adult medical and surgical patients in 1995 (van Bokhorst-de van der Schueren et al., 2014). NRS has identified as a good potential in the acute-care setting, as it was developed specifically for hospitalized patients who need nutritional support (Sieber, 2006a). The NRS-2002 composed of BMI, recent weight loss, recent decrease in food intake and severity of illnesses (Poulia et al., 2012). The total score ranges from 0 to 6, and patients were categorized into three groups: Score 5-6 as nutritionally at risk, 3-4 as medium risk and 0-2 as well-nourished (Koren-Hakim et al.). However, NRS 2002 was found to overestimate nutritional risk in the elderly (Poulia et al., 2012). Moreover, it was developed for various patient populations and not specifically developed for geriatric patients (Kondrup, Rasmussen, Hamberg, & Stanga, 2003).

2.7.5.6 Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN)

Seniors in the Community: Risk evaluation for eating and Nutrition is a simple tool. It has previously been developed to assess nutrition risk in community living older people in Canada (Wham, Redwood, & Kerse, 2014). This takes approximately 10 minutes to complete and it is a valid and reliable measurement specially in identifying nutritional risk in community dwelling elderly. SCREEN consists of 14 items related to weight change, food intake and risk factors of food intake (meal frequency, diet restriction, appetite, chewing and swallowing difficulties, meal replacement, eating alone, meal preparation and shopping difficulties). SCREEN scores range from 0 to 64; each question has several possible response options ranging from 0 to 4, with high scores indicating lower risk and scores of 2 or less indicating an area potentially leading to

nutrition risk (Watson, Zhang, & Wilkinson, 2010). The lower the score depicts increased nutritional risk as mentioned below (Wham et al., 2014).

SCREEN score 54 - No risk

SCREEN score = 50–53 -‘at risk’

SCREEN score 49 - ‘at high risk’

Although the SCREEN is a reliable questionnaire, it requires specific professional skills which make them less applicable for use at community settings (Wijnhoven et al., 2012).

When considering all the above nutritional status assessment questionnaires, all of them have been validated for assessing nutritional status of older persons (Table 2.3). Among them, only MNA-SF and SCREEN were developed for this population. MNA-SF, MUST and SCREEN use anthropometric parameters in assessing nutritional status. Both MNA_SF and MUST consider disease conditions. However, MUST does not consider the participants dietary intake. Hence, MNA-SF can be selected as the most practical measurement as it caters anthropometric vales, weight loss, dietary intake and disease conditions which are directly related to nutritional status.

Table 2.2: Characteristics of selected screening and assessment tools

	MST	NRS	MNA-SF	SNAQ	MUST	SCREEN
Country	Australia	Denmark	US	Netherlands	UK	Canada
Population	Adults	Adults	Older persons	Adults	Adults	Older persons
Setting	Hospital	Hospital	All	Hospital	Hospital	All
<i>Parameters</i>						
Weight	x	x	✓	x	✓	✓
Height	x	x	✓	x	✓	X
BMI	x	✓	✓	x	✓	X
Weight loss	✓	✓	✓	x	✓	✓
% weight loss	x	✓	x	x	✓	X
Dietary intake	✓	✓	✓	✓	x	✓
Diseases	x	✓	✓	x	✓	X

Table 2.2: Characteristics of selected screening and assessment tools (Continued)

	MST	NRS	MNA-SF	SNAQ	MUST	SCREEN
<i>Feasibility</i>						
No of questions	3	4	6	3	3	14
<i>Validation</i>						
Older persons	✓	✓	✓	✓	✓	✓

MST - Malnutrition Screening Tool

NRS - Nutritional Risk Screening

MNA-SF - Mini Nutritional Assessment Short Form

SNAQ - Short Nutritional Assessment Questionnaire

MUST - Malnutrition Universal Screening Tool

SCREEN - Seniors in the Community: Risk Evaluation for Eating and Nutrition

2.7.6 Selection of instruments for the current study

There is no any single screening or assessment tool is capable of adequate nutrition screening as well as predicting poor nutrition related outcome (van Bokhorst-de van der Schueren et al., 2014). When using anthropometric measurements, some limitations can be noted. For instance, standing height is a problem for those who are having age related changes in vertebrae. Body weight is not only considers body muscle mass but also fat mass and therefore cannot use to detect the change of body composition. Although biochemical methods are very helpful in detecting early changes related to nutritional status precisely and accurately, they are expensive and time consuming limiting the usage on a large scale. As most of clinical signs for nutrient deficiency are nonspecific, it is very difficult to quantify the nutritional status. Dietary assessment methods are tedious as recall bias exist. Several questionnaires are available as described above. Majority of studies considered several types of measurements together in assessing nutritional status.

When comparing the above tools, Mini Nutritional Assessment (MNA) has been tested for its specificity and sensitivity. Also, it has been used in several studies carried out on different population groups in different settings (Green & Watson, 2006). Furthermore, it is simple and easy to use. In addition, MNA can be used to identify risk of developing malnutrition as well as malnutrition at an early stage whereas the other tools cannot be used for that purposes. It measures all aspects of nutritional status such as physical, mental and dietary aspects. It has been recommended by the European Society for Clinical Nutrition and Metabolism (ESPEN) for the use of elderly people (Kondrup et al., 2003) . MNA can be used to obtain accurate results compared to the results obtained by anthropometric measurements alone (Fernando & Wijesinghe, 2010). Phillips, Foley, Barnard, Isenring, and Miller (2010) suggested that MNA-SF appears to be the most

appropriate nutrition screening tool for use in community-dwelling older persons. In a review, Galiana et al. (2016) summarized that MNA as the most efficient, simple and appropriate nutritional assessment tool for older persons. Therefore, MNA-SF was selected in assessing nutritional status of the older persons in the present study.

However, Rodrigues et al. (2014) reported that the anthropometric measurements were better able to stratify the nutritional status than the MNA. Body Mass Index, Calf Circumference, Mid Upper Arm Circumference, Skinfold Thickness, Abdominal Circumference are widely used anthropometric measurements among elderly (Rodrigues et al., 2014). Also, BMI can represent the body fat in the older persons better than other anthropometric measurements (Fernando & Wijesinghe, 2010).

Considering above facts and as there is no standard measurement to diagnose malnutrition, MNA-SF and anthropometric measurements such as Mid Upper Arm Circumference, Calf Circumference, Hand Grip Strength and BMI were used in this study.

2.8 The prevalence of malnutrition among older persons

The prevalence of malnutrition and at risk of malnourished among older persons is very high worldwide. The reported prevalence rates vary due to different criteria used. Also, the situation varies in different settings such as community, nursing homes, health care institutions (Esmayel et al., 2013; Schrader et al., 2014). However, malnutrition has become a public health issue mostly in developing countries (Andre et al., 2013).

Literature shows the difference values of the prevalence of malnutrition and at risk of malnutrition of older persons in various countries. Although the prevalence of malnutrition among older persons is high in all sectors, the low awareness of malnutrition among health and social care professionals is a remarkable fact (European Nutrition for Health Alliance, 2005).

2.8.1 Global

In 2015, one in eight people worldwide was aged 60 years or over. Within next 15 years period, the number of older persons is expected to grow fastest in Latin America and the Caribbean with a projected 71% increase in the population aged 60 years or over, followed by Asia (66%) and Africa (64%) (UN, 2015). As shown in Table 2.3, studies in all over the world regions (Figure 2:6) show that prevalence of malnutrition among older persons has become a global phenomenon. After reviewing more than 25 published studies in various regions in the world, it can be summarized that the prevalence of malnutrition among older persons varies between 1.3% in Albania, in European region (Bibeiro et al. 2010) and 68.8% in Iran in Eastern Mediterranean (Nazemi et al., 2015).

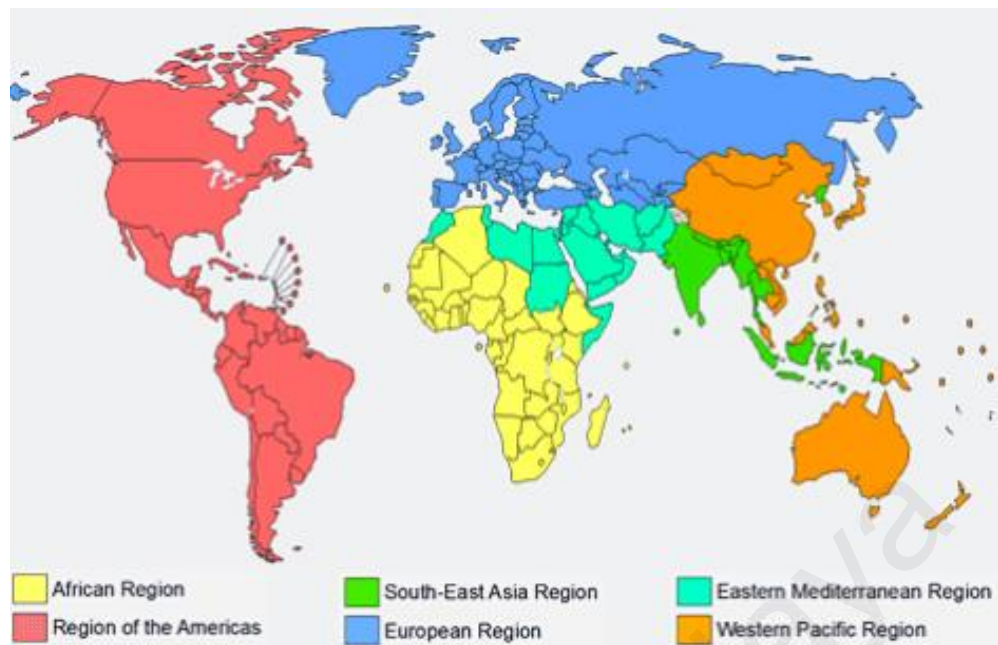


Figure 2:5 World regions grouped by WHO (Jaba, Balan, & Robu, 2013)

Table 2.3: Prevalence of malnutrition and at risk of malnutrition of older persons in various countries using various measures

Region/Country	Setting	Sample	Measurement	Prevalence		Reference
				Malnutrition	Risk	
Africa						
Congo	Community	370	MNA	28.4	57.8	Andre et al. (2013)
Ethiopia	Community	757	BMI	21.9		Tessfamichael et al (2014)
Ethiopia	Community	548	MNA	28.3	62.4	Hailemariam et al(2016)
South Africa	Community	1008	MNA	5.58	43.4	Naidoo, Charlton, Esterhuizen, and Cassim (2015)
America						
Brazil	Community	134	BMI	18.8		Boscatto, Duarte Mde, Coqueiro Rda, and Barbosa (2013)
Brazil	Hospital	236	MNA	1.3	25	Ribeiro, Rosa, and Bozzetti (2011)
Brazil	Home based	316	BMI	8.2-28.9		Fares et al (2012)
Eastern Mediterranean						
Pakistan	Community	380	MNA	5.53	42.1	Ghani et al(2013)
Lebanon	Community	1200	MNA	8	29.1	Boulos et al. (2016)
Lebanon	Nursing homes	221	MNA	3.2	27.6	Doumit, Nasser, and Hanna (2014)
Iran	Nursing homes	263	MNA	10.3	68.8	Nazemi et al. (2015)
Syria	Residential homes	316	MNA	19.4	39.8	Hallaj (2015)
Lebanon	Institutions	111	MNA	12.6	48.7	El Zoghbi et al., (2013)

Table 2.3: Prevalence of malnutrition and at risk of malnutrition of older persons in various countries using various measures (Continued)

Region/Country	Setting	Sample	Measurement	Prevalence		Reference
				Malnutrition	Risk	
Europe						
Espana	Community	666	MNA		23.33	Montejano Lozoya et al. (2014)
Portugal	Community	86	MNA	10.5	41.9	Santoos et al (2015)
Netherlands	Community	3959	SNAQ	11-35		Schilp et al. (2012)
Albania	Hospitals	963	NRS		71.24	Shapta et al. (2015)
Belgium	Hospitals	2329	MNA	33	43	Vanderwee et al. (2010)
Netherlands	Hospitals	448	MNA	17	58	van Bokhorst-de van der Schueren et al. (2013)
Sweden	Homes	579	MNA		14.5	Johansson et al. (2009)
Germany	Nursing home	221	MNA	3.2	27.6	Paker-Eichelkraut et al. (2013)
Italy	Institutions & Free living	718	MNA	26, 16.3	40, 9.35	Lorenzo et al. (2013)
Western Pacific						
Korea	Community	183	MNA	10.4	57.4	Hyun & Lee (2014)
Malaysia	Institutions	236	BMI	17.4		Chen et al. (2012)

Table 2.3: Prevalence of malnutrition and at risk of malnutrition of older persons in various countries using various measures (Continued)

Region/Country	Setting	Sample	Measurement	Prevalence		Reference
				Malnutrition	Risk	
South East Asia						
			MNA	26	62	
Bangladesh	Community	625	BMI	49.7		Kabir et al. (2006)
India	Community	360	MNA	15	55	Agarwalla et al. (2015)
India	Community	227	MNA	14	49	Vedantam
India	Community	235	MNA	29.4	60.4	Lahri et al (2015)
Sri Lanka	Hospital	175	MNA	66.66	27.27	Jayalath & Kumara (2011)
Sri Lanka	Institution	311	BMI	30		Rathnayake et al. (2015)
			MNA	3.8	59.1	Fernando & Wijesinghe (2010)
Sri Lanka	Institution	105	BMI	16.2		

MNA – Mini Nutritional Assessment BMI- Body mass Index
NRS – Nutritional Risk Screening

SNAQ - Short Nutritional Assessment Questionnaire

2.8.2 South East Asia

South East Asia is included of many varied ethnicities, religious and linguistic groups of people. The number of older persons is expected to grow fast in this region by 66% and it is home to the second largest aged population (UN, 2015). It has high prevalence rate of malnutrition comparing the other countries in the world. As shown in the Table 2.3, Sri Lanka shows the highest malnutrition rate among older persons (66.66%). Nevertheless, a small sample of old patients in one hospital in Sri Lanka were included in this study. Among the other countries in the region, India shows the highest prevalence of malnutrition among older persons and it is 29.4% (Lahiri et al., 2015). However, the prevalence of at risk of malnutrition among older persons is higher than the prevalence of malnutrition in all these countries.

2.8.3 Sri Lanka

Older person's malnutrition has been explored in institutions, hospitals and community setting globally. In Sri Lanka, Rathnayake et al. (2015) revealed that the prevalence of malnutrition among institutionalized older persons as determined by BMI as 30%. Fernando and Wijesinghe (2010) reported the prevalence of malnutrition among institutionalized older persons in Kandy district as 59.1% using MNA. In the same study based on BMI classification, prevalence of malnutrition was 16.2%. In a hospital setting located in Kandy, Jayalath and Kumara (2011) revealed that prevalence of malnutrition among hospitalized older persons differed according to their co-morbid conditions and varied from 21% to 66.66% accordingly. The authors assessed nutritional status using MNA.

All above studies were conducted in either older person's homes or in hospital settings. Research studies on malnutrition among community-dwelling older persons are under reported.

When considering the Table 2.3 regarding prevalence of malnutrition among older persons, the majority of them were from European countries. The reported prevalence of malnutrition is differ widely across countries, settings and measurements used. The majority (16) of the studies presented here was in community settings. Eleven studies were conducted in institutions/home care settings while only four studies from hospital settings. Only one study in Italy was done in both institution and community setting. However, it assessed the prevalence of risk of malnutrition among older persons. Twenty three studies used MNA while eight studies used BMI to measure malnutrition among older persons. One study used SNAQ and another one used NRS as the measurement tool.

Among the studies conducted in community settings, the highest prevalence (28.4%) of malnutrition was found in Bangladesh. It was measure using BMI. However, the prevalence of malnutrition was higher (28.4%) in Congo when using MNA. The study which used SNAQ should wide range of prevalence of malnutrition (11-35%) in their study. The country was Netherlands. The lowest prevalence of malnutrition was reported in Pakistan which used MNA as the measurement among the studies in community settings.

In view of studies in institutions/home care settings, the highest prevalence of malnutrition was found in Sri Lanka. It was 30% and measured using BMI. The lowest was in Lebanon and prevalence was 3.2%. It was measure by MNA.

In hospital setting, the highest prevalence of malnutrition (71.24%) was reported in Albania. The measurement was NRS. The lowest prevalence of malnutrition was reported as 1.3% in Brazil using MNA. One study used NRS as the measurement tool in hospital settings and reported prevalence of malnutrition as 71.24%. This study was conducted in Albania.

The important factors to be highlighted is that some studies showed widely different prevalence of malnutrition among older persons in the same population when using different measurement tools. For example, two of the above studies used both MNA and BMI to measure the prevalence of malnutrition. One study in Bangladesh community setting reported the prevalence of malnutrition among older persons as 26% when measured it by MNA while that was 49.7% when measured by using BMI. The prevalence of malnutrition by BMI is nearly two fold of the prevalence measured by MNA. Similarly, another study in an institution of Sri Lanka reported its prevalence of malnutrition among older persons as 3.8% when measuring MNA while 16.2% when measuring BMI. This clearly shows the prevalence of malnutrition among older persons varies extensively due to the characteristics of the subjects studied, and the criteria and the cut-off values considered to identify the disorder. Hence, the results of different studies concerning prevalence data may be not comparable (López-Contreras et al., 2012). However, to implement effective nutritional programs, it is very important to assess the malnutrition accurately. Hence, using multiple assessment methods should be considered in assessing prevalence of malnutrition among older persons.

2.9 Factors associated with malnutrition among older persons

Due to various factors, older persons are potentially vulnerable groups at risk of malnutrition. Literature shows various factors related to nutritional status/malnutrition among older persons. Malnutrition among older persons is a multi-factorial condition. Based on the 'refined conceptual-theoretical-empirical structure framework of malnutrition among elderly', Chen, Bai, Huang, and Tang (2007b) described factors affecting malnutrition among older persons. Accordingly, malnutrition among older persons encompasses physical and psychological elements. It is precipitated by loss, dependency, loneliness and chronic illnesses and potentially impacts morbidity, mortality and quality of life. Other than the above framework of malnutrition among older persons, clinical and epidemiological data showed various factors which affect nutritional status of older persons. This literature review groups factors associated with malnutrition among older persons as socio demographic, physiological, and psychological, lifestyle and dietary factors accordingly.

2.9.1 Socio demographic

2.9.1.1 Age

Age is the most significant factor which affects older person's malnutrition status. Many studies have confirmed that age is positively associated with malnutrition among this age group. Fares and colleagues (2012) conducted the cross sectional study to verify the association of nutritional status with socio demographic factors, lifestyle, and health status in elderly individuals from two cities in different regions of Brazil. They found that age (≥ 75 years) had positive association with malnutrition of the participants.

Torres et al. (2014) also found the similar results in their study on nutritional status in urban and rural community dwelling elderly in France. The prevalence of malnutrition odds ratio was higher in subjects ≥ 85 years as compared to the 65-69 years group among non-institutionalized older persons in social centers in the study conducted by Montejano Lozoya et al. (2014). These evidences confirm that age is as an important factor associated with malnutrition among older persons. Age related physical changes such as reduced appetite, reduction of food enjoyment may lead to less intake of foods (Ziylan, Haveman-Nies, van Dongen, Kremer, & de Groot, 2015). Further, interruption of metabolic pathway due to aging might be a reason for high prevalence of malnutrition in older persons (Amarya et al., 2015).

2.9.1.2 Sex

Sex has been identified as another factor associated with older persons' malnutrition. Torres et al. (2014) found that female gender independently associated with poor nutritional status among older persons. Montejano Lozoya et al. (2014) also highlighted that the prevalence of malnutrition odds ratio was higher in females compared to men (OR = 1.43). Estrogen deficiency of the females may affect the regulation of metabolism (Leblanc, Schneider, Angele, Vollmer, & Docheva, 2017). However, Vedantam, Subramanian, Rao, and John (2010) found no significant difference between men and women. Similarly, in the study of Abdelrahman and Elawam (2012), sex did not show a significant difference between well-nourished and malnourished patients.

2.9.1.3 Level of education

Educational level is another factor related to the malnutrition among older persons. Montejano Lozoya et al. (2014), in their study of the nutritional risk factors of autonomous non-institutionalized older persons showed that lower prevalence of malnutrition among people with lower educational level. Torres and colleagues found that low education level of their participants was independently associated with malnutrition (Torres et al., 2014). Moreover, Abdelrahman and Elawam (2012) in their study on nutritional status among community-dwelling older population in an Egyptian urban area found that education level had significant difference between well-nourished and malnourished older persons. A higher level of education is perhaps associated with higher income and better lifestyle, which in turn resulted in a better nutritional status in these older persons (Saeidlou, Merdol, Mikaili & Bektas, 2011). Literacy (knows how to write and read) is another well-known factor related to education as well as associated with malnutrition among older persons. A community based cross-sectional study conducted by Boscatto et al. (2013) in Ethiopia found that unable to read and write was negatively associated with nutritional status of older persons. Tarqui-Mamani, Alvarez-Dongo, Espinoza-Oriundo, and Gomez-Guizado (2014) also revealed the illiteracy associated with under nutrition among older persons in their cross-sectional study. Literacy directly associates with educational level which influences unhealthy food choices (Alkerwi, Vernier, Sauvageot, Crichton, & Elias, 2015).

2.9.1.4 Marital status

Marital status also showed association with the malnutrition status among older persons. Being widowed was independently associated with poor nutritional status among participants in the study on nutritional status in community dwelling older persons in urban and rural communities by Torres et al. (2014). Montejano Lozoya et al. (2014) further revealed that the prevalence of malnutrition was higher in widowed subjects as compared to those with a stable companion. Dos Santos, Ribeiro, Rosa, and Ribeiro (2015) reported the similar findings. The social support of the partents may have the mediating role in enhancing nutritional status (Saeidlou et al., 2011). However, marital status did not show significant association with nutritional status among older persons in the cross sectional study conducted by Abdelrahman and Elawam (2012) among community dwelling Egyptian older subjects, living in Cairo.

2.9.1.5 Income

Low income is considered as a factor associated with malnutrition among older persons (Donini, Poggiogalle, Pinto, Giusti, and del Balzo (2015). Limited financial resources may explain the restricted accesses to diverse nutritious food sources to maintain proper nutritional status (Alkerwi et al., 2015). Similarly, higher income independently associated with malnutrition among community dwelling elderly individuals living in rural communities in Lebanon (Boulos, Salameh & Barberger-Gateau, 2014).

2.9.1.6 Living conditions

Akın et al. (2015) considered living conditions (lives alone/with family member) as factors associated with the nutritional status among community dwelling elderly in their cross sectional study conducted in Kayseri, Turkey. They revealed that living alone significantly and negatively affected the nutritional status of their study subjects. However, Boscatto et al. (2013) showed no significant association with nutritional status (both underweight and overweight) of older persons in their study.

2.9.2 Physiological

2.9.2.1 Tooth loss

Literature shows that tooth loss, as a physiological factor associated with malnutrition among older persons. There is a direct relationship between edentulousness and malnutrition. The risk of malnutrition was eight times higher in edentulous as compared to dentulous subjects in a study conducted by Makwana, Agarwal, and Makwana (2014). Evidence suggests that older people with partial tooth loss change their diet and is associated with risk of malnutrition (De Marchi, Hugo, Hilgert, & Padilha, 2008). De Marchi and colleagues found that having one to eight natural teeth was protective against the risk of malnutrition/malnutrition among elderly. Wang, Chen, Liou, and Chou (2014) evaluated factors associated with tooth loss in older Taiwanese adults with different numbers of remaining teeth and found that tooth loss was associated with malnutrition among elderly people.

2.9.2.2 Wearing dentures

Natural teeth or dentures are important in chewing which is the very first step in digestion. To support this, Chavarro-Carvajal, Reyes-Ortiz, Samper-Ternent, Arciniegas, and Gutierrez (2015) reported that having dentures decreased the odds of malnutrition. In the line with these findings, Rathnayake et al. (2015) also found that the use of dentures decreased the risk of malnutrition. Yoshida, Suzuki, and Kikutani (2014) revealed that not wearing dentures increases the risk of malnutrition. The probable explanation for this may be teeth are important in enabling the consumption of a varied and healthy diet (Gellar and Alter, 2015).

2.9.2.3 Chronic diseases

Numerous chronic diseases are also found as factors associated with malnutrition among older persons. Kritika et al (2014) conducted a cross-sectional study among the elderly people in the field practice area of Rural Health Training Centre to assess the nutritional status and associated morbidities among the elderly. Co morbidities were found to be more in malnourished group as compared to the well-nourished in their study. Pathological changes of the body due to diseases affect appetite, functional ability or ability to swallow leading to limit food intake (Hackert, Schütte, & Malfertheiner, 2014; Leslie & Hankey, 2015).

2.9.3 Psychological

The association of malnutrition in the elderly with psychological factors is of growing concern (Rathnayake et al., 2015). Lack of interest, low mood, frequent negative thoughts, feeling lonely, depression, dementia and low cognitive status can be mentioned as psychological factors related to malnutrition among elderly (Akin et al., 2015; Torres et al., 2014). These psychological conditions cause for boredom, restlessness and unhappiness, and ultimately leads to a decrease in food intake (Rathnayake et al., 2015). Lower cognitive status was significantly related to malnutrition of the older people staying in elderly homes in Belgium (Verbrugghe et al., 2013). Ji, Meng, and Dong (2012) reported the similar findings. Another study mentioned that being demented and having a depressive symptomatology, appeared to be independently associated with poor nutritional status in their respective study (Torres et al., 2014). Supporting this, van Bokhorst-de van der Schueren et al. (2013) reported that odds ratio of depression related to malnutrition was 2.8. Symptoms of depression such as lack of interest and pleasure in life were associated with a 2.6-fold higher risk of malnutrition in the study conducted by Rathnayake and colleagues (2015). Further, Vafaei et al (2013) reported that risk of severe depression in patients with malnutrition was 15.5 times higher than non-depressed persons (odd ratio: 15.5; 95% CI: 2.9-82.5).

2.9.4 Lifestyle

Lifestyle factors can be modified and improve the nutritional status among elderly people. Hence, identifying life style factors is very crucial in research studies.

2.9.4.1 Physical inactivity

Physical inactivity is the most prominent lifestyle factor related to the malnutrition among older persons. Current research studies mention it using various terminologies such as ability to move, physical activity or leisure activities (Boscatto et al., 2013; Rathnayake et al., 2015). A lack of leisure activities have been associated with 3.2 times higher risk of malnutrition (Rathnayake et al., 2015).

2.9.4.2 Usage of medication

Usage of medication is another lifestyle factor associated with malnutrition among older persons. Drug-nutrient interaction may lead to malnutrition. Poly pharmacy is significantly found more among malnourished than well-nourished elderly people and increased number of medications is independent risk factor for malnutrition (Abdelrahman & Elawam, 2012). Intake of more than 3 drugs appeared to be independently associated with poor nutritional status (Torres et al., 2014). Boscatto et al. (2013) also reported that prevalence of underweight inversely related with greater medication use. Results of the study conducted by Saeidlou et al (2011) found that elderly people on medication (taking more than 3 prescription drugs per day) were more malnourished than those who were not on drug prescriptions. Medications usage may lead to alteration in the way nutrients absorbed, digested and expelled in the body

(Kritika et al, 2014). Also various medications affect loss of appetite, nausea, diarrhoea, reduced gastrointestinal motility and dry mouth, all leading to impairment of nutritional status of older persons (Leslie & Hankey, 2015).

2.9.4.3 Betel chewing

Some substance chewing also associated with nutritional status. Betel chewing is one of such substances. People chew betel leaf with betel nuts (areca nuts). Betel nut consumption is a popular social habit and a ritual in most South Asian countries including Sri Lanka (Karder, 2013). Chewing betel nuts has become the fourth most widely used addictive substance in the world in 2008 (Lin et al., 2008). Scholars have shown the positive association between betel nuts and metabolic syndrome and folate deficiency (Shafique, et al, 2013; Kader, 2013). Rathnayake et al. (2015) pointed out that 37% of the study participants chewed betel nuts.

2.9.4.4 Smoking

Research studies have shown that smoking was independently associated with an increased risk of malnutrition (Barcelo et al., 2013). Studies suggest that nutrition status is associated with smoking that may affect nutritional status indirectly through the impact on oral health in the older persons (Saeidlou, 2011).

Although several studies have suggested benefits of moderate alcohol consumption, the risks and/or benefits of moderate drinking are not completely understood among older persons because of physiologic changes associated with aging. Fares et al. (2012) observed an inverse association between overweight and alcohol consumption among

older persons sample in Brazil. However, Boscatto et al. (2013) found no associations between nutritional status and the alcohol consumption among community dwelling elderly in Southern Brazil.

2.9.5 Dietary

Insufficient or unhealthy nutritional intakes may course older persons to have an increased risk of morbidity and mortality (He et al., 2013). Skipping meals, eating/swallowing difficulties, food allergy and loss of appetite may decrease the food intake. Rathnayake et al. (2015) reported that skipping meals and food allergy significantly increased the risk of malnutrition among elderly. Having swallowing difficulties and taste difficulties also were strongly associated with being malnourished (Vanderwee et al., 2010). Hyun and Lee (2014) mentioned that the main factor affecting malnutrition among elderly as loss of appetite. Rathnayake et al. (2015) showed that the elderly who experienced a loss of appetite were 2.2 times more likely to be malnourished than those who retained their appetite.

Numerous studies showed that adequate energy and nutrient intake was helpful in alleviating malnutrition among older persons. Ongan and Rakicioglu (2015) revealed that energy and nutrients intake of well-nourished elderly was better than the malnourished and risk of being malnourished older persons. Wyka et al. (2012) mentioned about the low energy value in daily intake and incorrect energy structure such as too high energy from fat caused malnutrition among older persons (Wyka et al., 2012). Further, another study highlighted that reduced energy and nutrient of the meals of elderly caused their malnutrition (Söderström et al., 2013). Evidences showed that older vegetarians consumed inadequate energy rich foods and it causes malnutrition

(Burkert, Muckenhuber, Großschädl, Rásky, & Freidl, 2014). However, another study reported that vegetarian consumed such diet as a consequence of their disorders, since a vegetarian diet is often recommended as a method to manage weight (Tonstad, Butler, Yan, & Fraser, 2009).

2.10 Effects of malnutrition on older persons

Malnutrition affects older people in numerous ways. Mainly it affects the health status of the person. Then, it affects Quality of Life of them. World Health Organisation (2016) has identified health conditions associated with ageing as hearing loss, cataracts and refractive errors, back and neck pain and osteoarthritis, chronic obstructive pulmonary disease, diabetes, depression, and dementia. Further, as people age, several complex health states that do not fall into discrete disease categories can be observed among older persons due to multiple underlying factors (*Ageing and health*, 2015). They are called 'geriatric syndromes' and include frailty, urinary incontinence, falls, delirium and pressure ulcers. WHO further highlighted that these health related conditions can be seen among older persons because of genetic, physical and social environments including their homes, neighbourhoods, and communities, and their personal characteristics such as their sex, ethnicity, or socioeconomic status. In this section, all of the above health related conditions associated with ageing are discussed.

Hearing loss is one of the sensory impairments with a high prevalence in the older population. It impacts communication and functional ability as well as Quality of Life of older persons. (Walling & Dickson, 2012; Yueh, Shapiro, MacLean, & Shekelle, 2003). It affects one-third of older persons aged between 61 to 70 years and more than 80 percent of those older than 85 years. Males experience greater hearing loss compared

with females (Walling & Dickson, 2012). Evidence suggested that genetics, alcohol usage, family history, oestrogen concentration and industrial chemical such as toluene, styrene mostly effect on age related hearing loss (Van Eyken, Van Camp, & Van Laer, 2007).

Back pain and neck pain are identified as common, intermittent symptoms in old persons (Hartvigsen, Christensen, & Frederiksen, 2004). The most prevalent health condition in older persons that leads to functional limitations and disability is low back pain (Prince et al., 2015). It is further considered as the most prevalent regional musculoskeletal condition among older persons (Docking et al., 2011). A recent systematic review on prevalence of low back pain among older persons reported that its prevalence in community-dwelling older persons ranged from 13% to 50% (Leopoldino et al., 2016). It affects both physical and psychological health of older persons (Hartvigsen, Christensen, & Frederiksen, 2003). Female gender, loneliness, joint pain, hypertension and pre-existing back pain are some predictors of back pain among older persons (Jacobs, Hammerman-Rozenberg, Cohen, & Stessman, 2006). However, evidences suggested that aetiology of back pain may differ in older persons (Docking et al., 2011).

Osteoarthritis is the most common joint disorder among older persons and is likely to increase due to the aging. It cause for disability as well as difficulty with climbing stairs and walking than any other disease (Guccione et al., 1994; Hadler, 1992). Age, gender, hormones, ethnicity, genetic and diets are some of the systemic risk factors of osteoarthritis while obesity, injury, occupation, physical activity, mechanical factors and alignment are local risk factors of osteoarthritis (Zhang & Jordan, 2010).

Chronic obstructive pulmonary disease characterized by airflow obstruction and loss of gas exchange surface (Grembiale, Naty, & Ursini, 2010). It is an important cause of morbidity and disability of older person (Peruzza et al., 2003). It is a typical disease of aging as its prevalence dramatically increases with age and rarely presenting alone in elderly patients (Incalzi, Scarlata, Pennazza, Santonico, & Pedone, 2014). It affects impairments of Quality of Life of this population. However, it depends on the severity of airway obstruction (Peruzza et al., 2003).

Depression is an important psychological condition associated with health among older persons. A meta-analysis reported that prevalence rate of depression among older persons was between 4.7% and 16% (Barua, Ghosh, Kar, & Basilio, 2011). Ageing-related and disease-related processes increase vulnerability to depression. Older persons having depression are more prone to elevated risk of comorbidity, disability, mortality and suicide (Abas, Hotopf, & Prince, 2002; Alexopoulos et al., 2002; Beekman et al., 2002; Conwell, Duberstein, & Caine, 2002). However, Wig (2001) pointed out that cultural situations and various settings showed different levels of risk for depression.

Dementia becomes more prevalent with increasing age. A recent systematic review revealed that the prevalence of age associated dementia for those aged ≥ 60 years varied in a narrow band, 5%-7% in most world regions (Prince et al., 2013). It affects disability increment, costs of health and social care (Yu et al., 2012). However, the prevalence of dementia varies according to study designs, study settings, age structure of study population and between rural and urban areas (Prince et al., 2013).

When considering all the above age associated health related conditions, it is obvious that all of them are multifactorial. Genetic, environmental and various other factors affect the prevalence of such conditions. Also, the prevalence rates differ due to various study designs used, study settings, etc.

In addition, malnutrition also plays detrimental effects on older persons. This leads to various health issues, long hospitalization time, and increased nursing home admissions (Porter Starr, McDonald, & Bales, 2015). Malnutrition among older persons is the result of the loss of appetite cause by changes of oral cavity, decreased salivary flow, reduced acid secretion by gastric cells, slow peristalsis, chronic constipation and reduction of taste, smell and vision (El Zoghbi et al., 2013). It can increase the age associated muscle mass depletion and strength leads the reduction of physical activities (Bollwein et al., 2013). It is associated with numerous negative health consequences such as non-communicable diseases, chronic illnesses, premature death, length of hospital stay. Higashiguchi et al. (2017) summarized that malnutrition among elderly effects on home-acquired pressure ulcers, mortality, and development of surgical site infections, post-surgical complications, and increased risk of falling and higher rates of hospital readmissions. Majority of the above effects of malnutrition end up with long hospital stays which is in turn expected to increase healthcare costs (Higashiguchi et al., 2017).

2.11 Quality of Life

With ageing population and its decreasing of functional status, Quality of Life/Health Related Quality of Life has been identified as an important in the provision of measurement outcome for health related interventions as well as in health economic evaluation that guide health resources allocation (Kularatna, Whitty, Johnson,

Jayasinghe, & Scuffham, 2014; Ma & McGhee, 2013). Scholars define and measure Quality of Life (QoL) in various ways. World Health Organization (1997) defines it as 'individual perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations and standards and concern'. Ware and Sherbourne (1992) defined Quality of Life as a wellness resulting from a combination of physical, functional, emotional and social factors. Quality of Life in medical studies often refers it as Health Related Quality of Life (HRQOL). Various studies have investigated the HRQOL among older persons in different conditions and settings giving significant findings and highlighting the important of the concept.

Quality of Life is considered as a multidimensional concept that includes the individual's physical, psychological and social performances associated with an illness or its treatment (Revicki, 1989). It is a dynamic interaction between economic, cultural, social, educational and health aspects of older persons (Donmez, Gokkoca, & Dedeoglu, 2005; Mellor, Russo, McCabe, Davison, & George, 2008). Quality of life represent dimensions of human experience ranging from those associated with the necessities of life, such as food and shelter, to those connected with achieving a sense of fulfillment and happiness (Noro & Aro, 1996).

Various scholars have developed Quality of Life models to be easy to utilize in various settings. Wilson and Cleary developed a conceptual model which categorizes measures of patient outcome according to underlying health status concepts including five levels : (1) biological-physiological factors, (2) symptom status, (3) functional status, (4) general health perceptions, (5) overall quality of life (Wilson & Cleary, 1995). As the relationships between psychological factors and health status components are the most likely to be bi-directional, Wilson and Cleary did not consider psychological factors in

their QoL model. However, Eri and Tveter (1992) highlighted that QoL remained consisting of the patient's own evaluation of the relevant dimensions of their psychological condition, functional state and social relationships.

Nutrition is a major determinant of health and Quality of Life. Good nutritional status is crucial to maintain quality of life and adequate food consumption is very essential to maintain good nutrition status (Ongan & Rakıcıoğlu, 2015). The existing literature has shown the relationship between these concepts among older persons. However, limited studies have explored the interrelations among nutritional measures and Quality of Life among older persons.

Moreover, risk of malnutrition is a factor associated to HRQOL (Jimenez-Redondo et al, 2014). Good nutrition promotes HRQOL by avoiding malnutrition, preventing dietary deficiencies and promoting optimal functions (Amarantos, Martinez, & Dwyer, 2001). Several researches have been done in this regard. A prospective cross sectional study of malnutrition and QOL among older persons conducted by Rasheed and Woods (2014) showed that a significance association between QOL scores and the nutritional status. Clear differences were evident between malnutrition and QOL among the participants in their study. Regression analysis also showed nutritional status scores independently contributed to the predictors of QOL. Even among chronically ill older patients, the similar relationship could be seen (Artacho et al., 2014).

Another research conducted by Kostka, Borowiak, and Kostka (2014) showed the contrasting findings. They estimated the potential association of nutritional status and HRQOL among urban and rural community dwelling elders and institutionalized elderly people in Poland. In both community-dwelling participants, nutritional status (BMI, calf

circumference and overweight/obesity) was negatively related to QOL. In institutionalized residents, of opposite relationships were observed. Nutritional status was an independent predictor of low HRQOL in urban and rural elderly whereas higher HRQOL in institutionalized older persons.

2.11.1 Measurement of Quality of Life

The goal of any type of health care is to preserve or increase the quality of life of people. Various factors especially culture and religion affect Quality of Life. Further, living environment, educational level and economic conditions also have relationship with Quality of Life. However, these are beyond the scope of health care. Therefore, health can be considered as an important determinant of a person's quality of life. Health-related quality of life (HRQOL) is the main focus of health professionals and it can be used as an outcome measurements. Nevertheless, due to lack of a common definition and measuring standard, selecting a suitable measurement for Quality of Life has become a great concern. Quality of Life is described using multidimensional aspects. Hence, methods for assessing Quality of Life were developed as a response to growing recognition of these circumstances (Nord, 1992).

Longworth et al. (2014) reviewed Quality of Life and found that there were two groups of measurement used in QOL: generic and condition specific measures. Generic measures are necessary to compare outcome across different populations as well as interventions whereas condition specific measures assess the special states and concerns of diagnostic groups. Generic measures are intended to be relevant to everyone (Cunningham, Burtonw, Hawes-Dawson, Kington, & Hays, 1999). Five most commonly used generic utility measures are MOS 36-item short-form health survey

(SF-36), Health Utilities Index² (HUI2) and Health Utilities Index³(HUI3) , EuroQol (EQ-5D), and World Health Organization's Quality Of Life assessment (Pietersma, van den Akker-van Marle, & de Vries, 2013).

2.11.1.1 MOS 36-item short-form health survey (SF-36)

A 36-item short-form (SF-36) was developed for Medical Outcome Survey. It includes one multi-item scale that assesses eight health concepts: 1) limitations in physical activities because of health problems; 2) limitations in social activities because of physical or emotional problems; 3) limitations in usual role activities because of physical health problems; 4) bodily pain; 5) general mental health (psychological distress and well-being); 6) limitations in usual role activities because of emotional problems; 7) vitality (energy and fatigue); and 8) general health perceptions was constructed to survey health status in the Medical Outcomes Study. The SF-36 can be used for clinical practice and research, health policy evaluations, and general population surveys. It includes (Ware & Sherbourne, 1992).

2.11.1.2 Health Utilities Index² (HUI2) and Health Utilities Index³(HUI3)

These generic measures have been designed for measuring health status, reporting health-related quality of life, and producing utility scores. Health Utilities Index was developed to measure health status and Quality of Life. Both measures explain 1,000,000 unique health states. HUI3 is considered as the measure for primary analyses. HUI2 measures independent attributes including self-care, emotion and fertility (Horsman, Furlong, Feeny, & Torrance, 2003).

2.11.1.3 EuroQol-5D (EQ-5D)

EQ-5D is an instrument to be used to evaluate the generic quality of life and is widely used. “The EQ-5D descriptive system is a preference-based HRQL measure with one question for each of the five dimensions that include mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Three answer categories are provided for each item with the first category referring to the best state. The answers given to ED-5D permit to find 243 unique health states or can be converted into EQ-5D index an utility scores anchored at 0 for death and 1 for perfect health. The EQ-5D questionnaire also includes a Visual Analog Scale (VAS), by which respondents can report their perceived health status with a grade ranging from 0 (the worst possible health status) to 100 (the best possible health status). Finally the specific utility (in clinical and research setting) of each one of them is discussed. It can be applied for two purposes: describing health states; and constructing indices which represent the utilities of these health states”. (Balestroni & Bertolotti, 2012; Konerding, Elkhuizen, Faubel, Forte, Malmström, et al., 2014)

2.11.1.4 World Health Organization's Quality Of Life assessment

The WHOQOL assesses individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It has been developed collaboratively in several culturally diverse centres over four years. The WHOQOL produces a multi-dimensional profile of scores across six domains and 24 sub-domains of quality of life ("The World Health Organization Quality of Life assessment (WHOQOL): position paper from the

World Health Organization," 1995). The WHOQOL-BREF was developed as a short form of the WHOQOL-100 so that it would be suitable for elderly people.

All of the above measurements have been developed in English. Cross cultural validation as well as translations are required for non-English speaking populations. Content, concept, construct and scoring method of an instrument should be applicable to the population studied (Chen, Li, & Kochen, 2005). The SF-36 is considered as more comprehensive measurement. Its scores can be parametric statistical tests, but it may be too long for routine clinical use and its scoring method is more complicated.

All these measures focus predominantly on the physical health pillar of the general WHO definition of health (Pietersma et al., 2014). However, EQ-5D, addresses three domains: physical, mental and social well-being although majority of the measures focuses on physical health pillar. The validation and reliability tests have also been widely established in EQ-5D and used excessively in various countries including Sri Lanka (Kularatna, Whitty, Johnson, & Scuffham, 2013). Therefore, EQ- 5D QOL measure was used in this study using utility weights of Sri Lankans to calculate Quality of Life (Kularatna et al., 2014).

2.12 Factors associated with Quality of Life among older persons

Evidences suggested that numerous factors associated with Quality of Life of older persons. Sociodemographic, physiological, psychological, life style and dietary factors associated with Quality of Life is presented as follows.

2.12.1. Socio demographic

In addition to nutritional status, various factors associated with Quality of Life among older persons. Socio demographic factors such as age, gender and education are associated with QoL (Hoeymans, van Lindert, & Westert, 2005; Konderding, Elkhuisen, Faubel, Forte, Malmstrom, et al., 2014; Perneger, Combescure, & Courvoisier, 2010). Age is very crucial among these factors (Galiana et al., 2016; Kularatna et al., 2014). This may be due to various geriatric pathologies which affect physical, psychological, cognitive and social well-being of older persons (De Luca d'Alessandro et al., 2011). Male gender also showed the higher QoL than that of females in some studies. Women in this study were depended more on medical treatment, felt significantly less safe in everyday life and were less satisfied with themselves caused lower QoL than males (Kirchengast & Haslinger, 2008). Khaje-Bishak, Payahoo, Pourghasem, and Asghari Jafarabadi (2014) showed the contrast finding. Further, married, who live with family members, follow a religion and having high income were considered as factors associated with QoL among older persons (Faller et al., 2010). Engaging in religious activities is one form of social participation which increases QoL. Also, religious feelings relate to psychological well-being of the individual. Overall, religious activities provide relaxation for hectic events of the life (Idler, McLaughlin, & Kasl, 2009). Kularatna et al. (2014) also reported the similar finding in their study highlighting religion as well as income were associated with QoL. Higher income may allow more leisure time or better social support leading high Quality of Life (Lemos, Rodrigues, & Veiga, 2015).

Moreover, higher education level of older persons also showed the association between their QoL (Uchmanowicz et al., 2016). The similar findings were reported by Kularatna et al. (2014). Educational achievement is associated directly with increased self-esteem which is one of the most important factors influencing the promotion of quality of life (Edgerton, Roberts, & von Below, 2012)

2.12.2 Physiological

Chronic conditions among older persons showed a detrimental influence on their Quality of Life due to their physical disability and emotional concerns (Somrongthong et al., 2016). Groessl et al. (2007) showed that disease conditions affect QoL of older persons. Due to biological degeneration, older persons easily get various disease conditions. Lima et al. (2009) reported that hypertension, back pain, arthritis/rheumatism/arthrosis, were the most associated diseases with QoL of older persons in their study. Cancer, hypertension, osteoporosis, and diabetes mellitus were identified as the most frequent diseases associated with QoL of older persons in the study conducted by Li, Ford, Zhao, and Mokdad (2009). These chronic diseases affect mobility and consequently their physical and functional status, emotional balance and then QoL (Franzén, Saveman, & Blomqvist, 2007). Somrongthong et al. (2016) further showed that number of diseases may not affect the QoL of older persons. The possible reason may be that QoL is not solely dependent on diseases. Also, the level of illness acceptance may affect the QoL (Lorig et al., 2008; Schols, Crebolder, & van Weel, 2004)

Another physiological factor is tooth loss. Tooth loss negatively influences the individual's quality of life, mainly when it affects their well-being and appearance (Ide,

Yamamoto, & Mizoue, 2006; Saintrain & de Souza, 2012). Since tooth loss is common among this population, evidence showed its association with QoL (Mack et al., 2005). Holmen, Stromberg, Hagman-Gustafsson, Wardh, and Gabre (2012) pointed out that presence of teeth helps chewing and involve in pronunciation and helps to have a good facial appearance which lead to enhance QoL. Contradictory, Rodrigues, Oliveira, Vargas, Moreira, and e Ferreira (2012) reported no association between tooth loss and QoL. Also, location and distribution of tooth loss affect the severity of the impairment of Quality of Life of the individuals (Gerritsen, Allen, Witter, Bronkhorst, & Creugers, 2010). In addition, current evidences revealed that denture usage improve Qulaity of life of older persons through improving oral function and aesthetics for older persons (Yen et al., 2015a). However, Inoue, John, Tsukasaki, Furuyama, and Baba (2011) reported that dentures had a minimal effect on Quality of Life.

2.12.3 Psychological

Evidence showed that psychological factors such as depression and cognitive impairment associated with QoL of older persons (Chen & Chen, 2017). Heller, Fisher, Marks, and Hsieh (2014) also found the similar findings. Pyne et al. (1997a) further supported the evidence. Borowiak and Kostka (2004b) found depression as the strongest predictor of QOL in both community dwelling and institutionalised elderly. Another study suggested that older individuals with depression experienced a lower quality of life (Sivertsen, Bjorklof, Engedal, Selbaek, & Helvik, 2015). Also, poorer QoL was predicted by greater levels of psychological distress (Atkins, Naismith, Luscombe, & Hickie, 2013). In addition, cognitive impairment was strongly associated with QoL of older persons in some studies (Maki et al., 2014; Teng, Tassniyom, & Lu, 2012). These psychological factors impair functioning in a number of areas, including work

functioning, social functioning, and health (Wells et al., 1989). They are associated with numerous negative outcomes such as decreased work productivity; impaired work, family, and social functioning; and physical disability. (Brenes et al., 2005; Brenes et al., 2008; Olfson et al., 2000). All these negative outcomes cause the poor QoL.

2.12.4 Lifestyle

Various life style factors are associated with Quality of life of older persons. Physical activity involvement plays an important role in improving quality of life among older persons (Halaweh, Willen, Grimby-Ekman, & Svantesson, 2015; Vagetti et al., 2014). Physical activity improves the muscle fitness and lowers rate of all cause mortality and helps to increase QoL of older persons. Evidence suggested that older persons involve in physical activity live healthier lives and are at lower risk for cardiovascular disease (Paterson, Jones, & Rice, 2007). Additionally, physical activity promotes healthy aging and plays an important role in improving Quality of Life among older persons (Acree et al., 2006). Moderate intensity physical activities promote health status, improve treatment of many diseases which increase the Quality of Life (Pedersen & Saltin, 2006).

In addition, one study conducted in Thailand study reported that current drinkers were more likely to have a high Quality of Life (Somrongthong et al., 2016). The reason pointed out for this was those older persons were more likely to accept death and dying and this improved their quality of life. Similar findings were revealed by Chan, von Mühlen, Kritz-Silverstein, and Barrett-Connor (2009). However, Santos, Barreto, Santos, and Marchini (2014) reported no association between alcohol consumption and

QoL of older persons. This discrepancy may be due to the amount and duration of alcohol consumption and smoking.

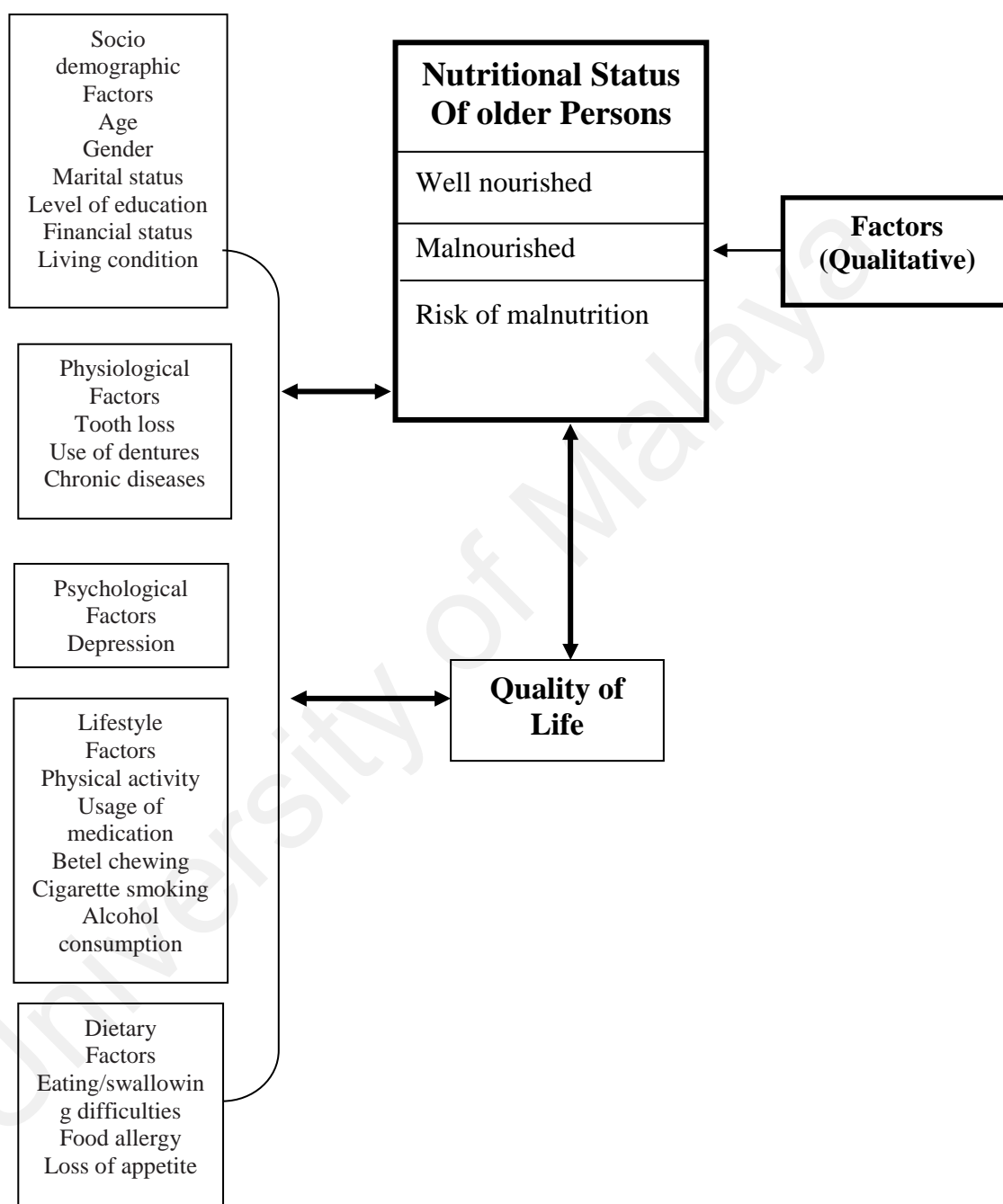
2.12.5 Dietary

Nutrition is a major determinant of Quality of Life among older persons and associated with various disease conditions. Healthy diet has the potential effect in reducing the burden of disease and improve Quality of Life (Magarey, McKean, & Daniels, 2006). Hence, nutrient dense foods play major role in improving Quality of Life of older persons (McNaughton, Crawford, Ball, & Salmon, 2012). Evidence suggested that vegetarians have low Quality of Life (Burkert et al., 2014).

2.13 Conceptual Framework of the study

The Conceptual framework for the current study is presented in Figure 2.1 based on empirical studies. There are five dimensions of factors associated with nutritional status: socio demographic, physiological, psychological, life style and dietary factors. Socio demographic factors include age, gender, marital status, level of education, financial status, number of people living with and living condition. Physiological factors include tooth loss, dentures usage and chronic diseases. Depression represents the psychological factors. Physical activity, usage of medication, betel chewing, cigarette smoking and alcohol consumption are related to lifestyle factors. Dietary factors include eating/swallowing difficulties, food allergy and loss of appetite. An outcome measure includes nutritional status measured by Mini Nutritional Assessment, body mass index, calf circumference, mid upper arm circumference and handgrip strength (dependent variables). The nutritional status of the older people may affect Quality of Life of the

people. Further, malnourished older persons perceived some factors influenced their malnutrition.



MNA = Mini Nutritional Assessment Questionnaire, BMI = Body Mass Index, MUAC = Mid upper arm circumference, CC = calf circumference, HGS = Handgrip strength

Figure 2.6: Conceptual framework

2.14 Summary

In this chapter two, the literature related to aging, nutritional status among older people and factors associated with malnutrition have been described. Among them, aging process and physical, psychological and social changes of aging were described followed by changes relevant to nutritional status. Malnutrition among older people and effects of malnutrition also discussed. The relationship between Quality of life and nutritional status also has been depicted under the effects of malnutrition. Global, Asian and Sri Lankan situation of older people malnutrition was discussed using appropriate literature. Factors associated with malnutrition among older people were further discussed using both quantitative and qualitative aspects. Anthropometric, biochemical, clinical, dietary assessment methods for assessing nutritional status with questionnaire based measurement were described using relevant examples. At the end of the chapter, the conceptual framework of the study is designed. The next chapter: methodology is guided by the conceptual framework of the study.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter describes the methods employed in this study. This study is based on the mixed method approach. Hence, this chapter is described in two phases. Phase I was the quantitative component describing the prevalence of malnutrition and its associated factors among older persons. Phase II was the qualitative component describing the perception of factors related to malnutrition among malnourished or risk of being malnourished older persons. This chapter includes the description of instrumentation procedures (study design, study population, study variables), data collection procedures and statistical analyses under two different phases.

3.2 Research design rationale

The researchers need to select an appropriate research approach to conduct and decide on a type of study within the choice. Research designs are types of inquiry within the research approaches that provide specific direction for procedures in a research design (Creswell, 2014).

3.2.1 Mixed method research approach

Creswell (2003) defined mixed method as a method of integrating quantitative and qualitative data collection and analysis in a single study or a program of enquiry. This systematic integration is employed for purposes of obtaining a fuller picture and deeper understanding of a phenomenon. For the purpose of better understanding mixed method

approach involves more than one methodological tradition, way of knowing, technique for gathering and analysing (Jennifer Greene as cited in Johnson et al, 2007).

Mixed methods approach can answer research question from a number of perspectives and provide a better understanding of a research problem or issue than either research approach alone (Bulsara, 2015; Creswell, 2007). This method is known as ‘multi-methodology’ or ‘triangulation’ and are considered to have high validity due to the variation in data collection (Bulsara, 2015; Taket, 2013) . It ensures there are no or fewer gaps to the information collected (Sansnee Jirojwong, Johnson, & Welch, 2014). Therefore, this method of inquiry was most suited for addressing the research aims of the current study. Mixed methods involve systematic integration of qualitative and quantitative research and data in a research study (Creswell, 2014).

3.2.2 Philosophical rationale for mixed method approach

Understanding the philosophical worldviews/research paradigms is very crucial as they lead to adopt the appropriate research approach; a qualitative, quantitative, or mixed methods (Creswell, 2007; Creswell, 2014). Creswell (2014) described three research approaches, (a) qualitative, (b) quantitative, and (c) mixed methods. The distinction between these three research approached is based on basic philosophical assumptions, type of research strategies, and specific methods employed in conducting these strategies (Creswell, 2014). The Figure 3.1 depicts the interaction between these elements in the above three research approaches.

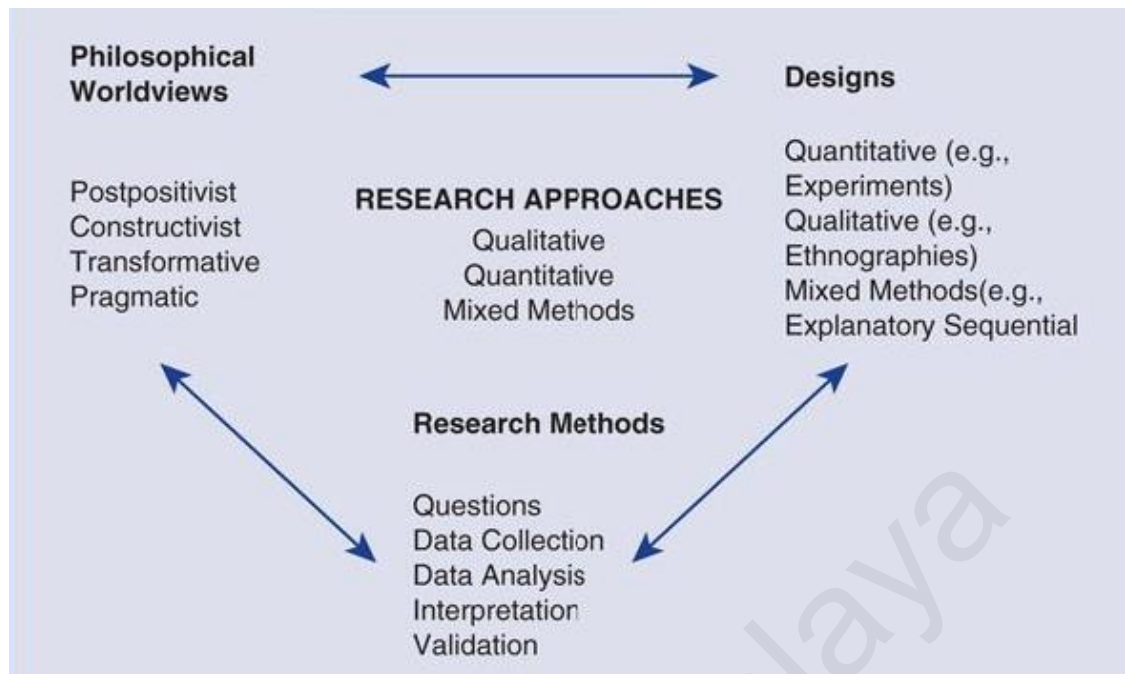


Figure 3.1: A Framework for Research—the Interconnection of Philosophical Worldviews, Design, and Research Methods (Creswell, 2014)

Worldviews are described as paradigms, epistemologies and ontologies, and broadly conceived research methodologies by various scholars (Guba, 1990; Lincoln, Lynham, & Guba, 2011; Mertens, 2010; Crotty, 1998 and Neuman, 2009 as cited in Creswell, 2014). Creswell (2007) described the meaning of worldview and paradigm as how the researcher view the world and go about conducting research. Houghton et al. described that a paradigm is made up of ontology as beliefs about reality, epistemology as the relationship between the researcher and what can be known and methodology as how to carry out the research relative to the question and context (Houghton, Hunter, & Meskill, 2012). Worldviews or paradigms are deeply rooted in discipline orientations, students' advisors/mentors inclinations, past research experiences, and new thoughts (Creswell, 2007 2014).

The four commonly agreed world views used in research are: post positivism, constructivism, transformative, and pragmatism. Post positivism is mostly associated in quantitative research approaches. Post positivists are deterministic in that the cause and effect thinking. They are reductionistic determining to narrow and focus on variables that compromise hypotheses and research questions. Thirdly, they develop numeric measures of observations and study the behaviour of individuals. Finally, post positivists test or verify and refine laws or theories that governed the world (Creswell, 2007 2014). Constructivism is often associated with qualitative approaches. Within constructivism there is no predefinition of dependent or independent variables. It focuses on exploring and giving an account of how people make sense of a situation at a particular point in time (Blaxter, Hughes & Tight 2006).

Transformative paradigm provides a framework for examining inequality and injustice in society using culturally competent, mixed methods approaches. Within this paradigm, a variety of quantitative and qualitative methods is employed to determine the focus of research, with a specific concern for power issues (Mertens, 2007).

The pragmatism is the fourth worldview which is also typically associated with mixed method research. It focuses on the 'what' and 'how' of the research problem and places 'the research problem' as central and applies all approaches to understanding the problem (Creswell, 2003, Mackenzie & Sally Knipe, 2006). Pragmatists believe that there is no value of any scientific enquiry into phenomenon if the ultimate purpose is not to increase human welfare (Pansiri, 2005 cited in Everest, 2014). In applied scientific research especially in research in health care, pragmatism plays an important role focusing on improving human welfare (Everest, 2014). The philosophical underpinning of pragmatism allows and guides mixed methods researchers to answer

research questions using variety of approaches (Doyle et al, 2009). Considering all four paradigms, the current research examines the philosophical basis of pragmatism and illustrates the application of this paradigm to a community based research project.

3.2.3 Selecting a research design for the current study

It is very crucial to select a specific mixed method design in the study. The choice of the research design is based on three main decisions (Creswell & Clark, 2007).

1. The timing of the use of collected data (The order in which the data are used in the study)
2. The relative weight of the quantitative and qualitative approaches (The emphasis given to each)
3. The approach to mixing the two datasets (How the two datasets will be related or connected) (Creswell & Clark, 2007).

The decision tree for mixed method approach is summarized in Figure 3.2.

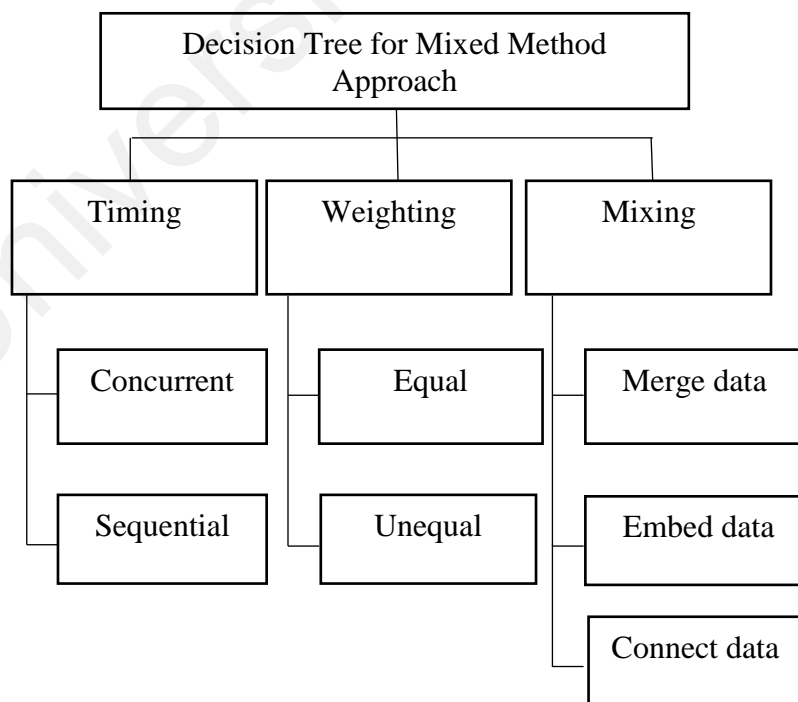


Figure 3.2: Decision tree for mixed method approach

3.2.3.1 Timing

When considering timing, the question ‘what will be the timing of the quantitative or qualitative methods be?’ should be addressed. Timing is often referred to as ‘implementation’ or ‘sequence’ (Creswell & Clark, 2007). The timing factor is more related to data analysis and interpretation than the data collection. It describes the order of the data usage in the study. As described in the figure.3.3, timing can be described in two ways: (a) concurrent timing and (b) sequential timing. When both quantitative and qualitative methods are implemented during a single phase, such type of research study is related to concurrent timing. When these two methods are implemented in two distinct phases, it is related to sequential timing (Creswell & Clark, 2007).

3.2.3.2 Weighing

Weighting is also very important in selecting a mixed method research. (Morgan, 1998) cited in Creswell(2007) described this weighting as ‘ priority decision’. It is twofold. The researcher can decide (a) equal weight or (b) unequal weight of the particular method. In equal method both quantitative and qualitative phases play an important role in the study. In unequal weighting, one method will have a greater emphasis than the other method within the study (Figure 3.3). Morse (1991) as cited in Creswell and Clark (2007) suggested the theoretical framework or worldview can be used to determine the weighing. In addition, weight is based on study purpose, research questions, a researcher’s familiarity with the data collection methods and the resources available to a researcher (Morgan as cited in Creswell and Clark 2007; Hall, 2011).

3.2.3.3 Mixing

How the quantitative and qualitative methods are going to mix is also very crucial in deciding the best suited mixed method design. As seen in Figure 3.4, mixing is categorized as (a) merge the data sets, (b) embed the data sets, and connect the data sets. In merging the data, analysing the data separately and bringing them together or integrating them can be seen. The data from two separate methods are merged during interpretation or during analysis of data. This is referred to the merging of data. The next method is embedding data at the design level. Here, data of the one type is embedded within the design of other type. Embedding qualitative data within a larger quantitative design or embedding quantitative data within a larger qualitative design can be done. The figure 3.3 illustrates the mixing categories.

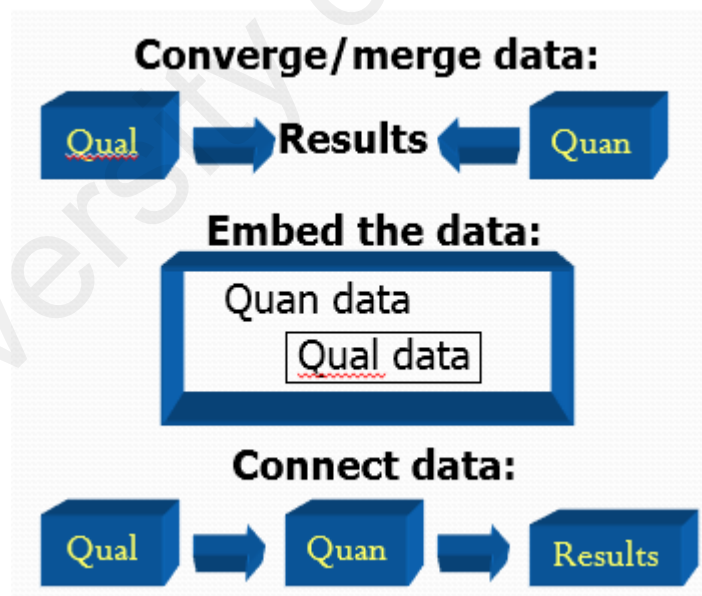


Figure 3.3: Mixing categories adapted from Creswell (2008)

3.2. 4 Mixed method design in the current study

The research design adopted in this study is the sequential mixed methods design. The sequential mixed methods design begins with quantitative phase (QUANTITATIVE → qualitative = explanation), was employed as the most appropriate design of the current as the researchers could purposefully select participants for the interview according to the initial quantitative results (Palinkas et al., 2015). Both quantitative and qualitative information was collected sequentially.

It included an initial quantitative survey and the follow-up qualitative focus group interviews with the priority on the quantitative phase. Quantitative data were obtained from questionnaires filled out by the elderly. Then, sample for the qualitative phase was selected based on the quantitative results. These quantitative and qualitative methods will be discussed later in this chapter separately.

In the current study, the quantitative and qualitative phases were connected when selecting the participants for the qualitative focus group discussions from those who responded to the quantitative phase based on their numeric scores. During the interpretation of the outcome, the results from the quantitative and qualitative phases were integrated (Ivankova, Creswell, & Stick, 2006). The sequential mixed methods design is shown in the Figure 3.4.

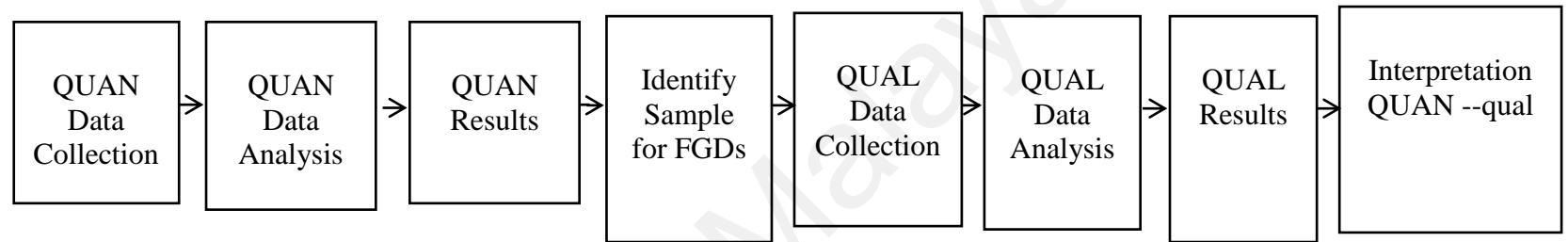


Figure 3.4: The sequential mixed methods design adopted from Cresswell & Clark (2007)

3.3 Stages of the study design

According to the mixed methods design, there are two main phases in the current study: (a) phase I and (b) phase II. Data in phase I was collected using a quantitative approach. In phase II, a qualitative approach was used. Considering the different approaches and uniqueness of the steps of the phases in the mixed method design in the current study, the methodology is described under two separate phases. The visual model for the mixed method design comprising these two phases is described in Figure 3.5.

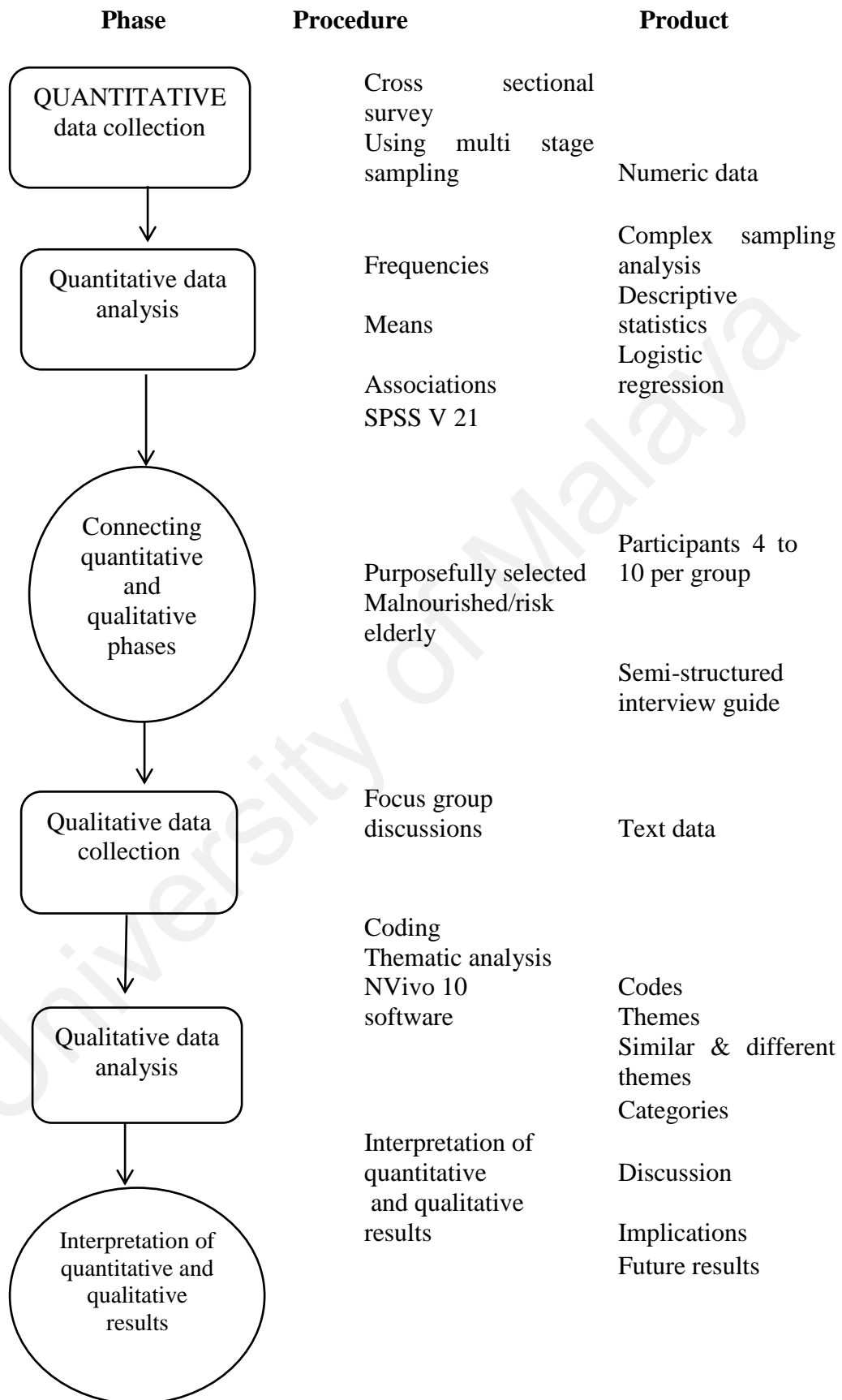


Figure 3.5: The visual model for sequential mixed methods procedure

3.4 Phase I: Quantitative

The first phase in a sequential explanatory mixed method design, was a quantitative section.

3.4.1 Study design and study area

This was a cross sectional study. The study was conducted in Kandy district in the central province of Sri Lanka. Among nine provinces of Sri Lanka, the central province reported the second largest share of population and consists of three main sectors namely, urban, rural and estate. Considering the central province, Kandy district reported the largest segment of its population. It is 1,369,899. Among the total Kandy population, 181,994 represents elderly which is 60 years and above (13.23%) (Department of Census and Statistics, Sri Lanka, 2012).



Kandy district



SRI LANKA

3.4.2 Study participants

The participants in the study were older persons who lived in Kandy district. Kandy district was situated in the central province which is the second largest populated province in Sri Lanka. Kandy district was selected as the proportion of elderly population was higher than the other districts in the central province.

3.4.3 Inclusion and exclusion criteria

The inclusion criteria of the study including age of 60 year old and above, older persons who stay in the community, not having cognitive impairments and able to sit and walk. The exclusion criteria of the study comprised of elderly who had physical disabilities such as paralysis, impaired speech and hearing loss.

3.4.4 Sample size calculation

Sample size is a crucial consideration in any research aimed at enhancing the reliability of population estimates. Sample size for the quantitative design was calculated considering the previous studies' Odds ratio of factors related to malnutrition among elderly. Open Source Epidemiologic Statistics for Public Health software (version 3.01) was used to calculate the sample size.

Table 3.1: Sample size estimation using different factors

Factor	Odds ratio	Sample Size
Being older	38.1	16
Female gender	3	208
Being poor	1.8	846
Alcohol	0.5	1026
No teeth	1.7	1056
Diabetes mellitus	1.7	1056
Medication use	0.34	514
No dentures	5.62	74

Considering all of the above sample sizes, the highest value (1056) was used in this study. Considering the 20% non-response rate, 1267 older persons were needed for the sample size of the study.

3.4.5 Sampling method

Multi-stage sampling was used to recruit older persons who were representative of the elderly population of Kandy district, Sri Lanka.

1. Stage One

From the 20 Divisional Secretariat (GS) divisions, seven Divisional Secretariat (GS) divisions were randomly selected using SPSS. The number of GS divisions needed from each cluster was calculated based on the number of GS divisions among its rural/estate, rural/estate/urban and rural areas. One GS division from rural, four GS divisions from rural/estate/urban and two GS divisions from rural/estate were randomly selected accordingly using computer generated random sampling (Appendix A).

2. Stage Two

In this stage, GN divisions were randomly selected from each of the seven DS divisions considering the probability proportionate to size (Table 3.3). All the elderly in the selected GN divisions were eligible to participate in the survey.

Table 3.2: Sample size selection in multi stage sampling

Divisional Secretariat	Number of elderly people	Proportion of elderly people	Number of elderly people needed	Number of GN divisions with 50 elderly
Doluwa	6395	0.072	91	2 x 50
Patha hewaheta	8015	0.090	114	2 x 50
Udunuwara	16570	0.186	236	5 x 50
Ganlhalakorale	14419	0.162	205	4 x 50
Kandy4gravit	15624	0.176	223	5 x 50
Yatinuwara	22245	0.250	317	6x 50
Thumpane	5687	0.064	81	2 x 50
Total	88955	1.0	1267	1300

3. Stage Three

In this stage a list of all elderly was obtained using the 2012 electoral registers utilizing simple random sample approach. In each DN division, random selection was utilized to select 50 households. There were 100 elderly from Doluwa, 100 from Patha hewaheta, 250 from Udunuwara, 200 from Gangawata Korale, 300 from Kandy Four Gravit, 300 from Yatinuwara and 100 from Thumpane identified. Finally there were 1300 eligible elderly were identified. Multi- stage sampling process is shown in Figure 3.6. The

current survey was conducted in 26 GN divisions of 7 GS divisions. A total of 1300 were recruited for the study.

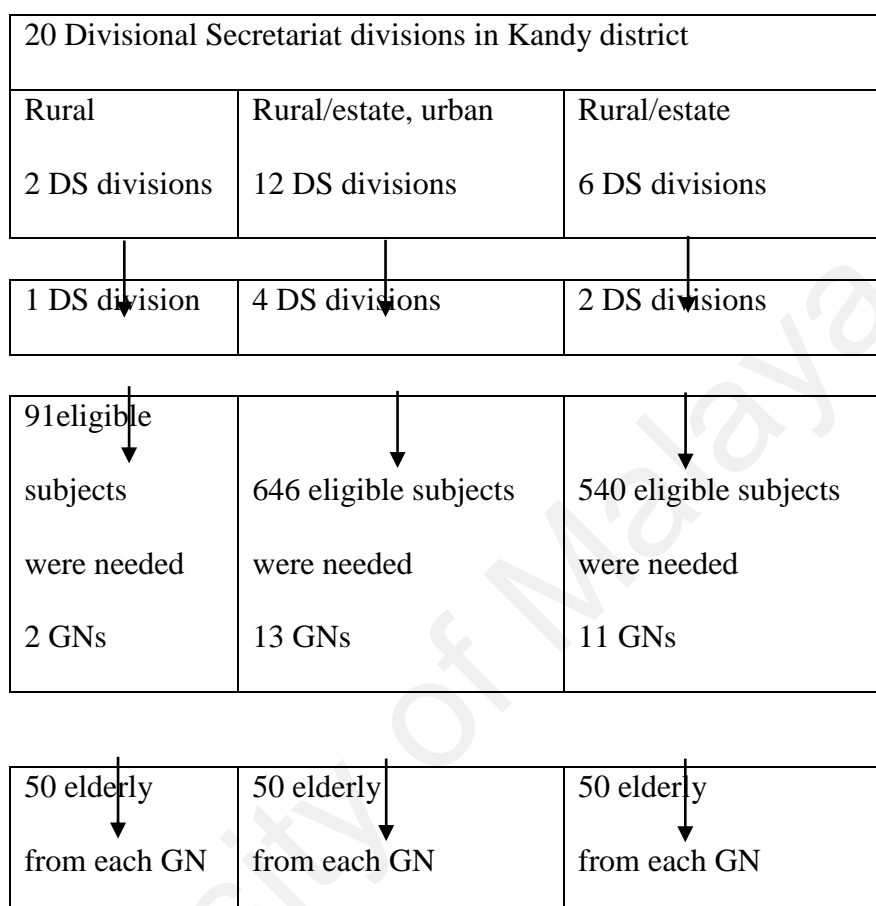


Figure 3.6 Multi-stage sampling process in the current study

3.4.6 Ethical clearance and consent

Ethical approval for this study was granted by research ethics committee, University of Malaya Medical Center, Malaysia (MECID NO 20156-1437) and Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka (Ref No 2015). (Appendix B) Permission was obtained from the authorities of Divisional secretariats of Kandy. A cover letter was attached with the research instruments to inform each participant about the purpose of the study (Appendix C). The older persons who agreed to participate

were asked to sign the consent form. Participants had the right to refuse to participate or to withdraw from the study at any time. All information was kept confidential. Confidentiality was ensured through the use of code numbers. The data obtained from the participants were secured during the study, and were used only for the purpose of the study and remain confidential. Elderly people were explained that all findings of the study would be reported as group results and be submitted for publication and presented as a thesis. Written information and the researcher's address and phone numbers were also provided. All participants were given a small token for involving in the study.

3.4.7 Study variables

The dependent and independent variables were presented in Table 3.4. The dependent variables were nutritional status and Quality of Life whereas the independent variables were sociodemographic, physiological, psychological, lifestyle and dietary factors. There were six variables in the socio demographic dimension; three variables in the physiological dimension; one variable in the psychological dimension; five variables in the life style dimension and four variables in the dietary dimension.

Table 3.3: Study variables and instruments

Study variable	Description	Instruments
a) Dependent variable Nutritional status	Nutritional status	Mini Nutritional Assessment (MNA) Body Mass Index Mid Upper Arm Circumference Calf Circumference Handgrip Strength
Quality of Life	Quality of Life	Euro QOL Five Dimension Questionnaire (EQ-5D-3L)
b) Independent Variables		
Socio demographic dimension	Age, gender, marital status, level of education, financial status, living condition	Socio demographic Questionnaire (Appendix D)
Physiological dimension	Tooth loss, use of dentures, chronic illness	Socio demographic Questionnaire
Psychological dimension	Depression	Geriatric Depression Scale
Life style dimension	Physical activity, usage of medication, betel chewing, cigarette smoking, alcohol consumption	International Physical Activity Questionnaire
Dietary dimension	Vegetarian habit, eating/swallowing difficulties, food allergy, loss of appetite	Socio demographic Questionnaire

3.4.8 Study instruments

The study instruments for both dependent and independent variables are presented in Table 3.4. The instruments were Mini Nutritional Assessment, Euro 5D 3L Questionnaire, Geriatric Depression Scale and International Physical Activity Questionnaire.

3.4.8.1 Measurement of Nutritional status

Nutritional status was subjectively measured using Mini Nutritional Assessment: Short Form (MNA: SF) questionnaire. The MNA is a validated screening tool to identify elderly people who are malnourished or at risk for malnutrition including community settings. Short Form Mini Nutritional Assessment (MNA-SF), a shortened form of the MNA, can be used for classification of malnutrition. It classifies elderly as well nourished, at risk or malnourished. The shortened MNA comprises six questions: Body Mass Index (BMI), declined food intake over the past three months due to loss of appetite/digestive problems or swallowing difficulties, weight loss during last three months, mobility, neuropsychological problems and psychological stress or acute disease in the past three months (Rasheed & Woods, 2014). According to MNA tool, a total score below 7 (out of 14) is considered malnourished, a score between 8- 11 is at-risk of malnutrition and a score above 12 is considered normal. It has been used in the Sri Lankan elderly population and Sinhala version of the questionnaire is available (Fernando & Wijesinghe, 2010). The investigator retrieved the Sinhala version of MNA-SF from the Nestle web site (Appendix E).

The MNA-SF retains the accuracy and validity of the full- MNA and was found to have 90% agreement with the full-MNA, 97.9% sensitivity, 100% specificity, and 98.7% diagnostic accuracy for predicting under nutrition (malnutrition) and it can be used as a valuable tool for rapid and reliable nutritional screening among elderly people (Kaiser, Bauer, R  msch, et al., 2009; Kaiser et al., 2010; Rubenstein, Harke, Salv  , Guigoz, & Vellas, 2011; Tsai, Chang, Wang, & Liao, 2010).

In this study, the reliability of a Sinhala version of MNA-SF was tested among 30 elderly in Kandy district. The Cronbach's alpha was 0.73. A Cronbach's alpha of 0.70 is

recommended as the minimum cut off for a reliable measure (Nunnally & Bernstein, 1994).

In addition to MNA, nutritional status was measured using anthropometric measurements (Body Mass Index, mid upper arm circumference, calf circumference, and handgrip strength) as follow.

BMI is defined as weight in kilograms (Kg) divided by height in meters (m) squared. The weight and height will be performed according to standard procedures in triplicate., and the mean value of each measurement was used for the analysis .During the body weight measurement, participants were required to wear only light clothing and no shoes. A digital weighing scale, accurate to the nearest 0.1 kg was used while placing on an even concrete floor. Height was measured by using upright plastic portable stadiometer to the nearest 0.1cm. Then, the BMI is calculated as weight (kg) divided by height (m) ².

According to WHO expert consultation (2004), following values was used to determine the nutritional status of elderly.

$\leq 18.5 \text{ kg/m}^2$	Underweight/under nutrition
$18.5 - 24.9 \text{ kg/m}^2$	Normal
$\geq 25 \text{ kg/m}^2$	Over weight
$25-29.9 \text{ kg/m}^2$	Pre obese
$> 30 \text{ kg/m}^2$	Obese

A non-stretchable measuring tape was used to assess MUAC. It was taken at the midpoint between the acromial process of the scapula and olecranal process of the

elbow of the non-dominant arm when the forearm will be hanging relaxed at the side. Less than 21 cm was selected as an indicator of under nutrition (WHO, 1995).

Calf circumference is considered as the most sensitive measures of muscle mass in elderly (WHO, 1995). The circumference of the widest point of calf was measured. When the largest circumference was located, by moving the loop up and down the calf, the tape was pulled snugly around the calf. This measurement was recorded to the nearest 0.1cm. Each measurement of circumferences was taken as three consecutive readings and average was used as the final reading (Fernando & Wijesinghe, 2010). The two categories of CC was set as < 31 cm and ≥ 31 cm (Akin et al., 2015)

The handgrip strength was measured with a calibrated Jamar Hydraulic Hand dynamometer. Measurements were obtained with participants on a chair with the shoulder adducted and neutrally rotated, elbow flexed to an angle of 90° and the forearm and wrist in the neutral position. Elbows were unsupported during HGS measurements. Participants were instructed to exert their maximum strength. No verbal encouragement was given during the measurement. Each participant needed to perform three measurements with 15 seconds recovery between each effort. All readings were recorded in kilogram and the maximum value was chosen as the HGS value (Moy et al., 2015). HGS was below the tenth percentile was considered as the cut-off point for defining malnutrition (Garcia et al., 2013; Schlussek et al., 2008).

3.4.8.2 Geriatric Depression Scale (GDS)

Geriatric Depression Scale has been developed as a basic screening measure for depression in elderly. This 15-item screening tool used to identify depression in healthy, medically ill and mild to moderately cognitively impaired adults. It has been extensively used in community, acute and long-term care settings. It is easy to administer and score and take approximately 5-7 minutes to administer. Considering scoring, score one point is given for each bolded answer. A score of 0 to 5 is normal, score ≥ 5 suggests depression and score ≥ 10 is almost always indicative of depression. It has been tested for psychometric properties (Burns, Lawlor, & Craig, 2002; Friedman, Heisel, & Delavan, 2005). showed its specificity and sensitivity as 88% and 95% respectively.

It has been translated into Sinhala language and validated in Sri Lanka by Kulathunga et al. (2010) and they highlight it as a culturally acceptable, easy to use, sensitive, and a valid instrument to diagnose depression among elderly Sri Lanka (Appendix F and K).

3.4.8.3 International Physical Activity Questionnaire (IPAQ): Short Form

The IPAQ addresses four domains namely leisure time physical activity, domestic and gardening (yard) activities, work-related physical activity and transport-related physical activity. It allows categorical and continuous measurements of physical activity. The continuous score allows the estimation of the weekly energy expenditure expressed in MET minutes/week (Metabolic Equivalent Task-Minutes). This is obtained by multiplying the value of energy expenditure for the given physical activity in MET by the weekly frequency days per week) and the time in minutes (minutes per day). MET values for vigorous physical activity, moderate physical activity and walking are 8.0, 4.0 and 3.3 respectively.

The categorical score classifies individual into three categories; 'inactive', 'moderately active' and 'highly active'. According to the IPAQ guidelines, 'low/inactive' category is considered as participants with total physical activity score of < 600 MET min per week. Those who have total physical activity scores 600-2999 MET min per week is considered as 'moderate' category and participants with ≥ 3000 MET min per week is categorized as 'high'.

It has been widely used in lots of countries. The validity and reliability of this questionnaire for elderly people also have been ensured (Tomioka, Iwamoto, Saeki, & Okamoto, 2011). IPAQ which was validated and translated into Sinhala was used (Arambepola, 2004) (Appendix G and K).

3.4.8.4 Euro QOL Five Dimension Questionnaire (EQ-5D-3L)

EQ-5D-3L includes five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. It has been widely validated by previous studies in different populations, diseases, settings and languages worldwide enabling comparison to be made and is one of the most commonly used generic questionnaires to measure HRQOL (Jansson, Nemeth, Granath, Jonsson, & Blomqvist, 2009). According to EuroQol Group (2013), the conceptual basis of the EQ-5D is the holistic view of health, which includes the medical definition as well as the fundamental importance of independent physical, emotional and social functioning.

EQ-5D-3L is a self-assessment questionnaire. The subject was asked to give the current level of function in each dimension (mobility, self-care, usual activities,

pain/discomfort and anxiety/depression). The respondent was asked to indicate his/her health state by ticking (or placing a cross) in the box against the most appropriate statement in each of the 5 dimensions. Level 1, 2 and 3 indicate no problem, some problems and extreme problems correspondingly. A unique health state is defined by combining 1 level from each of the 5 dimensions. A total of 243 possible health states are defined in this way. Each state is referred to in terms of a 5 digit code. EQ-5D health states, defined by the EQ-5D descriptive system, may be converted into a single summary index by applying Sri Lankan utility values for EQ-5D-3L were derived by (Kularatna et al., 2014) (Appendix H and K).

3.4.9 Pilot study

A pilot study with 30 participants was carried out for the MNA-SF questionnaire so that improvements and amendments can be made on the questionnaire. Also, it was helpful to assess the feasibility, time, cost and adverse events of the actual study.

The pilot test response rate was 100%. The Cronbach's alpha was 0.73 for the Sinhala version of MNA-SF questionnaire. A Cronbach's alpha of 0.70 is recommended as the minimum cut off for a reliable measure. Hence, the Sinhala version of the MNA-SF remained unchanged. Administrative officers in the selected Divisional Secretariats and the supportive staff were cooperative and supportive in assisting and facilitating the access, recruitment of participants and conducting the survey. Thus, decision was made to collect data in a community centre.

3.4.10 Study procedure

Following approval from the authorities of selected Divisonal secretariats, data collection was initiated under the following steps:

a) The researcher met with the administrators and officers of the selected Divisonal secretariats and informed them about the objectives of the study. The eligible criteria were outlined, and agreement was obtained for accessing potential participants.

b) The researcher obtained a list of eligible subjects (electoral registry) from the Grama Niladari/Development officers. Then, the researcher met the eligible participants at their homes and identified individuals with physical disabilities such as paralysis, impaired speech and hearing loss to be excluded in the study. Participants' cognitive status was not assessed. However, the researcher identified individuals who were cooperative with her during the first home visit to be recruited. Next, questionnaires were prepared for all selected individuals. The package included a cover letter, a consent form, and the questionnaires. The cover letter advised individuals that their participation was entirely voluntary and that they could withdraw at any time with no questions asked. The selected participants were requested to come to a nearby community center and all anthropometric measurements were taken by the researcher with two research assistants. Questionnaires were administered by the research team on the same visit. The participants who were unable to understand the meaning of the questionnaires were excluded during data collection.

3.4.11 Data management

3.4.11.1 Data coding

Data were coded as in Table 3.5.

Table 3.4: Coding of variables

Study variable		Coding
a) Dependent variable	Nutritional status	
	Mini Nutritional Assessment (MNA)	1:MNA<7.0 2: MNA 8-11 3: MNA >11
	Body Mass Index	1: BMI < 18 2: BMI 18-25 3: BMI >25
	Mid Upper Arm Circumference	1:MUAC <21 2: MUAC >21
	Calf Circumference	1: CC <31 2: CC >31
	Handgrip Strength	1:HGS<10 th percentile 2:HGS>10 th percentile
b) Independent Variables		
	Socio demographic	
	Gender	1: Male 2: Female
	Marital status	1: Married 2: Single 3: Divorced 4: Widowed
	Level of education	1: No formal 2: Primary 3: Secondary 4: Tertiary
	Financial status	1: Above poverty line 2: Below poverty line
	Living condition	1: Alone 2:With family members 3: With relatives/friends

Table 3.4: Coding of variables (Continued)

Study variable		Coding
Physiological	Tooth loss	0: Yes 1: No
	Use dentures	0: Yes 1: No

	Chronic illness	0: Yes 1: No
Psychological	Depression	1: Normal 2: Depression 3: Indicative depression
Life style	Physical activity	1: Inactive 2: Moderate 3: High
	Usage of medication	0: Yes 1: No
	Betel chewing	0: Yes 1: No
	Cigarette smoking	0: Yes 1: No
	Alcohol consumption	0: Yes 1: No
Dietary	Vegetarian habit	0: Yes 1: No
	Eating/swallowing difficulties	0: Yes 1: No
	Food allergy	0: Yes 1: No
	Loss of appetite	0: Yes 1: No

3.4.11.2 Data entry

The researcher reviewed all the data, checked for completeness. Manual checks for accuracy of the data entry were made. If errors were identified, more checking and correcting were done. Then, data were enter into the SPSS progam and organized for data analysis.

3.4.11.3 Data cleaning

Outliers and extreme values were identified using descriptive and frequency analysis.

3.4.12 Data analysis

Complex sampling data analysis was performed using the IBM Statistical Program for Social Sciences (SPSS) version 21. Before using the Complex Samples analysis procedure, the researchers used the Analysis Preparation Wizard which guided the researcher through the steps for creating or modifying an analysis plan for use with the various Complex Samples analysis procedures. Before starting the analysis, the researcher stored research design information in a plan file called 'analysis plan'. It included the sample structure, estimation methods for each stage, and references to required variables, such as sample weights. The related data of participants were weighted to ensure the sample, which came from complex sampling, better represent the population of elderly in Kandy district by reduced bias (Pan, Yuan, Zou, Cook, & Yang, 2016).

3.4.12.1 Sample weight calculation

The weighting factor was applied to each older person record to adjust for non-response and for the varying probabilities of selection.

The weight used for estimation is given by:

DS weight (W1) = the inverse of the probability of selecting DS divisions

GN weight (W2) = the inverse of the probability of selecting GN divisions within the selected DS divisions

Elderly weight (W3) = inverse of the probability of selecting the elderly within the selected GN divisions

Final weight (W) = $W1 \times W2 \times W3$

3.4.12.2 Descriptive analysis

Descriptive analyses were computed using the Complex Samples Descriptive procedure and Complex Samples Frequency analysis. It produced means, confidence intervals and unweighted counts.

3.4.12.3 Univariate analysis

The Complex Samples Crosstabs procedure was utilized to measure associations between categorical variables. The Complex Samples General Linear Model (CSGLM) procedure was employed to analyse correlations and covariances between parameter estimates. The quantitative dependent variables, categorical independent variables as factors, quantitative independent variables as covariates that are related to the dependent variable were considered in the Complex Samples General Linear Model. Numeric categorical variables such as gender were selected as the subpopulation variable. Continuous variables were presented as means with 95% confidence intervals (CI).

The Complex Samples Multinomial Logistic Regression procedure was used. Multinomial logistic regression model is an extension of the binomial logistic regression model. It is used when the dependent variable has more than two nominal or unordered categories. As in the binary logistic regression, multinomial logistic regression uses maximum likelihood estimation to evaluate the probability of categorical membership (Madhu , Ashok, & Balasubramanian, 2014). Binary and multivariate multinomial logistic regression was used with nutritional assessment status as the dependent variable.

Categorical independent variables such as gender, marital status, level of education, financial status, living condition, tooth loss, use dentures, chronic illness, depression, physical activity, betel chewing, cigarette smoking, alcohol consumption, vegetarian habit, eating/swallowing difficulties, food allergy and loss of appetite as factors and quantitative independent variables such as age and number of people living with as covariates were considered in this procedure. Odds ratios with 95% confidence intervals were calculated. Significance level was set at 0.05. Pseudo R^2 statistics were also obtained.

3.4.12.4 Multivariate analysis

The Complex Samples Multivariate Logistic Regression was used to adjust for potential confounders. Factors entered into the models were those found to have significant association with the dependent variable with $P < 0.05$, while those with $P > 0.25$ were removed from the model. Odds ratios with 95% confidence intervals (CI) were calculated. P values less than 0.05 was considered statistically significant.

3.5 Phase II

Phase II of the current study was a qualitative phase of study. The purpose of this section is to present the methodology regarding how the researcher explored the perceptions of factors related to malnutrition among malnourished elderly.

3.5.1 Study design and study area

This was the qualitative phase of the sequential explanatory mixed method design. The study area of the current study was Kandy district, Sri Lanka.

3.5.2 Study participants

Study participants of the phase II of the current study is the older persons who were identified as malnourished from the survey in phase I .

3.5.3 Inclusion and exclusion criteria

Inclusion criteria of the participants were malnourished or risk of being malnourished as identified in the phase I of the current study.

Exclusion criteria were who did not consent for the Phase II.

3.5.4. Sample size calculation

“There are no rules for sample size in qualitative inquiry. It depends on what you want to know, the purpose of the inquiry, what's at stake, what will be useful, what will have credibility, and what can be done with available time and resources” (Patton, 1990). Francis et al. (2010) proposed a ‘10+3’ formula to establish data saturation in a qualitative study. They specified at least ten interviews are to be conducted in a study for initial analysis. Then, further three are needed to evaluate if any new insights are being emerged. All the participants in the current study experienced similar characteristics as malnourished or being risk of malnourished and they represent different sectors (urban or rural). Based on Francis et al. (2010), principal and sectorial difference (urban and rural) of participants, 15 focus group discussions was conducted in the current study. Number of participants in a FGD is another crucial factor. The size

of the FGD can be ranged as 4 to 12 (Richard A. Krueger & Casey, 2009). Based on the Francis et al. (2010) and Richard A. Krueger and Casey (2009), the researcher recruited five to eight participants for FGDs.

3.5.5 Sampling method

Purposive sampling is used in qualitative research for identification and selection of information-rich cases related to the phenomenon of interest (Palinkas et al., 2015). The inclusion criterion was older persons who has been identified as malnourished.

3.5.6. Reflexivity

Reflexivity is a process of thoughtful, conscious awareness of the researcher in the process of research (Finlay, 2002). It is very crucial to apply the concept of reflexivity in qualitative research practices in order to develop transparency in the research process and to increase robustness in the research. It requires the researcher to be completely open about decisions that are made in the research process. It identifies and acknowledges the limitations of the research (Engward & Davis, 2015).

The researcher considered few ways in which reflexivity can be incorporated into the qualitative research process. The team discussed the fact that participants recruited from various DS divisions might show a wish to raise particular issues during group discussions which may relate only indirectly, or not at all to the main purpose of the discussion. Therefore, the purpose of the study was clearly mentioned prior to the discussions.

3.5.7 Ethical clearance and consent

Ethical approval had been grant at the Phase I of the current study. However, an informed consent was taken from the participants prior to the data collection of Phase II.

3.5.8 Study instruments

The researcher developed the interview questions by aligning the guide with the research questions, reviewing the literature and consultation with geriatricians . The semi-structured interview guide was used to explore factors related to malnutrition and dietary behaviour of older persons. It mainly focused on weight, appetite, food intake, physical activity, mental status, social environment, accessible of foods and medical status.

The final semi structures interview guide consisted of 8 areas of open ended questions and probes related. (Appendix I and J). The semi structured interview guide was evaluated by the two supervisors: one an expert in qualitative research designs and the other an expert in nutrition in terms of its relevancy and appropriateness. Then it was translated into Sinhala language which is the national language of Sri Lanka. Two bilingual language experts verified the English to Sinhala and Sinhala to English translations.

3.5.9 Pilot study

A pilot testing was conducted on six individuals who were similar to the target population. The completion of the focus group interview took approximately one hour.

Piloting of the interview guide was conducted in a community centre. A Sinhala version of the interview guide was easily understood by the participants. Based on the participants' comments, minor adjustments were made to few questions in order to prevent ambiguities and misunderstandings the participants had. Audio recordings of the focus group discussion were done. However, the recording was found to have sound interference from outside sources such as vehicle sounds, and thus was disturbing the conversation and affected the transcribing process. This helped to arrange of non-disturbing venue for actual FGDs.

3.5.10 Focus Group Discussions

The focus group discussions were conducted in the Sinhala language by the researcher. Two native speakers, females were recruited as note takers. They were provided with training on the study and methods to be used by the researcher (Dibari et al. 2010).

3.5.11 Rigor and trustworthiness

The researcher considered validation strategies of the focus group discussions. Prior to the conducting focus group discussions, the semi structured interview guide was shared with one of the supervisors who is expert in qualitative research. The feedback was incorporated to the final interview guide. Shenton (2004) highlighted Guba's four criteria of trustworthy of a study :a) credibility ; b) transferability ;c) dependability and d) confirmability .

3.5.11.1 Credibility

This is preference to internal validity of quantitative studies. (Shenton, 2004)) mentioned that the development of an early familiarity with the culture of participating

organisations before the first data collection take place was very important in maintaining credibility. In the current study, the participants were selected from the previously known group (same in the quantitative phase). It helped to adequately understand the participants group and to establish good interpersonal relationship. Lincoln and Guba and Erlandson et al. as cited in Shenton (2004) mentioned that this was very crucial in credibility. Further, triangulation can be used to ensure the validity of qualitative data. Another strategy for credibility considered by the researcher was site triangulation. As there were communities from rural, urban and estate, the researcher selected participants from these three sectors. Where similar results emerged at different sites, findings may have greater credibility in the eyes of the reader as suggested by Shenton (2004). Voluntary participation is another approach to help ensure honesty in informants when contributing data Shenton (2004). All the participants were informed in this regard prior to the discussions and they were informed that they had the right to withdraw from the study at any point. It helped to gain information from the participants freely.

Further, specific strategies were incorporated to uncover deliberate lies. For instance, the researcher used probes to elicit detailed data and iterative questioning to identify falsehoods and discarded the suspected data. Frequent debriefing sessions between the researcher and the supervisors were conducted to enhance credibility Shenton (2004). Further, the researcher did the examination of previous research findings in a similar situation to ensure the creditability. It can be help to assess the degree to which the results of the current research are congruent with those of past studies (Shenton, 2004). NVivo software was used in the data analysis as using computer software for managing qualitative data analysis is one of the validation strategies (Li et al. 2015).

3.5.11.2 Transferability

In preference to external validity/generalizability of quantitative studies, qualitative studies use the terminology of transferability. As qualitative research studies deal with a comparatively small number of participants, it is impossible to generalize the findings Shenton (2004). However Bassey (1981) cited in Shenton (2004) recommended that, if practitioners believe their situations to be similar to that described in the study, they can relate the findings to their own positions.

The researcher tried to enhance the transferability of the data by thorough description of the research context and the assumptions related to the study as guided by Cole and Gardner, Marchionini and Teague, and Pitts cited in Shenton (2004). For this purpose, the researcher clearly described the target population in the study and where they were based, any restrictions in the type of people who contributed data, the number of participants involved, the data collection methods employed, the number and length of the data collection sessions and the time period over which the data was collected.

3.5.11.3 Dependability

This is very similar to the process of reliability in quantitative studies. Shenton (2004) suggested that the researcher needs to report the study design in detail to enhance the dependability and it is viewed as a 'prototype model'. In this regard, the researcher described the research design with the related data collection procedure in detail.

3.5.11.4 Confirmability

The objectivity of the quantitative studies is preference with confirmability of qualitative studies. Patton as cited in Shenton (2004) debated that objectivity of the

qualitative studies was difficult as interference of the researcher's biases. However, in the current study the researcher took steps to ensure as far as possible that the work's findings were the result of the experiences and ideas of the informants. As described by Shenton (2004), an audit (decision trail), a detailed methodological description was developed to ensure the confirmability of the findings. Schneider et al (2013) described that an audit trail provides evidence where findings were derived directly from the data, thus supporting confirmability of the findings. Lincoln and Guba (1985) cited in Carcary (2009) pointed out six categories of information that need to be collected to inform the audit process: raw data, data reduction and analysis notes, data reconstruction and synthesis products, process notes, materials related to intentions and dispositions and preliminary development information. Further, two researchers reviewed and confirmed the qualitative results (Li et al. 2015). The researcher and the supervisor who is expert in qualitative research independently read and code all the transcripts. Then, the codes were reviewed by both of them to ensure agreement. They discussed any conflicting codes and ambiguous statements to come to an agreement. The agreed codes were synthesized and grouped into categories and then merged them into themes.

3.5.12 Study procedure

Data were collected through focus group discussions. Focus group discussions were conducted for this study because it allowed the researcher to receive information about the target population's perceptions of factors related to malnutrition to clarify survey results and develop rapport with participants. The aim of the FGD is to promote self-disclosure among participants. In a FGD, the researcher can gain information on what people really think and feel (Kruger & Casey, 2009). Kruger & Casey (2009) identified five characteristics of FGDs.

1. Focus group involves people

The size of the FGD is typically 5 to 10 although it can be ranged as 4 to 12. The crucial point of selecting members is to give everyone opportunity to share insights. Therefore, the group must be small enough. A dozen of participants in a group has tendency for fragmentation. In the current study, the average participants of a FGD were six. Kruger & Casey (2009) pointed out that “small focus groups or mini focus groups with four to six participants are easier to recruit and host and are more comfortable for participants” (p.67). Schneider et al (2013) mentioned that sample size should be adequate to achieve data saturation, richness of data and it should not be too large as it is difficult to undertake in-depth meaningful answers.

2. The people possess certain characteristics

In a FGD, participants should be similar to each other in a way that is important to the researcher (Kruger & Casey, 2009). The purpose of the study determines this nature of this homogeneity. In the current study, the participants were homogeneous. They have the commonalities of being older persons (60 years and above), community-dwelling and identified as malnourished/risk of being malnourished.

3. Focus group provide qualitative data

Groups are aiming to collect data that is determined by the researcher. The current study conducted to find out the range of opinions of malnourished older persons across

several groups. The data was rich enough to compare and contrast data. According to Kruger & Casey (2009), at least three groups are required for this purpose.

4. Focus groups have a focus discussion

As the focus group is planned to gain information that is intent to the researcher, questions should be carefully predetermined and sequenced accordingly. They should be easily understandable for the participants. Open ended questions and interview guides are generally used for this purpose. Current study utilized a semi- structured interview guide considering natural and logical sequences. The validated semi-structured interview guide was used to provide a rough structure to the discussion. Questions of the interview guide were arranged in a way of gaining more specific and focused information from the participants. It was helpful in allowing unanticipated themes to emerge.

5. The uses of focus groups

According to Kruger & Casey (2009), there are several uses of focus groups such as they are helpful in decision making, guide on development, providing insights on organizational concerns and issues. They can be used with other research methods. In the current study, the focus groups were useful in helping interpret the results of the quantitative phase.

In addition to the above, in planning focus group discussions, the priority was given to select the venue. Selecting the venue for the discussions were based on the participants' convenience and carried out at the quiet community centres or temples nearby. Participants' convenient time was considered. Prior to begin the focus group discussions, all the participants were warmly welcome. Then, they were asked to fill out

a short registration form that asked few demographic characteristics. Once all the participants arrived, and before the group discussion was to be started, the researcher dropped name tents around the table in a random manner.

The first few moments are very crucial in a focus group discussion to make all the participants feel comfortable with the topic, create a permissive atmosphere, provide the ground rules, and set the time of the discussion (Kruger & Casey, 2009). After warmly welcome all the participants, the researcher explained the over view of the topic. Then, the ground rules were introduced. For instance, the researcher explained the participants that there were no right or wrong answers. They were informed that they were free to share their opinions. They were further informed that discussions were audio recorded to prevent missing any of the comments. They were ensured that the comments given by them were confidential and no names would be included in any reports. The name tents in front of the participants were kept to remember the names during discussion. Written consent was obtained from each of the participants prior to the discussions (Lian et al. 2007).

All the participants were kindly requested to put their mobile phones on the quite mode. During the focus group discussion, field notes were taken by the interpreter.

All the conversation was audio recorded using a digital audio recorder. Essential information was written by the interpreter so that important points were not left out. Each FGD approximately lasted for 45-60 minutes.

Impressions, interesting ideas were recorded in the notes. These notes were incomplete and fragmented and used in transcribing. During the discussions, pause and probe techniques were used to draw additional information from the participants. Would you

please explain further, can you give us an example, is there anything else, please describe what you mean are some of the probes widely used in the discussion.

The researcher as the moderator of the discussions, responded comments verbally and non-verbally. Head nodding was very useful in signing encouragement; agreement and it lead elicit additional comments. Short verbal responses such as 'okay', 'yes' were used to sign approval or acceptance. The researcher tried to avoid short verbal responses such as 'correct', 'that's good' and 'excellent' as they imply judgement about comments given by the participants.

Most importantly, the researcher tried to conduct the focus group discussions in a friendly manner and it helped participants feel comfortable. Before concluding the discussions, the researcher thanked the group for participating. Participants were debriefed at the end of each FGD to ensure accuracy and completeness of the provided data (Gholizadeh et al.2015). During the summary presentation signs of agreement, hesitations or confusion was noted. Then, all the participants were given a time for further comments, amendments or corrections. Snacks with light refreshments were provided after the discussion. Each participant was given a small token for appreciating their participation.

After the tenth FDG, and after discussion with the supervisor, it was agreed that there were no new themes emerged. However, to ensure the analysis has reached thematic saturation, extra five FGDs were conducted.

3.5.13 Data analysis

The goal of the data analysis is to illuminate the experiences shared by the participants. The analysis is determined by the purpose of the study. The purpose of the second phase of the current study was to explore factors of malnutrition and dietary patterns of the malnourished older persons.

In qualitative researches, there are three stages where data analysis is occurred (Schneider et al. 2013). In the current study, data were analysed accordingly.

Analysis occurred with data collection and initiated after the first focus group discussion. Then, more data were collected and analysed, and so on.

After the data collection is complete, the complete set of data is considered for data analysis. In this stage reading and re-reading several times was done. This was very helpful in gaining a 'sense' of the whole data set.

- a) When the data collection and analysis are 'staged'.

As soon as possible, the digital records of FGDs were copied to a computer and save them in several different locations. The recordings were transcribed verbatim, as soon as possible after the FGDs and read and re-read for several times. The researcher translated the transcripts into English. The interpreters simultaneously translated the Sinhala version of the transcript into English. The team involving the researcher and the interpreters checked the inaccuracies in the translations and made adjustments. Data analysis was initiated immediately after the first FGD (Gholizadeh, Yazdi, Dehghan Nayeri, & Mohammadi, 2016) et al.2015). Field notes were used to support FGDs data during the analysis.

In the current study, 'fracturing', 'grouping' and 'gluing' style of qualitative data analysis was utilised (Schneider et al. 2013). Miles and Huberman (1994) described the similar process called 'thematic analysis'. They highlighted the element of qualitative data analysis as the central steps of coding the data, combining the codes into broader categories or themes and displaying and making comparison. Following this method, data were fractured or divided into bits called 'codes'. They are the most important components to be considered. The researcher used several techniques in this purpose (Schneider, 2013).

b) Line by line coding

The researcher carefully examined keywords, key concepts, phrases and sentences for data relevant to the research question. Then they were abstracted to various codes. Any minor or contradictory themes were identified (Dibari et al., 2012) . Scanning paragraphs for units of meaning is relevant to answering the research question and abstracting them into descriptive codes. In the current research, the researcher studied the paragraphs and interpreted all the identified relevant views of the participants and composed a code for that interpretation.

c) Categorization

Then, the process of categorization began. The categories were derived from the coded data. After line by line coding and scanning paragraphs, all the abstracted and fractured codes were logically grouped. The next step was placing (gluing) the groups into

hierarchies- categories and sub categories. Then the relationships of the categories and sub categories were identified through conceptualization. Quotes were used as evidence to the themes to represent the findings.

In the preliminary analysis of the transcripts, initial coding was carried out by the researcher who carried out the FGDs. The focus group discussion transcripts were coded by the researcher using NVIVO 10 qualitative research management software (Appendix L). It “allows import and code textual data, edit the text; retrieve, review and recode coded data; search for combinations of words in the text or patterns in coding; and import or export data from and to quantitative analysis software” (QSR La Trobe, Australia 2000).

3.6 Summary

In summary, this chapter focused on the mixed-method methodology section of the study. This chapter presented research methodologies including study design, study population, study variable, study setting, instruments, data collection procedures and data analysis separately in Phase I and II. The Complex Samples Analysis was employed in the Phase I to account for unequal probabilities of selection and non-response rate. Thematic analysis was used to analyse qualitative data. Ethical consideration with protection of human rights was also ensured.

CHAPTER 4: RESULTS (QUANTITATIVE)

4.1 Introduction

This chapter presents the findings of the quantitative phase of the study. It is divided into five sections: (a) response rate and sample weight, (b) descriptive characteristics of participants, (c) prevalence of malnutrition, (d) factors associated with risk of malnutrition and malnutrition (e) Quality of Life and associated factors. At the beginning, the description of response rate and weighing participants is reported. Then, the descriptive characteristics include socio demographic characteristics, anthropometric measurements, Body Mass Index, Mini Nutritional Assessment and Quality of Life and prevalence of malnutrition and associated factors. Prevalence of malnutrition sub section presents various prevalence of malnutrition according to various assessment methods. Associated factors sub section narrates the descriptive characteristics of socio demographic, physiological, and psychological, lifestyle and dietary factors. Finally, Quality of Life and its associated factors will be presented.

4.2 Response rate and sample weight

One thousand and fifteen questionnaires were completed out of 1300 administered questionnaires with a response rate of 76.85%, and of these 999 questionnaires were completed (Figure 4.1).

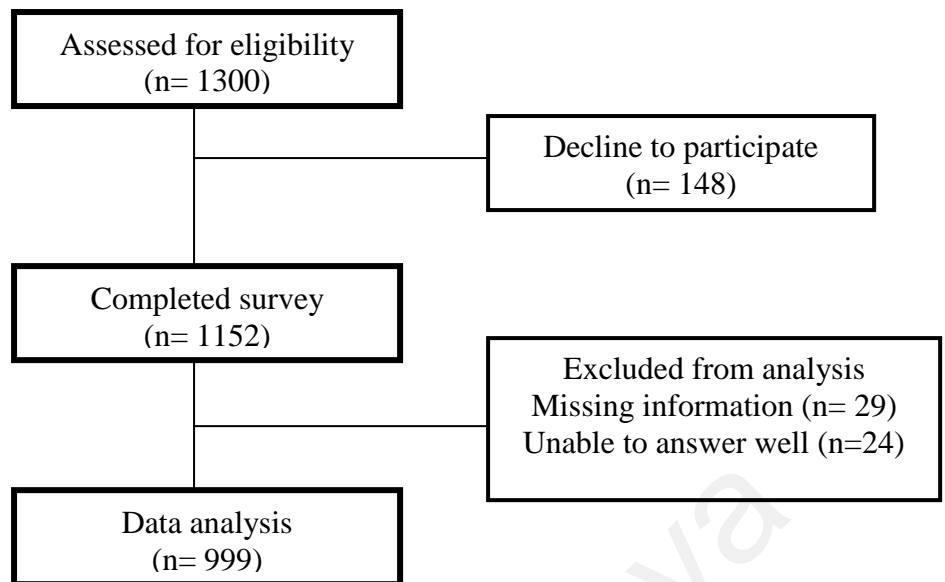


Figure 4.1 Flow chart of responses

Due to unequal selection probabilities and non-respondent rate, appropriate weights were applied before analysis of data. Final weights (Table 4.1) were incorporated into a file plan in Complex Sample Analysis. It created a sample representative of the population of interest.

Table4.1: Final weight of elders

No	DS Division	Total	Total participants	DS weight	GN weight	Older person Weight	Final weight
RE							
1	Akurana	6091	-	-	-	-	-
2	Doluwa	6395	89	42.10	16.5	3.88	2692
3	Udadumbara	2975	-	-	-	-	-
4	Panvila	3573	-	-	-	-	-
5	Pathahewaheta	8015	92	33.59	36.5	2.20	2692
6	Poojapitiya	7928	-	-	-	-	-
7	Deltota	3721	-	-	-	-	-
8	Medadumbara	7948	-	-	-	-	-
9	Kundasale	7420	-	-	-	-	-
10	Udunuwara	16570	173	16.25	16.0	4.14	1076
11	Ganlhalakorale	14419	155	18.67	31.0	2.33	1346
12	Hataraliyadda	4693	-	-	-	-	-
	Total	89748					
REU							
13	Harispattuwa	11922	-	-	-	-	-
14	Kandy4gravit	15624	191	15.59	19.0	3.29	974
15	Pathadumbara	11473	-	-	-	-	-
16	Udawalatha	11998	-	-	-	-	-
17	Pasbagekorale	7925	-	-	-	-	-
18	Yatinuwara	22245	233	10.95	10.7	6.95	811
	Total	81187					
R							
19	Thumpane	5687	66	3.89	33.5	1.70	221
20	Minipe	5372	-	-	-	-	-
	Total	11059					
Grand Total		181994	999				9815

RE: Rural/Estate

REU: Rural/Estate/Urban

R: Rural

4.3 Descriptive characteristics of participants

4.3.1 Socio demographic characteristics

The descriptive characteristics of the participants are presented in Table 4.2. The mean age of the participants was 70.8 years (95% confidence interval: 70.13-71.47). The majority of them were females with mean age of (69.3%). Ninety point one per cent of participants were Sinhalese.

The majority of participants were married (73.7%), 23.5 were widowed, 2.8 % were single and 0.1% were divorced. Most participants had secondary education 45.2%, followed by a primary education (41.5%). Regarding the income, the majority of older persons had an income below the poverty line (79.2%). With regard to living arrangements, the majority of the older persons stayed with their family members such as spouse or children (88.9%). The mean number of people living in the family was 3.60(95% confidence interval: 3.42-3.77).

Table 4.2: Socio demographic characteristics of participants

	Number(n)	Weighted%
Age groups		
Young old	542	48.1
Middle old	375	42.3
Very old	81	9.5
Gender		
Male	251	28.1
Female	748	71.9
Ethnicity		
Sinhalese	972	94.0
Tamil	27	6.0

**Table 4.2: Socio demographic characteristics of participants
(Continued)**

	Number(n)	Weighted %
Marital status		
Married	840	79.4
Single	15	2.2
Widowed	142	18.3
Divorced	2	0.1
Level of education		
No formal	76	10.2
Primary	270	34.2
Secondary	630	54.1
Tertiary	23	1.5
Medical history		
Diabetes	62	5.2
Hypertension	203	20.7
Dyslipidaemia	14	1.1
Income		
Below poverty line*	678	73.9
Above poverty line	321	26.1
Living arrangement		
Alone	89	9.6
With family members	900	89.5
With relatives/friends	10	0.9
Mean (95% Confidence Interval)		
Age (years)	70.80 (70.13,71.47)	
No of household occupants	3.60 (3.42,3.77)	

*Poverty line- Kandy district poverty line July 2015 26 USD (Minimum expenditure per person per month need to fulfil the basic needs)

4.3.2 Physiological factors

Table 4.3 showed the proportion of participants according to physiological factors. The majority of the participants had lost their teeth. Nearly one fifth of them used dentures instead.

Table 4.3: Physiological factors

	Number(n)	Weighted%
Tooth loss	881	89.1
Use of dentures	270	21.7
Chronic illness	503	55.0

4.3.3 Psychological factors

Depression was considered as a psychological factor associated with malnutrition. As shown in Table 4.4, participants were classified into three groups considering GDS scores: <5 , ≥ 5 and ≥ 10 . The proportions of participants for these categories were 36.7%, 58.5% and 4.8% respectively. The mean value of the depression was 6.29 (95% CI: 6.05, 6.52).

Table 4.4 Psychological factors

	Number(n)	Weighted%
Depression		
GDS <5	413	36.7
GDS ≥ 5	566	58.5
GDS ≥ 10	20	4.8
Mean (95% Confidence Interval)		
Depression	6.29 (6.05,6.52)	

4.3.4 Lifestyle factors

Table 4.5 showed the proportions of lifestyle factors of the participants. The mean value of the physical activity was within the 'moderate' category of physical activity. Approximately similar proportions of the participants were in the categories of inactive and high physical activity. More than half of the participants used any kind of medication and half of them chewed betel.

Table 4.5: Lifestyle factors

	Number(n)	Weighted%
Physical activity		
Inactive	164	15.4
Moderate	729	68.4
High	106	16.2
Usage of medication		
Yes	568	60.1
No	431	39.9
Betel chewing		
Yes	269	46.3
No	730	53.7
Cigarette smoking		
Yes	28	3.5
No	971	96.5
Alcohol consumption		
Yes	36	5.2
No	963	94.8
Mean (95% Confidence Interval)		
Physical activity(MET)	2477(2140,2813)	

4.3.5 Dietary factors

Eating/swallowing difficulty, food allergy, loss of appetite and vegetarian food consumption were some of dietary factors and were presented in Table 4.6. Approximately one tenth of the participants had eating/swallowing difficulty, food allergy and loss of appetite. One third of them consumed vegetarian diets.

Table 4.6: Dietary factors

	Number(n)	Weighted%
Eating/swallowing difficulty		
Yes	125	10.7
No	874	89.3
Food allergy		
Yes	73	6.7
No	926	93.3
Loss of appetite		
Yes	140	11
No	859	89
Vegetarian		
Yes	328	34.7
No	671	65.3

4.3.6 Anthropometric measurements

Among the anthropometric measurements, mean values of mid upper arm circumference (MUAC), handgrip strengths (HGS) were above the cut-off point for malnutrition. The mean value of calf circumference (CC) was below the cut-off point of malnutrition. The mean values of Body Mass Index (BMI) and Mini Nutritional Assessment (MNA) were within the normal limits (Table 4.7).

Table 4.7: Anthropometric measurements and Body Mass Index

	Mean (95% Confidence Interval)
Weight (kg)	52.16 (51.25,53.07)
Height (cm)	151.55 (150.63,152.47)
Mid Upper Arm Circumference (cm)	24.89 (24.52,25.25)
Calf Circumference (cm)	29.64 (29.32,29.97)
Rights HGS (kg)	11.81 (11.21,12.41)
Left HGS (kg)	12.17 (11.55,12.80)
Highest HGS (kg)	12.56 (11.94,13.19)
BMI (kg/m ²)	22.73 (22.37,23.08)

BMI, Body Mass Index; HGS, Handgrip strength

4.4 Prevalence of malnutrition

As shown in the Table 4.8, the prevalence of malnutrition varied according to the measurement considered for the assessment. Considering MNA, 12.5% of the older participants were malnourished while 54.4% of them were diagnosed as risk of being malnourished. BMI measures showed 10.1% was as undernourished. Among the participants, 9.8% was diagnosed as malnourished using MUAC measurement. The Calf Circumference measurement showed the highest prevalence of malnourished older persons (60.4%). Finally, 13.1% of the participants were diagnosed as malnourished considering handgrip strength.

Table 4.8: Prevalence of malnutrition by MNA, BMI, MUAC, CC and HGS

	MNA	Unweight count	Weighted %
MNA			
Malnourished	<7	151	12.5
Risk of being malnourished	8-11	485	52.4
Well nourished	>12	363	35.1
BMI (kg/m ²)			
Underweight	≤ 18.5	127	10.1
Normal	18.5 – 24.9	541	52.3
Overweight	≥ 25	324	37.6
MUAC (cm)			
Malnourished	< 21	104	9.8
Well nourished	> 21	895	90.2
CC (cm)			
Malnourished	<31	616	60.4
Well nourished	>31	389	39.6
HGS (kg)			
Malnourished	< 6	115	13.1
Well nourished	> 6	884	86.9

MNA: Mini Nutritional Assessment

BMI: Body Mass Index

MUAC: Mid Upper Arm Circumference

CC: Calf Circumference

HGS: Handgrip Strength

4.5 Factors associated with malnutrition and risk of malnutrition (univariate analysis)

Univariate statistics of all variables used in the analysis is shown in Table 4.9.

Among the risk of malnutrition, only the number of people living with older persons was significantly associated with risk of malnutrition (OR: 0.91, 95% CI: 0.86, 0.97). Age (OR: 1.06, 95% CI: 1.02, 1.10), hypertension (OR: 1.89, 95% CI: 1.15, 3.09), smoking (OR: 4.70, 95% CI: 2.21, 9.99) and alcohol use (OR: 4.60, 95% CI: 2.35, 8.98) were significantly associated with malnutrition.

Table 4.9: Crude odds ratio (95% CI) of nutritional status according to associated factors in multinomial logistic regression

	Risk of malnutrition	P value	Malnutrition	P value
	OR (95% CI)		OR (95% CI)	
Age	1.02(0.99,1.05)	0.291	1.06(1.02,1.10)	0.008
Gender				
Male	1.49(0.92,2.45)	0.111	1.32(0.65, 2.68)	0.437
Female	1			
Level of education				
No formal	1.79(0.58,5.50)	0.311	1.98(0.90,4.34)	0.288
Primary	1.21(0.61,2.41)	0.581	1.36(0.85,2.17)	0.197
Secondary/tertiary	1			
Income				
Below poverty line*	1.29(0.64,2.41)	0.400	1.05(0.45,2.44)	0.909
No household occupants	0.91(0.86,0.97)	0.006	0.90(0.76,1.70)	0.216
Tooth loss(Yes)	1.17(0.47,2.87)	0.727	1.85(0.43,8.02)	0.390
Use dentures (Yes)	0.96(0.65,1.43)	0.840	1.17(0.64,2.13)	0.596
Chronic illness(Yes)	1.11(0.87,1.42)	0.385	0.81(0.40,1.64)	0.546
Diabetes (Yes)	0.87(0.36,2.08)	0.731	0.80(0.27,2.44)	0.686
Hypertension (Yes)	1.02(0.81,1.29)	0.859	1.89(1.15,3.09)	0.014
Dyslipidaemia (Yes)	0.99(0.19,5.06)	0.992	0.64(0.16-2.58)	0.526
Depression	0.96(0.85,1.09)	0.524	1.00(0.91,1.10)	0.952
Physical activity				
Inactivity	0.75(0.23,2.44)	0.631	0.99(0.45,2.20)	0.983
Moderate	0.86(0.35,2.09)	0.737	1.01(0.54,1.90)	0.638
High	1			
Usage of				
medication(Yes)	0.98 (0.75,1.28)	0.901	1.47(0.87,2.49)	0.142
Betel chewing(Yes)	1.10 (0.71,1.69)	0.669	1.65(0.93,2.92)	0.082
Cigarette Smoking(Yes)	2.20(0.75,6.45)	0.141	4.70(2.21,9.99)	<0.001
Alcohol use(Yes)	2.04(0.73,5.71)	0.167	4.60(2.35,8.98)	<0.001
Eating difficulty(Yes)	1.02(0.58,1.80)	0.931	1.06(0.51,2.24)	0.866
Food Allergy(Yes)	0.84(0.34,2.07)	0.685	1.14(0.45,2.88)	0.777
Loss of appetite(Yes)	1.28(0.80,2.05)	0.290	1.28(0.65,2.54)	0.456
Vegetarian(Yes)	0.87(0.45,1.70)	0.680	1.03(0.73,1.47)	0.843

*Poverty line- Kandy district poverty line July 2015 26 USD (Minimum expenditure per person per month need to fulfil the basic needs)

4.6 Factors associated with malnutrition and risk of malnutrition (multivariate analysis)

Six factors namely age, the number of people living with, diagnosed as hypertension, usage of any type of medication, cigarette smoking, betel chewing had p value < 0.25 and were entered into the multivariate models.

In the gender adjusted model (Table 4.10), the number of household occupants was considered as a protective factor of risk of being malnourished (aOR: 0.91, 95% CI: 0.85, 0.97). Among malnourished, age, hypertension and alcohol consumption remained statistically significant. The odds of malnourished among the participants who had hypertension was 1.71 compared to the participants who had no hypertension. Moreover, the odd of alcohol consumption and age was 4.06 and 1.06 respectively.

Table 4.10: Factors associated with risk of malnutrition and malnutrition

	Risk of malnutrition (n=485)			Malnourished (n=151)		
	#	**aOR (95% CI)	P value	#	**aOR (95% CI)	P value
Age		1.02 (0.99,1.05)	0.268		1.06 (1.01,1.11)	0.020*
Gender (M)		1.26 (0.59,2.72)	0.533		0.95 (0.33,2.68)	0.912
No household occupants		0.91 (0.85,0.97)	0.006*		0.90 (0.74,1.10)	0.277
Hypertension(Yes)		0.99 (0.79-1.27)	0.994		1.71 (1.02,2.89)	0.044*
Usage of medication(Yes)		0.97 (0.74-1.28)	0.827		1.47 (0.82,2.66)	0.186
Alcohol use(Yes)		1.63 (0.65,4.08)	0.281		4.06 (1.17,14.07)	0.029*
Cigarette Smoking(Yes)		1.57 (0.75,3.29)	0.222		2.28 (0.88,5.93)	0.087
Betel chewing(Yes)		0.99 (0.66,1.50)	0.986		1.30 (0.77,2.19)	0.304

The reference category is well-nourished (n= 363)

#Multinomial regression was used, with a removal probability of 0.25

**Adjusted for gender and for age, No household occupants, hypertension, usage of medication, alcohol use, cigarette smoking, betel chewing in the model. * P < 0.05 is significant

4.7 Quality of Life

4.7.1 Total Quality of Life

The mean QoL score was 0.44 (95% CI: 0.42, 0.46). Overall, males had higher QoL mean score (mean 0.45, 95% CI: 0.41, 0.49) than females (mean 0.44, 95% CI: 0.41, 0.46).

4.7.2 Quality of Life by domain and Gender

The proportion of older persons with problems by domain by sex is shown in Figure 4.1. Usual care was the most frequently reported problem (77.7%) followed by pain/discomfort (73.8%). Males were more likely to report problems in pain/discomfort (75.9%) whereas the most frequently reported problem among females was usual care (78.7%).

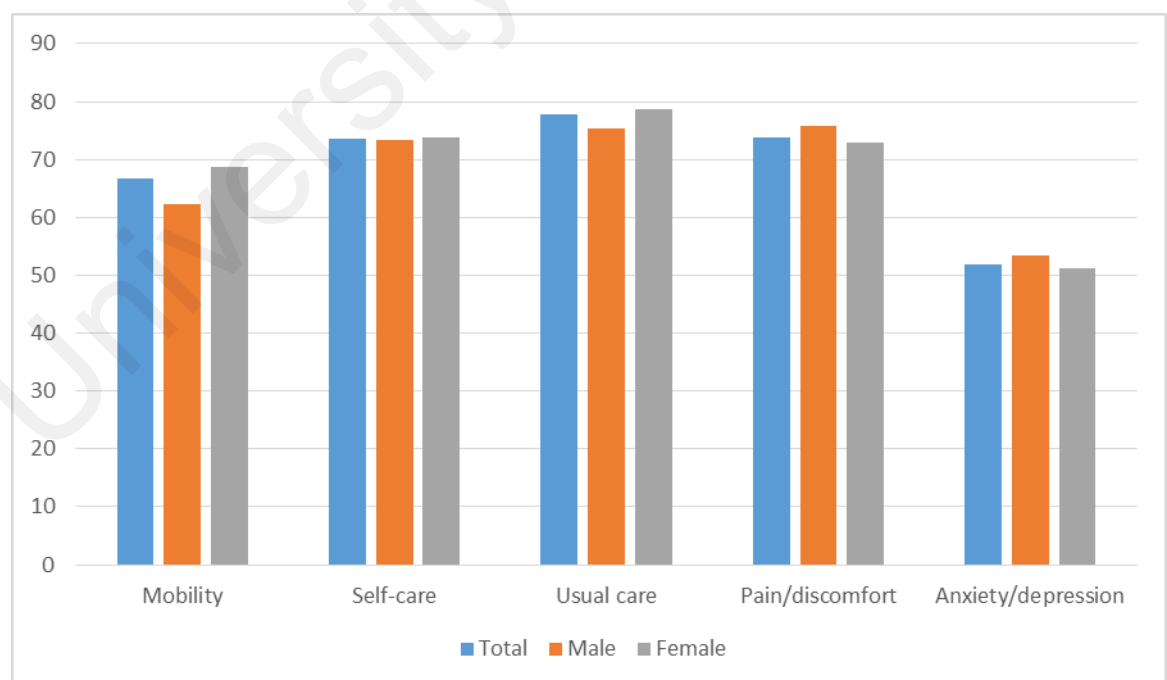


Figure 4.1 Proportion of older persons with problems by domain by sex

Table 4.11 shows the results of both univariate and multivariate analysis of factors associated with QoL. In univariate analysis, several factors were associated with QoL. After adjusting other factors, only age and high physical activity showed statistically significant association with QoL.

Table 4.11 Factors associated with Quality of Life (Univariate and multivariate)

Variable	Univariate		Multivariate**	
	Beta coefficient β (CI)	p value	Beta coefficient β (CI)	p value
Age	-0.02(-0.02,-0.01)	<0.001	-0.02(-0.02,-0.01)	<0.001*
Gender				
Male	0.02 (-0.03,0.07)	0.496	-0.03(-0.08,0.01)	0.174
Female	0		0	
Educational level				
No formal	-0.07 (-0.13,-0.002)	0.044	-0.009(-0.07,0.05)	0.764
Primary	-0.06(-0.10,-0.007)	0.024	0.02(-0.07,0.02)	0.291
Secondary/tertiary	0		0	
House hold income				
Above poverty line	0.04 (-0.02, 0.10)	0.152	0.00(-0.05,0.05)	0.987
Below poverty line	0		0	
Chronic Illness				
Yes	-0.04(-0.08,0.006)	0.089	-0.03(-0.07,0.01)	0.196
No	0		0	
Diabetes mellitus				
Yes	-0.03 (-0.09,0.03)	0.370		
No	0			
Hypertension				
Yes	-0.06(-0.11,-0.006)	0.029	-0.02(-0.08,0.04)	0.479
No	0		0	
Hypercholesterolemia				
Yes	0.02 (-0.07,0.12)	0.630		
No				

Table 4.11 Factors associated with Quality of Life (Univariate and multivariate) continued

Variable	Univariate	p value	Multivariate**	p value
	Beta coefficient β (CI)		Beta coefficient β (CI)	
Smoking				
Yes	0.16(-0.02,0.34)	0.079	0.100(-0.05,0.247)	0.179
No	0		0	
Alcohol				
Yes	0.05(-0.10,0.185)	0.533		
No	0			
Tooth loss				
Yes	-0.46(-0.23, -0.06)	0.001	-0.03(-0.10,0.03)	0.333
No				
Use of dentures				
Yes	0.02(-0.04, 0.09)	0.481		
No				
Physical activity				
High	0.10(0.02,0.19)	0.011	0.12(0.04,0.19)	0.003*
Moderate	0.05(-0.01,0.11)	0.115	0.04(-0.02,0.09)	0.231
Low	0			
MNA	0.005(-0.005,0.015)	0.322	0.003(-0.005,0.01)	0.418

** Adjusted for age, gender, education level, income, chronic diseases, hypertension, smoking, tooth loss, physical activity and MNA; * $p < 0.05$

4.9 Summary

The majority of the participants were females, Sinhalese, secondary/tertiary educated, married and stayed with their family members. The prevalence of malnutrition varied according to the assessment method concerned. It was measured by MNA, BMI, MUAC, CC and HGS. The values were 12.5%, 10.1%, 9.8%, 60.45 and 13.1% respectively. In the multivariate model after adjusted for gender, alcohol consumption, cigarette smoking, betel chewing, medication usage, age, number of household

occupants and having hypertension, older persons with hypertension (aOR: 1.71, 95% CI: 1.02, 2.89), alcohol consumption (aOR: 4.06, 95% CI: 1.17, 14.07), and age (aOR: 1.06, 95% CI: 1.01, 1.11) were positively associated with malnutrition. Increased number of people living with the older persons was protective of being at risk for malnutrition (aOR: 0.91, 95% CI: 0.85, 0.97). Considering, QoL, the mean QoL score was 0.44 (95% CI: 0.42, 0.46). Males had higher QoL mean score than females. Usual care was the most frequently reported problem followed by pain/discomfort Age, (Beta coefficient :-0.02, 95% CI:-0.02,-0.01) and high physical activity (Beta coefficient :0.12, 95% CI:0.04,0.19)) were significantly associated with QoL of older persons.

CHAPTER 5: RESULTS (QUALITATIVE)

5.1 Introduction

This chapter presents the findings of the qualitative phase of the study. It is divided into two sections: (a) descriptive characteristics of participants and (b) main themes and sub themes identified in thematic analysis. At the beginning, descriptive characteristics of the participants are reported. Then, the identified main themes are described with the quotes of the participants. These themes are described under the sub themes appropriately. Each code used here is illustrated according to the number assigned to the participant and the place where they were from.

5.1 Demographic characteristics

Demographic data were analysed using descriptive statistics of frequencies and percentages. Fifteen focus group discussions were conducted with the 43 minutes average time for a FGD. Of 150 people who were invited to participate in the study, only 85 were present. The mean age of the participants was 68.74 years (SD: 6.32). The age range was 60-97 years.

5.2 Identified themes and subthemes

Thematic analysis was used to analyse qualitative data to identify key patterns and themes. Data were transcribed verbatim as soon as possible after each focus group discussion. Then, they were read and re-read for several times in terms of familiarization. Next, initial coding was done in the preliminary analysis of the

transcripts. Then, these codes were grouped into exhaustive categories. Merging these categories into themes was done representing the most common perceptions regarding malnutrition that emerged from the focus group discussions. Four major themes and 15 sub themes were identified accordingly. Quotes were taken from the transcripts and presented using code number for anonymity and the site of the interview was included with the quotes to provide contextual information.

Table 5.1 Themes and subthemes regarding older persons' views of nutritional status

Themes	Sub themes
Factors affecting dietary patterns	Loss of Appetite <ul style="list-style-type: none"> • Loss of taste • Difficulty in swallowing/eating • Less amount Physical work/ activity Routine Food preparation <ul style="list-style-type: none"> • Availability • Home made • Financial constraints Gender roles Eating with others
Factors affecting food choices	Knowledge Taboos
Health status	Disease conditions Restrictions
Psychological challenges	Mood change Loneliness Family issues Loss of children/spouse Acceptance

5.2.1 Factors affecting dietary patterns

The participants reported that they were having several factors related to their dietary patterns. Loss of appetite, physical work/activity, routine, food preparation and gender roles emerged as the factors that affect their dietary pattern.

5.2.1.1 Loss of appetite

Considering participants' discussions, loss of taste, difficulties in swallowing/eating and less amount were mostly associated with loss of appetite sub theme.

a) Loss of taste

The discussions revealed that in several cases, major changes in their taking meals were issues related to their taste which lead to loss of appetite. The several comments made by the participants in this regard were:

"Now, it's difficult to feel the taste. If something produces more smell although it is good, it irritates me a lot" (P4, Aladeniya)

"I feel I cannot eat even though I take foods to eat. Eat very less.. Sometimes, just one spoon of rice. Loss of appetite due to some curries" (P6, Siyambalagoda)

"I can eat anything. No harm for me. But, I have loss of appetite. I feel crazy when I eat very little. Sometimes, I stay hungry. No appetite to eat" (P5, Heeressagala)

Some participants highlighted the reasons for their appetite.

“When we are getting old, I feel loss of appetite.” (P1, Ampitiya).

“Appetite can be changed, if we don’t like the particular food and with disease conditions” (P6, Bowalawatta)

One participant said that mixing coconut milk or certain ingredients such as hot spices which are highly consumed by Sri Lankans caused her to lost her appetite and she tried to minimize using it. For example:

“We use about one and half coconuts to prepare jack fruit curry and more curry powder when cooking fish and meat. But, when I eat these curries, now I get headache. I feel comfortable by eating curries prepared using less coconut milk”.(P5, Bowalawatta)

Another participant also revealed the similar story mentioning some type of curries causes her loss of appetite:

“I feel I cannot eat even I take foods to eat. Eat very little. Sometimes, just one spoon of rice. Loss of appetite due to some curries”. (P6, Pilimathalawa)

b) Difficulty in swallowing/eating

Almost all the participants were struggling with difficulty in swallowing/eating. Two participants said directly they could not chew well:

“I feel numbness like feeling when chewing foods. So, it’s difficult for me”. (P1, Ampitiya)

“The only thing is I cannot chew foods. I have two or three teeth. So, difficult to chew. Lips are very painful. Now if rice is too hard, cannot eat. Scaling lips. Oh... cannot eat”. (P4, Heeressagala)

The other respondents also revealed their ideas about the reasons for difficulty in eating or swallowing such as previous neck surgeries, hardness of foods, aging or lack of teeth:.

“I have swallowing difficulty too. I have undergone a neck surgery. So, feel difficulty in swallowing all the time.” (P4, Hantana)

“I also do not have teeth. So, can’t bite. Less taste”. (P5, Muruthalawa)

“Yes, teeth are very weak now. Some of them have been extracted. So, difficult to bite hard foods”. (P2, Yatinuwara)

“Miss, due to tooth loss, we do not feel taste. Don’t we? Now my sister brought ‘kokis’. So, I like to eat it. I ate with her. See my lips. It removes skin. Very painful”. (P4, Heeressagala)

The majority of the participants talked about their difficulty in eating or swallowing and they highly perceived that they need some strategies to overcome this and explain their views on it. The common strategy used by the participants was keeping a glass of water or drinking water before meal. For instance:

“I drink some warm water before my meals”. (P1, Aladeniya)

“While eating, I usually take some water. I take some food. Then, again drink some water. That’s how I finish my meal”. (P4, Aladeniya)

“It’s bit difficulty to take foods. Specially, swallowing. So, I take some water. I keep a glass of water aside while I am having my food”.(P1, Ampitiya)

“Before eating, I usually drink a glass of water. I feel difficulty when my mouth is dry. It helps to relieve the difficulty”. (P1, Heeressagala)

“ I need water whenever I take my food. Easily obstructed otherwise. I eat rice after having few sips of water. While eating also, I take some water”. (P7, Yatinuwara)

Some participants need gravy curries in order to swallow easily:

“I usually keep a glass of water while eating when it is difficult to swallow. Also, gravy curries must be included in the meal. (P1, Bowalawatta)

“If we have gravy curries, it’s good. Therefore, we usually prepare them”. (P6, Bowalawatta)

One lady sadly said that she also needed gravy curries and sometimes, she didn’t have it:

“For me, it is very difficult to swallow. I usually drink water before eating. Sometimes, foods retain here (showing her chest). Cannot swallow or pull them back. It is bit easy for me when I have gravy. . (P5, Heeressagala)

Massaging was identified as a strategy to relieve difficulty in swallowing by a participant. For example:

"I have difficulty in swallowing. So, I massage my neck after drinking some water".

(P6, Siyambalagoda)

Eating soft foods and ripen fruits are some strategies practiced by participants:

"I need foods which are very softly cooked. I can eat fruits when they are ripening well". (P2, Yatinuwara)

"Then, rice is not cooked well at my home. If I have well cooked rice, I do not feel loss of appetite. I cannot eat rice which is not cooked well. "(P4, Heeressagala).

One participant told that she blended hard food and consumed it as she liked the food very much:

".....So, I blended it and ate. " (P4, Heeressagala)

c) Consuming less amount of food

The focus group discussions showed consuming fewer amounts or less quantity was an issue of almost all the participants. They talked about this in various ways such as related to their main meals, snacks etc. For example:

".....cannot eat well as I did in the past. I just take one coconut spoon". (P2, Aladeniya)

“.....Mmm. I take less sweets, salt, chilly and spices also”. (P1, Aladeniya)

“I just take small amount of food. I think it is the cause for my weight loss”. (P6, Aladeniya)

“I eat very small amount of rice”. (P,3 Bowalawatta)

“.....eat very little. Only the portion I need. Np more”. (P4, Ranawana)

Further, participants highlighted that they consumed less amount of foods in certain meals:

“I like to have rice for all meals. I need rice all the time. But, for dinner, I take it less”. (P5, Udaperadeniya)

“ I am taking very less for dinner. I am very afraid to have more”. (P6, Udaperadeniya)

5.2.1.2 Physical work/activity

Comments of the participants indicated that physical work or activity affect their meals in various ways. Some common perceptions are described below.

“.....I have lots of work at home. I have to do everything of father and son. From the past, all house hold works are done by me. So, I think these things may affect my weight loss”. (P4, Aladeniya)

Some participants talked about the positive effects of various physical activities which help them to have more foods.

“...It affects a lot. If I work lot, I need more foods”. (P1, Ampitiya)

“Yes, true. When we work hard or feel tired, we can eat and drink well”. (P3, Ampitiya)

“I do my house hold activities alone. Then, can eat well”. (P2, Hantana)

“When I clean my house after having tea, I feel very tired. Then, quickly have my breakfast. Otherwise, feel dizziness”. (P5, Siyambalagoda)

One participant tried to relate physical activity and one of his discomforts:

“I can eat lot when I worked hard. When I do not work, no need to eat.” (P5, Heeressagala)

Further, some participants perceived their physical activity negatively affect their nutritional status:

“...when we worked hard, it is very difficult to take meals. Have a rest , then take meals”. (P1,Udawela)

“.....the days we work hard, I feel I cannot eat. Then, I skip my meals”. (P3, Udawela)

“I have some experience skipping my dinner due to tiredness”. (P4, Udawela)

In addition, one participant mentioned that she needs more water when she feels tired:
“I need to have plenty of water when I feel tired. Nothing else. Need more water”.
(P4, Yatinuwara)

5.2.1.3 Routine

In addition the participants mentioned their routines may affect the dietary patterns. Majority of the participants stated that consuming three meals a day: breakfast, lunch and dinner is a part of their eating. For example:

“.....I have three main meals”. (P5, Aladeniya)

“ I take three main meals. If I had heavy meal in between three main meals, on major meal can be missed. Therefore, I make sure that I have breakfast, lunch and dinner”.
(P1, Ampitiya)

All the participants spoke of eating rice in their main meals while snacks mostly consisted of light foods such as biscuits, a fruit or a short eat:

“For me mainly take rice for three meals. In addition, take some snacks”. (P1, Aladeniya)

“Rice three times. Then, I take biscuits and banana”. (P1, Ampitiya)

“.....If it is rice, only two meals. I take morning tea with toasted bread or biscuits, etc. and tea or plain tea with biscuits around 3 pm”. (P2, Bowalawatta)

"I have rice for breakfast, lunch and dinner. Biscuits as extra meal if available". (P5, Bowalawatta)

".....Eat rice for three meals. In between at biscuit or a slice of bread. Rice for three meals. Even though string hoppers are available, I need rice for dinner". (P5, Heeressagala)

On the other hand, some participants talked about their favourite meal consumption.
For example:

"... green leaves, dried fish and sprats are mostly in my dish. I like them". (P5, Muruthalawa)

"I prefer to have green leaves, fish, meat and potatoes. I take fish and meat too". (P3, Pilimathalawa)

"I prefer to have 'kolaknda'". (P4, Pilimthalawa)

"I like vegetables, green leaves. Fish and meat is not a main food I love. In addition, I prefer to have milk". (P4, Pilimathalawa)

"I highly consume dhal, potatoes and sweet potatoes like foods". (P5, Pilimathalawa)

"In addition to main meals, I take a bite packet, grams etc.". (P6, Ranawana).

"...take something for three meals. Take a banana or a piece of jambola in between". (P6, Siyambalagoda)

From the discussions it could be discerned that the majority of participants consumed various type of tea beverages in between their main meals:

“I take something with tea at 10. I must have a plain tea at 3 pm too.”. (P7, Siyambalagoda)

“ I usually drink a cup of milk in the morning and evening. I take tea without sugar”. (P7, Udaperadeniya)

“I also usually take a plain tea with a ‘wade’ brought by sons”. (P4, Werellamana).

“Around 9 take a cup of tea with a biscuit. In the evening take a banana like thing. Around 4 pm take a cup of milk tea with a biscuit. It’s our usual pattern”. (P4, Yatinuwara)

“Sometimes, after I have morning tea, I take another tea if I feel hungry. After meals, normally take something with a cup of tea around 10-11 am. After lunch, I make lemon juice also. Then, I used to have a cup of tea around 4 pm”. (P2, Yatinuwara)

“Yes. yes. A lot. More tea (laugh). Drink a lot at once also”. (P3, Udaperadeniya)

“ The first thing I do is taking a cup of tea after getting up at 5 am. Then, start to cook. Then,.....take breakfast. Then, take a plain tea with a biscuit around 11 am.”. (P7, Yatinuwara)

Few participants told that they had certain foods when they visit friends and they do not have regular intake of snacks otherwise. For example:

“If we visit someone, usually they will treat with refreshments like biscuits or tea. O, in that way, I will have snacks”. (P2, Bowalawatta)

“I will have extra meals, if someone treats with short eats and tea, when I visit them”.
(P3, Bowalawatta)

“....If someone visit our home and when we treat them, I take snacks. Other times not take any snacks or tea”. (P3, Mulgampola)

Many participants spoke about their regular time of their meals. They used terms such as ‘usually’, ‘every day’ and ‘always’ to describe their meal. Almost all of the participants who had routine meals talked about their time for taking meals and reasons for selecting the time. For example:

“..... our consumption pattern is almost same each and every day”. (P1, Bowalawatta)

“ I want to eat at the exact time daily, as a routine. For example, a lunch around 12.00-12.30 pm. There will be a severe headache which cannot be relieved with anything, if that time changed anyhow. So, I used to eat at the same time daily”. (P1, Bowalawatta)

“I always have the lunch at 12 noon. If not, I usually wait until children arrive home after school”. (P4, Bowalawatta)

“I usually have my breakfast before 7.30 -8.00 am due to morning medication doses and lunch after children arrives home. Dinner is usually around 8 to 8.30 pm.”. (P5, Bowalawatta)

Some participants expressed that they were having routine dietary patterns comparing to their past. They were previously involved with jobs or child care activities which interrupted their routine meals:

“ During we did our jobs, we didn’t have exact time for having our meals. After retirement, we have proper time for it”. (P3, Mulgampola)

“Previously, we didn’t have proper time due to taking care of children. Now eat around 6.30 am”. (P1, Mulgampola)

Although a many a participants have routine dietary pattern, one of them mentioned that she did not follow any routine to have their meals. For example:

“ I do not have exact time to eat. I usually eat whatever I feel hungry. Therefore, I never eat at exact time”. (P6, Bowalawatta)

5.2.1.4 Food preparation

According to the participants’ views, their food preparation was mainly based on availability, homemade and purchasing power.

a) Availability

Participants talked about their food availability as it is important for meal preparation.

For example:

“Usually, I eat foods from my garden....”. (P1, Aladeniya)

“I stay with my youngest son. He brings food. I live having whatever the things they give me”. (P3, Muruthalawa)

“....if available, we take....”. (P2, Werellamana)

b) Home made

Majority of the participants stated that consuming homemade foods. Some of the comments are shown below.

“..we can have our own foods prepared at our homes”. (P6, Hantana)

“ ...we prepare it at our home”. (P1, Uduwela)

One participant mentioned that they consumed take away foods occasionally.

“Yes, we too prepare our foods at homes. But, if we need, I buy it”. (P6, Hantana)

Some pointed out that they prepared their foods together with other family members.

For instance:

“For me my wife or daughter cooks. I also help them little bit. We prepare foods at our home”. (P7, Pilimathalawa)

“We three people together prepare our meals”. (P1, Pilimathalawa)

c) Financial constraints

Participants were generally concerned with their finance. They revealed it in the discussions. Majority of the participants' was supported by their children. For example:

“I prepare food according to my income. There is no one to give me...”. (P3, Aladeniya)

“My son brings all. So, I cook then...”. (P4, Aladeniya)

“Me too. I prepare meals at homes. Sons bring things”. (P2, Ampitiya)

“My daughter does it”. (P1, Ampitiya)

“ I manage by discussing with my children. My children give me money”. (P2, Ampitiya)

“I do not go to market. All the necessary things are brought by my children. I am a kind of person who live my life peacefully....” (P1, Bowalawatta)

“Money is provided for us by my sons. We manage that money provided by children for the monthly cost”. (P2, Bowalawatta)

“My husband is not working now. When he was working, we used to manage with his salary. Now, our son is the one who money and do everything”. (P5, Bowalawatta)

Few participants told that their financial activities were done by their spouses or by their own.

“After I take my pension, I accompany a child to go to market. I buy foods for Rs. 5000-6000 monthly”. (P1, Heeressagala)

“ I buy foods paying Rs. 4000-5000 once per month. Then, if needed, buy more. I am alone at home during dya time. I have to buy sugar, tea, salt, chillies etc. if they are not available at home. So, difficult to manage”. (P4, Heeressagala)

“My husband does shopping and buys all foods for one month. Sometimes, I do it. Once a week I go to market and buy vegetables. Once a week I go to town and buy vegetables and other necessary items”. (P3, Mulgampola)

“We were retired. However, we have not pensions. It was funds. Husband is also the same. We have a land in Hataraliyadda. We can earn money from it. Son also does a job. Son helps to financial management in our home. Most of the time, I and my husband do it”. (P4, Mulgampola)

“For us.....mmmmm. Children bring all. In between, we sell something from our garg=den and buy our needs”. (P1, Yatinuwara)

One male participant expressed his view on financial constraints as follow.

“I have to balance the things. We cannot do like other people. We have to think of everything. For example, if we earn Rs. 1000, we must think of how we live with Rs. 1000. We bring rice and others and keep them at home for use. In between, our son also brings goos or gives money to his mother. Daughter too. I also bring however I can”. (P7, Siyambalagoda)

Few participants talked about their subsidies provided by the government. For example:

“I do not have money to manage. Children bring foods. I receive a ‘pinpadi’. I buy something if needed”. (P5, Heeressagala)

“....I have to go..... to get ‘Samurdhi’ goods”. (P5, Muruthalawa)

5.2.1.5 Gender roles

The participants’ expressions clearly show the gender roles in diets. Purchasing activities were mainly managed by husbands or sons. Food preparation activities were kind of responsibilities of female members of the family such as mother or wife, daughters and daughter in laws.

A participants who was having a son stated that

“my son brings all. So, I cook then”. (P4, Aladeniya)

“My son brings everything”. (P3, Ampitiya)

“My husband goes to market” (P5, Ampitiya)

“I prepare meals only if my daughter in law is not at home. Usually, she is the one who prepare meals”. (P1, Bowalawatta)

“Meals are prepared at my home by my daughter in law”. (P4, Heeressagala)

“ I prepare foods with my daughter in law. She is not at home during day time. We make food stuff ready at night. In the morning we both prepare foods. I do not prepare foods at lunch. In the evening daughter in law comes home. Then, we work together. We prepare foods together on holidays.....”. (P1, Mulgampola)

Among the participants, male ones highlighted that their meals were prepared by either their wives or daughters. One participant expressed his beloved feelings towards his wife in preparing foods for him. For example:

“ For me, my wife or daughter cooks. I also help them a little bit”. (P7, Siyambalagoda)

“When my wife arranges my meal, I have to take more (laughing). May be because of love. I never tell her anything. She may feel upset otherwise. Therefore, I eat whatever I can. Then, wash my plate and keep it”. (P2, Udawela)

Moreover, one male participant mentioned that he earned money and let his wife to manage finance:

“I give money to her. She brings. Two people cannot do it. Whatever the things she needs, she brings them”. (P1, Pilimathalawa)

5.2.1.6 Eating with others

Majority of the participants expressed pride in having meals with others. They loved to have meals with others. They believed that having meals with others increase their food intake as well as increase happiness. However, participants cannot take all the meals together due to various reasons as mentioned below.

“I take meals with father (husband) at lunch. At dinner, son, father and myself”. (P4, Aladeniya)

“I think when we have relatives, we take meals together. Then, can have more foods.” (P1, Aladeniya)

“Yes....When I take meals while chatting with tem, I can easily eat more”. (P2, Aladeniya)

“I usually have lunch with my husband. At day time, only I and my husband are at home as my son is working and grandchildren are schooling. We usually have dinner together”. (P5, Bowalawatta)

“ I eat extra amount of food as it is very enjoyable. I have two granddaughters. Sometimes, when we answer our grandchildren, we’ll have a reminiscence of our past. Therefore, even if I finish with my meal, I remain in the table continuing chit chat until they finish”. (P1, Bowalawatta)

“ It is very happy when we eat together. It is good for the mind when we chat and eat together. When eat alone, it is not good.....”. (P5, Heeressagala)

In addition, one participant talked about the current changes in the society such as taking meals while watching television. She further mentioned that it may interrupt the relationships among family members:

“How can we chat these days? Everyone is watching TV while eating....(laughs)...”. (P4, Heeressagala)

Contrast to having meals with family members, some participants mentioned that they have their meals alone due to some reasons such as living alone, not having anyone during day time and their preferences. For example:

“I take breakfast alone. Take lunch alone too. Only for dinner, I take it with my family”. (P1, Gannoruwa)

“I take meals alone. I am staying at home lonely most of the time”. (P3, Gannoruwa)

“Mine is different. After praying for Lord Buddha, I am the first one who eats at home. When my son is at home, I never eat first. On those days, my daughter in law serves

everyone. Then, I take my meals with them. I do not know when they eat otherwise. I often take my meals alone". (P4, Heeressagala)

"I am alone at all the time. Father and grandson are there. I feel very hungry at 7.30. They have told me to have my meals anytime". (P3, Pilimathalawa)

" For me, I cannot wait for others. After everyone have their meals and go to bed, I take my meals. For a long time, it is my practice. From childhood of my children, take meals at last. Same nowadays". (P6, Siyambalagoda)

5.2.2 Factors affecting food choices

It seems that food choices of the participants were based on the knowledge and misconceptions expressed by them.

5.2.2.1 Knowledge

Participants were generally concerned with their health status and selected foods accordingly:

" When eating rice with extra vegetables and green leaves according to the weight, body weight can be maintained. Weight may be reduced due to some disease conditions or reduced food consumption". (P4, Bowalawatta)

" I think nutritional diet is important. If we take nutritional diet with vegetables and fruits, it is good for our health". (P1, Mulgampola)

“.....I changed everything according to doctors’ advices. So, everything is good. No high blood pressure, no cholesterol or no any disease”. (P7, Siyambalagoda)

Majority of the participants mentioned that nutrition services are not readily availability in their communities to update their current knowledge regarding nutrition. However, some of them talk about the facilities such as hospitals, clinics etc.

“We don’t have such facilities. Only pregnant mothers have”. (P5, Hantana)

“There are some maternity clinics. Most of them for pre-elderly. If there is any clinic for elderly, we can go there and get advices”. (P3, Pilimathalawa)

“We take such facilities from rural hospitals. We are unable to go for paid facilities”. (P7, Yatinuwara)

“..., we get information from our health worker, so called midwife. Also, we go to clinics. They give information early especially when we are having diabetes, what to eat, what not to eat etc. that’s how we get nutritional services”. (P2, Aladeniya)

Few of the participants told that peer interactions were very helpful in gaining new knowledge regarding foods and meals. Media also was considered as a readily available nutrition service by one participant.

“When we friends meet together, we do discuss some nutritional issues. So, we can update our knowledge”. (P5, Hantana)

“....., we can watch several nutritional programs in the television. In addition, we can get information from our family doctor”. (P6, Hantana)

5.2.2.2 Taboos

Several participants stated that they did not consume certain types of foods due to various reasons. Few of their comments are described below.

“....It influenced. For example, if I eat jack, I feel wheezing and body ache. I do not eat brinjoles”. (P1, Aladeniya)

“When taking cool foods, it causes for pain in hands. When taking very cold things, end up with chest pain even”. (P1, Heeressagala)

5.2.3 Health status

Overall, the discussions revealed that majority of the participants suffered from any type of disease condition. The disease conditions and some food restrictions affect the participants' food and meals.

5.2.3.1 Diseases

The discussions showed that the participants had various types of diseases and having medications concerned of their health. Some of them mentioned that it affected their dietary intake. Then, they tried to avoid some kind of foods. For example:

“I'm a diabetic patient. So, I have limited sugar intake.....”. (P3, Aladeniya)

“Diseases all the time. Then, it is very difficult to eat..... I have gastritis now. So, it is very difficult to digest. So, cannot eat”. (P1, Ampitiya)

The participants who had some diseases pointed out that they were advised to have certain dietary guidelines to control their disease conditions:

“I am a heart patient and I take medications in the morning and night. So, I have to take my diet according to that medication schedule. My cholesterol levels are also high. Therefore, I have to limit the consumption of oil. Consumption of rice is much less”. (P2, Bowalawatta)

“I have been taking medicines for 26 years. I try to control my diseases while thinking of my diets mainly”. (P6, Hantana)

“I was advised not to eat too much. I need to divide my portion into four groups. Then, eat only one part of it with vegetables. So, I eat that amount”. (P1, Ranawana)

“I go to clinic at Bogambara. I go there monthly for 11 months. Doctor asked me to come and see him to stop medicine. I take medicine as I was advised. I take my foods accordingly”. (P7, Siyambalagoda)

“We were advised by doctors to reduce cholesterol. Therefore, we use coconut milk to reduce oil. So, we cannot eat foods as we did in our 50s. A bit reduction.”. (P5, Yatinuwara)

However, one participant mentioned that she could take usual meals although she had a cancer and on treatment.

“Appetite can be changed with disease conditions. However, I am a cancer patient and on medication for 6 years.I had foods and beverages as usual”. (P1, Bowalawatta)

5.2.3.2 Restrictions

Some participants pointed out that they restricted certain types of foods. Few of them further described reasons for it. The main reason for restricting foods was feeling various types of discomforts:

“ I don’t like eat meat and fish. I dislike drinking milk even”. (P2, Aladeniya)

“I cannot eat foods made out of flour. Eating bakery products causes wheezing. I do not eat jack. If I eat it, it is very difficult for me to breathe”. (P1, Aladeniya)

“I do not eat wheat flour products. If I eat roti, I feel breathing difficulties”. (P2, Aladeniya)

“Salmon has been fried. I ate a piece of salmon. It was delicious. But, I vomited few hours later. So, cannot eat. I hate fish and meat”. (P4, Heeressagala)

“.....I cannot eat some kind of vegetables. Feel pain. Cannot even walk. Brinjoles, bitter guard etc. I give up them. Back pain too”. (P7, Werellamana)

5.2.4 Psychological challenges

Participants talked about the changing of dietary pattern due to various psychological conditions related to their mood such as anger or sadness.

5.2.4.1 Mood change

The issues that respondents raised about eating when they were angry and sad were, in most cases, avoiding their meals.

“I cannot eat when I feel angry or sadness”. (P3, Ampitiya)

“I can spend a whole day without eating anything, if I feel sad or any trouble. Sometimes, I spend these days only having my morning tea”. (P5, Bowalawatta)

“I have spent a whole day without eating and sometimes even without water, when I feel sad”. (P6, Bowalawatta)

However, some participants spoke about their relieving methods such as adhering to religious activities.

“....Most of the times, do not think about that. Think according to my religion. It helps me to manage my mood changes”. (P2, Mulgampola)

“We do not think more. According to our religion, we can manage mood changes. We have enough strength to manage mood changes”. (P3, Mulgampola)

The discussions revealed that social changes such as living alone, demise of spouse or children, family issues greatly affected their diets.

a) Loneliness

Loneliness is often associated with diets. Some participants expressed their views on loneliness and some of them pointed out its relation with foods:

“I stay with my two grandsons whose mother left them alone. My son got married to another lady. My husband took care of me and my grandsons till his death. My husband left us about five months ago. So, I am very sad and staying taking care of two grandchildren”. (P3, Aladeniya)

“I cannot eat when I am alone at home. I can eat when somebody is at home”. (P5, Heeressagala)

“Now I feel loneliness. Take meals after everyone take their meals”. (P1, Siyambalagoda)

5.2.4.2 Family issues

Various types of family issues which were related to diets were identified through the discussions. For example:

“When our children said something in angry mood, I cannot eat 2 or 3 meals”. (P2, Mulgampola)

“If my children have any problem, I cannot eat. Cannot bear it up”. (P6, Siyambalagoda)

“ If my grandkids were stresses to do their homework, I stop eating. Cannot eat”. (P7, Yatinuwara)

5.2.4.3 Loss of spouse or children

Few participants expressed their feelings of the loss of their spouse or children. According to their views, the loss affects their diets in various ways. For example:

“One of my sons dies. My son was an army soldier. He died. When it is coming to my mind, I feel difficulty in swallowing”. (P1, Aladeniya)

“My husband died five months ago. So, I live sadly. I cannot eat when I recall him. So sad”. (P3, Aladeniya)

“.....He comes to my mind all the time. So, difficult to eat”. (P3, Aladeniya)

“When I feel sad, it I is very difficult to eat. One of my sons passed away. I think and worry about him every day. But, I try to tolerate that pain. However, it is difficult to eat whenever I remember him”. (P2, Bowalawatta)

“My husband is not alive. When I think of him, I cannot eat”. (P5, Pilimathalawa)

“.....When he was with me, we had meals together. Now it I is no more. So, when I take meals, he came to my mind”. (P5, Yatinuwara)

Although the participants who missed spouse or children worried too much about them and missed their diets, two participants said that they tried to control their mind:

“.....But, now I tried to control my mind”. (P3, Pilimathalawa)

“As I told before, death and dying is a universal phenomenon. It’s a common for everyone. So, I have understood the concept and therefore I can control my emotions. It is better to spend our life rather than thinking about someone who died. Even if I do not eat and drink, the dead will not come again. Therefore, my husband death does not have any effect on my meal pattern”. (P1, Bowalawatta)

5.2.4.4 Acceptance

The majority of the participants get any kind of assistance from their spouses or children. Some of them have already accepted their disability whereas the other participants were experiencing transition from independency to dependency. Few participants felt that they had to accept their dependency and get others assistance in preparing or getting meals. For example:

“ I don’t go anywhere. It’s difficult to walk. I am so old. 78 years now. So, my sons bring everything”. (P5, Siyambalagda)

“ I also cannot work as I did in the past. I stay at home doing nothing”. (P6, Yatinuwara)

“Generally, we have diseases now. My eye sight is low. But, we don’t care of it. In other words, we don’t worry of it. Now, we are ready to go”. (P1, Yatinuwara)

5.3 Summary

Fifteen focus group discussions were conducted. The majority of the participants who participated in the focus group discussions were females. The mean age of the participants was 68.74 years (SD: 6.32). The age range was 60-97 years. Four main themes were identified in the thematic analysis of the focus group discussions: factors affecting dietary pattern, factors affecting food choices, acceptance, health status, nutritional services and psychological challenges. Fifteen subthemes were noted appropriately.

CHAPTER 6: DISCUSSION

6.1 Introduction

This chapter will discuss the findings of both quantitative phase and qualitative phase of the current study. The prevalence of malnutrition measured using various measurements and association of factors with malnutrition and at risk of malnutrition will be discussed. Moreover, factors which are significantly associated with malnutrition and at risk of malnutrition are compared with previous findings. Also, the level of quality of life among the older persons and associated factors are discussed with relevant previous studies.

The response rate of the current study was 76.85% and only 16 questionnaires were excluded due to missing data. Thus, the sample of the study can be considered as a representative of the study population.

6.1 Descriptive characteristics

6.1.1 Socio demographic factors

6.1.1.1 Gender

A higher proportion of the participants of the study were females. This is due to the greater improvement in female life expectancy relative to that of males in Sri Lanka (DeSilva, 2007). The life expectancy of females was 78.6 years for females while it was 72 years for males (Department of Census and Statistics, Sri Lanka, 2016). In

addition, the high involvement of Sri Lankan women in decision making over health care and realizing their biological advantage over men may be reasons for high female participation in the study (Indrani Pieris & Caldwellb, 1997).

The gender distribution of the study may affect several life style factors associated with malnutrition among older persons such as smoking, alcohol consumption and betel chewing. Also, evidence suggested that female gender was independently associated with poor nutritional status among older persons.

6.1.1.2 Age

Age has been identified as the most significant factor related to malnutrition. All of our participants were older persons whose age was 60 years and above. Half of them were among the young old grouping (60-69 years) and 10% of them were very old (more than 80 years). This pattern is very similar to the age structure of Sri Lankan population (Department of census, 2013). Older persons are particularly vulnerable to malnutrition. This is further worsen among the very old older persons as both lean body mass and basal metabolic rate decline with age (Frangos et al., 2016). Scholars suggested that age stratifications of the older persons are important in assessing their malnutrition (Yoshimura, Yamada, Kajiware, Nishiguchi, & Aoyama, 2013).Montejano Lozoya et al (2013) reported that the prevalence of malnutrition was higher among very old older persons compared to young old people.

6.1.1.3 Ethnicity

Majority of the participants of the current study was Sinhalese followed by 6% of Tamil participants. The similar proportions of ethnic groups could be observed in various community based studies in Sri Lanka (Malhotra, Chan, & Ostbye, 2010; Katulanda et al. 2012). However, Kandy district consists of Sinhala 74.34%, Tamil 11.31%, Muslim 13.95% and other 0.40% of the total population. Life style and food pattern of various ethnicities may affect the malnutrition status of older persons (Rathnayake et al., 2015). Hence the effect of ethnicity on malnutrition among older persons would likely be underreported in the current study.

6.1.1.4 Marital status

Marital status has been identified as a crucial indicator to identify social wellbeing of the older persons. Torres et al. (2014) and Dos Santos et al. (2015) reported that being widowed was independently associated with malnutrition of older people. In the current study, the majority of the participants were married. The proportion of widowed also was comparatively higher than single and divorced. It was highest among females. Changes in marital status of the older people are likely to influence their living arrangements such as social security and economic reasons which may be important for older persons. In Sri Lanka widowed are more prevalent among females due to various reasons: wives are generally younger than the husbands and higher life expectancy of females and higher re-marriage rates among older widowed men than widowed women (United Nations, 2009). De Silva highlighted that widowed older persons and those who have never married were the most vulnerable in aging societies as older persons who are

in marital union have someone to share the difficulties and to make positive influence on their physical and mental stability (De Silva, 2013).

6.1.1.5 Living arrangement

Living arrangement is a social factor related to health status as well as nutritional status among older persons. Akin et al (2016) found that living alone significantly and negatively associated with malnutrition among older persons. Considering the results of the current study, it showed that the majority of the participants stayed with family members. This is in line with the previous study in Sri Lanka. This may be due to the fact that Asian societies have a tradition which holds the older persons in reverence. The younger generation provide social and financial assets required by the older persons (Kaluthanthri, 2014). However, Siddhisena (2014) pointed out that there is a growing demand of older persons entering elderly homes in Sri Lanka.

6.1.1.6 Number of people living with

According to Department of Census and statistics (2013), the average household size in Sri Lanka was 3.8 and it was lower than the previous values. In the current study, the mean number of people staying with older people was 3.60 and in line with the island wide information.

6.1.1.7 Educational status

As reported in the census of Sri Lanka, a larger proportion of persons were observed in secondary education category. Therefore, it is not surprising to have the majority of our participants who had secondary education. This is consistent with previous studies in Sri Lanka (Rathnayake, Madushani, & Silva, 2012). Moreover, it was found that literacy which is associated with higher educational status directly affects the nutritional status of older individuals (Alkerwi et al., 2015; Tarqui-Mamani et al., 2014).

6.1.1.8 Income

Income is a very important factor related to malnutrition of older persons. It has been evidenced that low income restricted access to diverse nutritious food sources (Alkerwi et al., 2015). The majority of the participants in the current study were below the poverty line (below Rs. 3909). Rathnayake et al. (2012) also revealed the similar results highlighting that their participants' income was lower than LKR 3000 per month.

6.1.1.9 Medical history

Nearly half of our participants reported that they did not have any type of chronic illness and it is consistent with a previous Sri Lankan study (Rathnayake et al., 2015). Only 23.5% had hypertension and less than 5% had diabetes mellitus, hypercholesterolemia, asthma and other types of disease conditions. One tenth of them were having more than one chronic disease. Evidence indicated that older persons are at risk of malnutrition due to chronic illnesses.

6.1.2 Physiological factors

6.1.2.1 Tooth loss

Evidence revealed that edentulism (tooth loss) had a direct impact on malnutrition among older people. The risk of malnutrition was eight times higher in edentulism among older persons (Makwana et al., 2014). In the present study, the majority of the participants had tooth loss.

6.1.2.2 Use dentures

In contrast to the edentulism in older people, using dentures had protective effect in malnutrition of older people. Removable dentures can improve oral function of the older people (Yen et al., 2015b). One fifth of the participants of the current study used dentures. A similar finding was reported in another Sri Lankan study (Rathnayake et al., 2015).

6.1.3 Psychological factors

Various types of psychological factors such as lack of interest, low mood, frequent negative thoughts, loneliness, depression may affect malnutrition among older people (Akın et al., 2015). In the current study, 62% of the participants were depressed.

6.1.4 Lifestyle factors

6.1.4.1 Physical inactivity

Physical inactivity has been identified as the fourth leading cause of mortality (WHO, 2009). Inactivity inherently develops abdominal adiposity which leads to various non-communicable diseases (Ranasinghe, Ranasinghe, Jayawardena, & Misra, 2013). Our finding was lower than the mean physical activity of Sri Lankan adults (Katulanda, Jayawardana, Ranasinghe, Rezvi Sheriff, & Matthews, 2013).

6.1.4.2 Use of medication

In the present study, 40% of our participants were on medication.

6.1.4.3 Betel chewing

Chewing betel nuts has become the fourth most widely used addictive substance in the world by year 2008 (Lin et al., 2008). It has long been a common habit in Sri Lanka, especially amongst rural populations (Perera, 1999). Among tea pluckers in Sri Lanka, chewing tobacco in combination with the betel and areca nut can be widely seen (Weerakoon et al, 2009). Nearly half of the participants in the present study had the habit of betel chewing.

6.1.4.4 Alcohol consumption

It is well documented that moderate alcohol consumption has beneficial effects on health (Somrongthong et al., 2016). However, it has not been completely understood among older people as physiological changes with aging. Fawehinmi et al (2012) suggested that there were differences in dietary patterns in relation to the level of alcohol consumption. In the present study only 5.2% participants consumed alcohol and majority of alcohol consumers were males. Similar to other South Asian countries, alcohol use in Sri Lanka is considered a predominantly male habit (Jayasinghe & Foster, 2011). The low prevalence of alcohol consumption among older persons in this study may be due to religion, cultural upbringing, and concerns for adverse health effects (Lombardo et al., 2013).

6.1.4.5 Smoking

Tobacco use within Sri Lanka is also relatively common, particularly among adult males (Lombardo et al., 2013). In this study 3.5% of the participants were smokers and the majority of them were males. This is in line with a cross-sectional study reporting low smoking prevalence (1-2%) among women (Perera et al, 2005). The prevalence of smoking increased from young adulthood to middle age, and then decreased slightly among those of retirement age (Lombardo et al., 2013).

6.1.5 Dietary factors

6.1.5.1 Eating/swallowing difficulties

Eating/swallowing difficulties (dysphagia) is a prevalent difficulty among aging adults and is associated with age-related changes in swallowing physiology as well as age-related diseases (Sura, Madhavan, Carnaby, & Crary, 2012). Barczi, Sullivan, and Robbins (2000) pointed out that 15% of the older persons population is affected by dysphagia although the exact prevalence of dysphagia across different settings is unclear and the situation is worsened with advancing age. In the current study 10.7% of older persons was suffered from eating/swallowing difficulties. This might be the reason for having poor dentition reported by majority of the participants.

6.1.5.2 Food allergy

Self-reported food allergy was considered in the present study. Less than ten percent of our participants reported that they had a history of food allergy. Due to age-induced decline of physiological functions, including vitamin D deficiency and gastric pH increase, allergic disorders in older persons may be masked by various symptoms (Mohrenschlager & Ring, 2011).

6.1.5.3 Loss of appetite

Appetite is the desire to fulfil a bodily need, especially for foods. The brain, digestive system, endocrine system and sensory nerves are involved in the appetite regulation. Older people experience a decrease in appetite due to changes of these systems in aging.

In addition, factors prevalent in the older persons such as comorbidities and polypharmacy often cause loss of appetite (Malafarina, Uriz-Otano, Gil-Guerrero, & Iniesta, 2013). This is often called as 'anorexia of ageing'. Loss of appetite increases risk of nutritional deficiencies and weight loss (Pilgrim, Robinson, Sayer, & Roberts, 2015). Evidence suggested that between 15% and 30% of older people are estimated to have anorexia of ageing in a recent systematic review (Malafarina et al., 2013). Around eleven per cent of our participants of the current study were having loss of appetite. The reason for comparatively low prevalence of loss of appetite of the participants may be due to various strategies from family members to help them to improve their appetite such as enhancing the flavour of food with herbs, spices, improving mealtime ambience and having company at mealtimes (Pilgrim et al., 2015). The majority of our participants stayed with their family members and thereby they can receive good meals with love and affection.

6.1.5.4 Vegetarian diets

Food intake patterns play an essential role in the maintenance of health and well-being (Jayawardena, Byrne, Soares, Katulanda, Yadav, et al., 2013). American Heart Association described that vegetarian diet includes only foods from plants: fruits, vegetables, legumes (dried beans and peas), grains, seeds and nuts ("American Heart Association -Vegetarian Diets "). A typical healthful plate of food contains 1/2 plant foods (nonstarchy vegetables and fruits), 1/4 whole grains or unprocessed starchy food, and 1/4 lean protein. It should include eating a variety of fruits and vegetables that may include beans, legumes, seeds, nuts, and whole grains and avoiding or limiting animal products, added fats, oils, and refined, processed carbohydrates. (Tuso, Ismail, Ha, & Bartolotto, 2013). However, in a Sri Lankan diet, rice and pulses are the main

contributors of protein. The main lipid source in Sri Lankan diet is coconut milk/oil (Jayawardena et al., 2014). Monotonous, cereal-based diets cause macro and micro nutrient deficiencies among Sri Lankans (Rathnayake et al., 2015).

A recent community based study conducted among older persons in India found that high proportion of older persons who consumed vegetarian diets were malnourished comparing to those who consumed mixed diets (Ananthesh, Bathija, & Bant, 2016). Nearly one third of our participants were vegetarians. It is higher than the vegetarians in other countries like America (Craig, 2009). A Sri Lankan study revealed that Sri Lankans are reluctant to consume meat products due to religious concerns and antipathy for killing animals (De Silva, et al., 2010). Further, Senhui et al, (2003) also highlighted that when people become older they pay a special attention to health attributes of their diet and thus cut down their meat consumption. Craig (2009) mentioned that vegetarian diet is associated with many health benefits due to its higher content of fibre, folic acid, vitamins C and E, potassium, magnesium, and many phytochemicals and a fat content that is more unsaturated (Craig, 2009). However, Jayawardena et al. (2012) revealed that major nutrients in Sri Lankan adult diets were below the national recommendations.

6.2 Anthropometric, MNA and Quality of Life measurements

6.2.1 Weight

Body weight is a widely used measurement to assess nutritional status. It represents both fat free mass and fat mass of the body. The mean weight of the participants of our study was 52.16 kg (95% CI: 51.25-53.07). The mean weight of males (55.74 kg, 95% CI:

54.07-57.42) was higher than that of females (50.57kg, 95% CI: 49.55-51.59). Considering Sri Lankans, the mean weight of the participants in this study is lower than the mean weight of adults having metabolic syndrome. However, it is similar to the mean weight of adults with non-metabolic syndrome (Katulanda, Ranasinghe, Jayawardena, Sheriff, & Matthews, 2012). This may be because of recruiting all categories of adults rather than older persons in the other study.

6.2.2 Height

Height is used in assessing the risk of malnutrition as well as obesity and basal metabolic rates. Due to age related changes such as osteoporosis, height is not considered as the best measurement for assessing nutritional status of elderly (Madden & Smith, 2016). The mean height of the participants of our study was 151.55cm (95% CI:150.63-152.47). Both of these values were lower than the national height values for Sri Lankan adults. However, they are comparable to published data from other regional countries (Ranasinghe et al., 2011). The reason behind the low mean values of height may be the age related physiological changes of older persons of this study.

6.2.3 Mid Upper Arm Circumference

Mid upper arm circumference is an indicator of protein and energy reserves of the individual (Benítez Brito et al., 2016). The mean MUAC values of males in our study was slightly higher than that of females. However, the values are higher than the malnutrition cut-off values defined by WHO (1995). Comparing the international values, the current value is lower than the global values (Wijnhoven et al., 2010). Nevertheless,

the current study value is line with a recent study conducted among older persons in Sri Lanka (Rathnayake et al., 2015).

6.2.4 Calf circumference

Calf circumference is a sensitive measure of muscle mass of older persons (WHO, 1995). The mean CC of our participants was 29.64cm and it is lower than the cut-off point of malnutrition defined by WHO (1995). However, it is very similar to the findings of a Sri Lankan elderly study (Rathnayake et al., 2015). The possible reason for the low value of CC of our participants may be the weakness in leg strength in this population (Rathnayake et al., 2015)

6.2.5 Handgrip strength

Older males have greater hand grip strength than females which is in accord with many previous studies (Moy, Chang, & Kee, 2011; Wagner, Ascenço, & Wibelinger, 2014; Zhao, Yu, Zhang, & Zheng, 2013). This may be due to the fact that males are having greater muscle mass than females (Moy et al., 2011). Males have more lean muscle mass justified by higher concentration of testosterone which contributes to growth of lean muscle mass by stimulating muscle protein synthesis (Wu et al., 2012). Further, the mean handgrip strength of the current study was comparatively lower than the Western population (Dodds et al., 2016). Also, it is lower than the population in Malaysia, a country in the same region (Moy et al., 2011). Further, very older participants of the study tended to have lower handgrip strength. For example, the lowest handgrip strength was found among the very old age category in the current study. The results of this

study are in agreement with the findings that handgrip strength progressively declined with age (Moy et al., 2011).

6.2.6 Body Mass Index

Mean BMI of the current study was within the normal weight category according to WHO (WHO, 1995). Females had higher mean BMI than that of males. Our results were higher than the mean BMI values of previous Sri Lankan studies including the Sri Lanka Diabetes and Cardiovascular Study (Katulanda et al., 2008; Katulanda, Jayawardena, Sheriff, Constantine, & Matthews, 2010) and institutionalized older persons (Rathnayake et al., 2015). This may be due to high percentage of moderately active participants in our study. Nevertheless, the mean values of BMI in the current study are lower than the majority of international studies (Chen et al., 2012; Fares et al., 2012; Paker-Eichelkraut et al., 2013). This may be due to differences of percentages of body fat and fat free mass and its distribution across populations. WHO recommends that country specific values should be developed taking into consideration of race, biotype, gender, culture, and age into consideration (Rodrigues et al., 2014).

6.2.7 Mini Nutritional Assessment

The mean MNA value of our study was 10.45 and it was within the category of at risk of malnutrition. However, our MNA mean value is higher compared to other Asian countries such as Japan, meaning the nutritional status of our participants was higher than the Japanese older persons (Izawa, Enoki, Hasegawa, Hirose, & Kuzuya, 2014). Moreover, the mean MNA of our study is lower than that of Italian population showing low nutritional status in our study (Mastronuzzi, Paci, Portincasa, Montanaro,

& Grattagliano, 2015). This may be due to the different energy intakes in these different populations which own their cultural eating habits.

6.3 Prevalence of malnutrition

The prevalence of malnutrition is varied due to the measurements concerned. Our study analysed prevalence of malnutrition using MNA-SF, BMI, Mid Upper Arm Circumference, Calf Circumference and Handgrip Strength.

6.3.1 MNA- SF

Considering Mini Nutritional Assessment, the prevalence of malnutrition in this study was 12.5%. The mean value was lower compared to two other Sri Lankan studies highlighting better nutritional status of community-dwelling older persons than older persons who were at institutions and hospital settings (Fernando & Wijesinghe, 2010; Rathnayake et al., 2015). The possible elucidation might be the settings and the target populations of the previous studies. Two of them were conducted among institutionalized older persons while our study was conducted among community-dwelling older persons. In Sri Lanka most of the elderly homes are managed by religious and non-government organizations, philanthropic families or trusts. The set menus with low nutrients and dietary diversities may impact on high malnutrition rates among the older persons stay in elderly homes. Moreover, the majority of the participants stayed with their own family members and families have strong values around caring for older persons as it is a cultural norm of the Sri Lankan society (Watt et al., 2014). Moreover, in our study, older men had significantly high prevalence of

malnutrition compared to elderly women. This is similar to findings reported from previous studies (Boulos, Salameh, & Barberger-Gateau, 2013; Jamir et al., 2013).

In addition, comparing the prevalence of global malnutrition of community-dwelling older persons measured by MNA, South Africa, Portugal, Korea and Pakistan, a south Asian country showed high prevalence of malnutrition (Hyun & Lee, 2014; Naidoo et al., 2015; Santos, Amaral, & Borges, 2015). This could be due to low income of Sri Lankan older persons compared to the other countries. The majority of our participants was below the poverty line which leads to inability of purchasing nutrient rich foods. This is supported by the findings of (Rathnayake et al., 2012). Further, the prevalence of depression was also very high in our population leading to high prevalence of malnutrition among older persons.

Further, prevalence of malnutrition was high in our study compared to observations from other countries such as India, Ethiopia and Congo (Agarwalla, Saikia, & Baruah, 2015; Andre et al., 2013; Hailemariam, Singh, & Fekadu, 2016; Vedantam et al., 2010). In addition to the income, differences in prevalence of malnutrition across studies might be due to urban-rural differentials, age distribution, and type of occupation.

The MNA not only gives the prevalence of malnutrition but provides the prevalence of at risk of malnutrition. Considering the current study 52.4% of older persons were identified as at risk of malnutrition. All of the above studies which used MNA showed more than 40% of the participants as at risk of malnutrition. That means, MNA identified more at risk of malnutrition than the malnutrition.

In our study one eighth of older persons were malnourished. More than half of them were at risk of malnutrition. Hence, this finding provide information that malnutrition is a serious public health problem in Sri Lanka.

6.3.2. Body Mass Index

According to Body Mass Index, the prevalence of malnutrition/underweight of the current study was 10.1%. Rathnayake et al. (2015) revealed that prevalence of under nutrition among institutionalized older people in Sri Lanka as 30%. The difference between the two prevalence values may be the setting difference. The community-dwelling older persons may have better nutritional care than that of institutionalized people. Considering the global values, the prevalence of malnutrition measured by BMI in our study was lower than the prevalence of malnutrition among older persons in Bangladesh, Brazil and Ethiopia (Kabir et al., 2006; Tessfamichael, Gete, & Wassie, 2014). The prevalence estimates of malnutrition in older people are highly variable due to different settings, age distribution and various BMI cut off values (Boscatto et al., 2013; Torres et al., 2014). For instance, Rahimi, Romi, Hedayatkordestani, Zh, and Hasanzadeh (2012) reported the prevalence of malnutrition among older persons as 21% considering BMI 22 as the cut off value for malnutrition. Also, Boscatto et al. (2013) showed the prevalence as 18.8% among older persons whose age was more than 80 years.

6.3.3. Mid Upper Arm Circumference

The prevalence of malnutrition measured using MUAC in our study was 9.1%. This value is similar to the prevalence of malnutrition measured by BMI in the present study. This is because both measurements mainly deal with the muscle mass of the older people and it represent depletion of muscle and fat mass. Evidences showed that MUAC as a parameter that correlates very well with BMI (Benítez Brito et al., 2016; Sultana, Karim, Ahmed, & Hossain, 2015). However, some international studies reported different prevalence in different countries such as 0.8% and 84.8% in Iraq and India respectively (Debsharma, 2013; Mohammed & Khaleel, 2016). All these studies used different reference values for malnutrition using MUAC.

6.3.4. Calf Circumference

Calf Circumference emerges as a useful measure of nutritional status (Bose, Ganguly, Mamtaz, Mukhopadhyay, & Bhadra, 2006). Considering 31 cm as the cut off value for malnutrition, our study showed 60.4% of prevalence of malnutrition among older persons. Bonnefoy, Jauffret, Kostka, and Jusot (2002) also mentioned that 30.5 cm provided good diagnostic capacity. Some studies used different cut-off points for males and females separately (Tsai & Chang, 2017). Accordingly, Hsu, Tsai, and Wang (2016) reported different prevalence of malnutrition for males and females in their study such as 44.9% and 48.9% respectively. However, our value is higher than all the prevalence values measured by the other measurements such as MNA, BMI, MUAC, and Handgrip Strength. Cuervo et al. (2009) highlighted that CC was more accurate than BMI and MUAC.

6.3.5. Handgrip Strength

Muscle function reacts early to nutritional deprivation. Hence, handgrip strength is very useful marker in assessing nutritional status of older persons (Norman, Stobaus, Gonzalez, Schulzke, & Pirlich, 2011). The prevalence of malnutrition of older persons in our study was 13.1% using handgrip strength. This value was very closed to prevalence of malnutrition using BMI and MUAC in our study. This might be due to the high correlation between handgrip strength, BMI and MUAC (Chilima & Ismail, 2007; Pieterse, Manandhar, & Ismail, 2002).

6.4 Factors associated with malnutrition among older persons

There are several factors associated with malnutrition. We identified two main types of malnutrition such as malnutrition and at risk of malnutrition. In this section, factors associated with both malnutrition and at risk of malnutrition are discussed. These identified factors provide very crucial information on those older persons with a high risk to develop malnutrition. They help early detect of older persons having poor nutritional status.

6.4.1 Socio demographic

6.4.1.1 Age

Increasing age was a risk factor for malnutrition among older persons in the current study. This may be due to the physiological changes of aging which directly affects the metabolism of nutrients. This is congruence with the findings of the previous study

(Boulos, Salameh, & Barberger-Gateau, 2016b). However, the same study did not show any significant association with age and malnutrition when it was adjusted for all the significantly associated variables. This may be explained by the individual impact of age on malnutrition.

Age related dysfunctions of bodily systems affect malnutrition of older persons in various ways. For instance, due to dysfunction of gastro intestinal tract, decreasing in gastric acid secretion, saliva production directly affect the peristalsis process. Dysfunction of thirst regulation limits the intake of water which interrupts whole metabolic processes of older persons (Amarya et al., 2015). Sensory defects including vision, smell and taste reduce food intake. In addition, bodily acid base balance is regulated by urinary system and dysfunction of the system leads to deteriorate the nutritional status of older persons. Further, age related dysfunction of endocrine system affects whole body functions. However, Madeira et al. (2016) revealed that malnutrition is not exclusively determined by the aging process. Further, loss of appetite lead to loss of taste, difficulty in swallowing and less intake of foods perceived by malnourished older persons in our study.

6.4.1.2 Sex

Sex is an important factor associated with malnutrition among older persons. Several previous studies reported the association between sex and malnutrition (Montejano Lozoya et al., 2014; Torres et al., 2014). However, our study did not show any significant association with malnutrition. Our finding is line with previous studies conducted among community-dwelling older persons (Abdelrahman & Elawam, 2012; Vedantam et al., 2010). Although sex was not significantly associated with malnutrition

in our study, it is very important to note that traditional dietary practices are still common in Sri Lankan society. For instance, men eat usually before women and they consume the large portion of the foods while females' portions are smaller and thereby leads to malnutrition. This is line with the perception of malnourished older persons in our study. They highlighted that gender role is an important in maintaining their nutritional status. Purchasing, preparing and consumption of foods depend on gender roles in our society accordingly.

6.4.1.3 Education level

Education is another factor associated with malnutrition. As reported in other studies, educated older persons were less prominent to get malnutrition (Abdelrahman & Elawam, 2012; Torres et al., 2014). Education is more important to improve dietary habits and food choice (Vedavalli Sachithanathan, Mohammed Buzgeia, Fadwa Awad , Rema Omran , & Faraj, 2012). However, education categories in our study did not show any significant association with malnutrition. Also, there are no formal educational services for older persons to update their nutritional knowledge within the community except government hospitals. Many of the malnourished persons believed various food taboos. Hence, malnourished older persons in our study suggested to have such programs in the community.

6.4.1.4 Marital status

Marital status is crucial in maintaining social relationship. Its impact on nutritional status is complex. Being widowed or separated cause social isolation or loneliness. Both social isolation and loneliness were independently associated with a higher risk of

malnutrition (Boulos, Salameh, & Barberger-Gateau, 2017). Previous literature showed significant association between marital status and malnutrition. Being widowed was independently associated with poor nutritional status (Torres et al., 2014). In line with this finding, Montejano Lozoya et al. (2014) reported that prevalence of malnutrition was higher among widowed older persons. The loss of a partner causes for late life depression and thereby increases the vulnerability of nutritional status (Djernes, 2006). Nevertheless, our study did not show a significant association between marital status and malnutrition. Similar findings were reported by (Abdelrahman & Elawam, 2012).

6.4.1.5 Income

Financial resources plays a crucial role in accessing nutritious foods. Hence, income has been identified as a factor associated with malnutrition (Donini et al., 2015). Literature showed that higher income may allow more leisure time or better social support (Lemos et al., 2015). Although the majority of our participants earned less than Rs. 3909, which is the poverty line, income did not show a significant association with malnutrition. However, focus group discussion among the malnourished older persons perceived that income played a major role in accessing their foods. They experienced financial stressors due to moving away from a land-based economy and increasing expenses related to both the desire for and availability of Western medicine (Watt et al., 2014). Only a few of our malnourished persons received government subsidies to maintain their older lives. This shows existing health infrastructure and systems are not adequate and still require strengthening, reorientation and coordination, to meet the needs of the older persons (Samaraweera & Maduwage, 2016).

6.4.1.6 Living conditions/ number of people living with

Living conditions and number of people living with concepts go together. Living conditions of the older persons greatly support the social support, thereby decreasing depressive symptoms and psychological distress which lead to poor nutritional status of older persons (Chatters, Taylor, Woodward, & Nicklett, 2015). Akın et al. (2015) reported living alone as a negatively affected factor for malnutrition among older persons. The majority of our participants lived with their family members. However, it did not significantly associated with malnutrition. The malnourished older persons expressed the importance of living with family members. They like to be with family members. Eating with family especially with grandchildren increase their food intake.

The number of people living with was a protective factor of malnutrition in our study. In Sri Lanka, taking care of older persons remains the responsibility of their adult children and legally, it is the responsibility of family members especially, adult children (*Ministry of Justice and Law Reforms in Sri Lanka. Protection of the Rights of the Elders Act.*, 2000). Most of families in Sri Lanka are multigenerational and caring of older persons is done by generally the female (i.e., daughter or daughter-in-law). The other children typically provide material support to the aged parents promising their responsibility to support the older parents (De Silva, 1994; Watt et al., 2014). This is clearly shown from the perceptions of malnourished older persons in our study. However, Boscatto et al. (2013) reported no association between living arrangements and malnutrition of their participants. This may be mainly due to cultural differences of the study populations.

6.4.2 Physiological

6.4.2.1 Tooth loss and dentures

Previous literatures showed numerous physiological factors associated with malnutrition of older persons such as tooth loss, and various comorbidities (De Marchi et al., 2008; Makwana et al., 2014; Mathew et al., 2016). It is obvious that that dental status and chewing ability are significantly related to nutritional intake as they impaired masticatory performance of older persons (Tsai & Chang, 2011). This condition leads to greater difficulty with eating a range of foods, more chewing problems occurred, and mouth dryness (Nakanishi et al., 1999). A recent study reported that use of dentures decreased the risk of malnutrition among older persons (Chavarro-Carvajal et al., 2015). Yoshida et al. (2014) also showed the similar findings. The majority of our participants lost their natural teeth in line with a previous Sri Lankan study (Rathnayake et al., 2015). One fourth of them wore dental prosthetics/dentures. However, both tooth loss and wearing dentures were not significantly associated with malnutrition among the participants of our study. The malnourished participants of our study perceived that they experienced various feeding difficulties due to their tooth loss. This condition can be explained by various facts. First, remaining teeth of our participants might not highly impaired (Mojon, Budtz-Jorgensen, & Rapin, 1999; Nordenram, Ljunggren, & Cederholm, 2001). Then, other clinical variables, such as the number of teeth, tooth distribution, number of occluding natural pairs, tooth condition or duration, and the number of chewing strokes before swallowing should be taken into consideration to conclude their effects on malnutrition (Appollonio, Carabellese, Frattola, & Trabucchi, 1997; de Oliveira & Frigerio, 2004; Joshipura, Willett, & Douglass, 1996; Lamy, Mojon, Kalykakis, Legrand, & Butz-Jorgensen, 1999).

6.4.2.2 Diseases conditions

Further, numerous physiological conditions affect malnutrition of older persons. Among them, frailty is associated with health outcomes including acute illness, decline in physiological reserve, and increased risk for adverse outcomes including disability, falls, hospitalization, need for long-term care, and death (Gielen et al., 2012). Excess adiposity is associated with many chronic health conditions among this population (Mathus-Vliegen, 2012). Half of our study participants had any type of disease conditions such as diabetes, hypertension, hypercholesterolemia, asthma and other diseases. Among them, only hypertension showed the negative association with malnutrition among older persons. The lack of association with other disease conditions might be a fact that development of such diseases is due to combination of genetic, environment, and behavioural factors in addition to nutritional aspect (Bernstein & Munoz, 2012).

6.4.3 Psychological

Depression, social isolation, and loneliness are few of the psychological factors which affect nutritional status of older persons (Porter Starr et al., 2015). Loss of appetite and eat alone due to psychological changes leads to a decline in macro- and micro-nutrient intake (Romero-Ortuno et al., 2011; Williams et al., 2015). Early research on this area pointed out that the above psychological conditions affect negatively on malnutrition among older persons (Akin et al., 2015; Ji et al., 2012; Ohayon & Roth, 2003; Torres et al., 2014). Similar findings were reported in a recent Sri Lankan study (Rathnayake et al., 2015). Although the majority of our participants were depressed, it was not associated with their malnutrition. However, malnourished older persons in our study

experienced mood change, loneliness, some family issues and they perceived that those conditions directly affected their food intake. Few of them prefer to eat alone. The reason behind this may be the culture of the participants of our study. Religion play an important role in their lives providing social support for older persons. The majority of them was Buddhists. Buddhist mindfulness practices have been identified as a way of alleviating sufferings, depression and anxieties (Aich, 2013). Most of them engage in religious activities. Hence, it alleviates psychological issues including depression, stressors and strains (Agarwal, 1989; "Spirituality and aging," 2010).

6.4.4 Lifestyle

6.4.4.1 Physical activity

Life style factors of older persons affect their nutritional status in many ways. Physical inactivity is a main life style factor among them. It has been identified as the fourth leading cause of global mortality. Evidence supported the fact that physical inactivity associated with malnutrition among older persons (Cupisti et al., 2017). Physical activity provides an opportunity for linking to social activities thereby improve general wellbeing and contribute to better energy intake (Flanagan et al., 2012). The majority of the participants in our study were moderately physical active. Only one tenth of them were highly engaged in physical activities. However, it was not significantly associated with malnutrition among our participants. This may be due to the fact that in Sri Lankan culture, older persons are mostly taken care by their children. Traditionally, Sri Lankan society holds older persons in reverence and provides social and financial assets for their older family members (Kaluthanthri, 2014). Older parents do house hold works

and they feel house work as a form of exercise which help them to stay healthy in both mind and spirit (Watt et al., 2014).

6.4.4.2 Medication usage

Medication use can be considered as a life style factor in terms of life style modification although it is greatly related to disease conditions (Wilson et al., 2014). Many drugs have side effects which affect nutrient intake. They cause nausea and vomiting, delayed gastric emptying, anorexia, diarrhoea, and malabsorption. Having more medication/polypharmacy increase the incidence of these adverse effects (Hickson, 2006). Previous studies showed that medication usage as a risk factor of malnutrition among older persons (Boscatto et al., 2013; Torres et al., 2014). In the univariate analysis of our study, we could find the similar association.

6.4.4.3 Betel chewing

Substances chewing such as betel chewing is considered as a risk factor for malnutrition. People chew betel with areca nuts and tobacco. It is more popular in Asian countries including Sri Lanka (Ariyawardana, Athukorala, & Arulanandam, 2006). Our study also showed betel chewing as a risk factor for malnutrition in univariate analysis. However, it was a protective factor in at risk of malnutrition because it may be affected as an appetizer (Lin et al., 2009). The recent Sri Lankan study among older persons also reported that majority of its participants had the habit of betel chewing (Rathnayake et al., 2015). Betel chewing seriously affects oral and periodontal health resulting in poor oral health (Sumanth, Bhat, & Bhat, 2008). It affects appetite, which results in

reduction of food intake, and irritation of oesophagus (Kamangar, Chow, Abnet, & Dawsey, 2009; Strickland, Veena, Houghton, Stanford, & Kurpad, 2003).

6.4.4.4 Alcohol consumption

Alcohol consumption of older persons is associated with their malnutrition. Excessive consumption of alcohol leads to many nutrient deficiencies. It changes metabolism of most nutrients especially alters carbohydrate and fibre metabolism (Bunout, 1999). Kim, Chun, and Kwon (2011) reported that vitamin and mineral deficiencies associated with alcohol consumption further deteriorates the nutritional status of older persons. Moreover, sarcopenia is a condition associated with a loss of muscle strength and mass in relation to ageing. Alcohol consumption decreases protein synthesis and inhibit growth factors in skeletal muscle and act as a risk factor of sarcopenia (Steiner & Lang, 2014). However, recent meta-analysis did not support alcohol consumption as a risk factor for sarcopenia (Steffl, Bohannon, Petr, Kohlikova, & Holmerova, 2016). Our study showed alcohol consumption was four times risk of getting malnutrition. Another study reported that there was no significance association between alcohol and nutritional status of older persons (Boscatto et al., 2013). In addition some experts reported that moderate alcohol consumption has been found to be associated with healthy dietary lifestyles compared with other drinkers or non-drinkers (Ruidavets et al., 2004). Our study did not consider the amount and frequency of alcohol consumption and further research is warranted to see the clear association.

6.4.4.5 Smoking

Apart from the above life style factors, smoking causes malnutrition among older persons. Smoking has multiple effects on metabolic control (Chiolero, Faeh, Paccaud, & Cornuz, 2008). Only few of our participants were smokers. The majority of the Sri Lankans were non-smokers and our sample represents the national population (Perera, Fonseka, Ekanayake, & Lelwala, 2005). Smoking was associated with both malnutrition and at risk of malnutrition among our study participants in univariate analysis. However, the association was diminished when controlling confounders. As nicotine acutely increases energy expenditure, smokers tend to have malnutrition (Chiolero et al., 2008). However, the number of cigarettes smoked daily leads to seriousness of effects in nutritional status (Chiolero, Jacot-Sadowski, Faeh, Paccaud, & Cornuz, 2007). Our study did not investigate smoking behaviour in detail. Hence, associations with malnutrition could not be established.

6.4.5 Dietary

Eating/swallowing difficulties, food allergy, loss of appetite are some factors studied in our study. In addition, vegetarian diets was also considered as a dietary factor.

6.4.5.1 Food allergy

Food allergy has been identified as a risk factor of malnutrition among older persons (Rathnayake et al., 2015). It is the consequence of maladaptive immune responses to common food antigen (Vassallo & Camargo, 2010). However, it was not identified as an associated factor with malnutrition in our study. Self-reported nature of the questions

related to food allergy limits this association. Further studies are needed to see the associations of food allergy with malnutrition among this population in detail.

6.4.5.2 Eating/swallowing difficulties

Eating or swallowing difficulty can be considered as both physiological and dietary factors. Due to age related pathological changes in swallowing as well as diseases, difficulty in eating or swallowing can be seen (Barczi et al., 2000). This can result in reduced or altered oral intake of foods (Serra-Prat et al., 2012). In our study, only ten percent of our participants had such difficulties. Also, it did not show any significant association with malnutrition among older persons. However, malnourished older persons in our study reported that majority of them experienced eating or swallowing difficulties all the time.

6.4.5.3 Loss of appetite

Loss of appetite is a common problem for older persons (Pilgrim et al., 2015). It is the desire to fulfil a bodily need (Mattes, Hollis, Hayes, & Stunkard, 2005). This complex factor affects brain, digestive system, endocrine system and sensory nerves and finally limits the dietary intake of older persons (Pilgrim et al., 2015). Also, the smell of a favourite food or offering a tasty treat can stimulate appetite (Berthoud, 2011). Although our study participants did not show any significant association between loss of appetite and malnutrition in the quantitative analysis, the malnourished older participants clearly mentioned that they had loss of appetite frequently. They practiced several strategies to enhance their appetite such as adding spices or frying foods.

6.4.5.4 Vegetarian diets

Vegetarian habit also considered as a dietary factor. American Heart Association described that vegetarian diet includes only foods from plants: fruits, vegetables, legumes (dried beans and peas), grains, seeds and nuts("American Heart Association - Vegetarian Diets "). In our study, one third of older persons were vegetarians. However, this factor was not associated with malnutrition of older persons in our study. As the quality and quantity of consumed food directly affect the nutritional status, further researches are warranted to see the effect of vegetarian diets on malnutrition.

In summary, one eighth of our participants was malnourished while more than half of them were at risk of malnutrition. It shows the social disparity in the community setting. Numerous factors were associated with malnutrition among older persons in our study. Age was the more prominent factor among them. The amount of the food consumption of the older persons in our study might be affected by age related physiological and psychological changes. Reduced appetite, eating/swallowing difficulties, tooth loss, chronic illnesses such as hypertension, physical inactivity, medication usage are identified by malnourished older persons as the factors mainly affect their nutritional status. Previous evidences showed the similar findings. Moreover, alcohol consumption was also associated with malnutrition in our study. In line with the other studies, alcohol consumption might lead to nutrient deficiencies as well as sarcopenia of our participants. Most of the participants of our study lived with their family members. They like to be with their family. Eating with family members especially with grandchildren is enjoyable experience/activity in their lives. Our findings reported that the number of people living with decreases the risk of getting malnutrition among our participants.

6.5 Quality of Life among older persons

This study is novel in using the EQ-5D-3L instrument as a measure of the QoL of the Sri Lankan older population. Few studies have been conducted in Sri Lanka using EQ-5D-3L to measure the predictive ability of the instrument (Kularatna, Chen, Byrnes, & Scuffham, 2017; Kularatna et al., 2014). Primarily, the findings indicate that, in general older persons in Kandy report low QoL according to EQ-5D-3L classification comparing to the previous study conducted by Kularatna et al (2014) that targeted participants aged 18 years and older. The difference in QoL between this study and the previous study may be due to differences in the study population and study period (Deng et al., 2017). Another possible explanation for the low QoL among older persons in our study is the great socioeconomic heterogeneity in the country. The majority of our participants were poor and their income was below the poverty line. In addition, low QoL of our participants might be due to the presence of strong health inequalities in the community settings. The EQ-5D-3L is considered a good measure for QoL in developing countries and countries with higher levels of social inequality (Menezes Rde, Andrade, Noronha, & Kind, 2015). However, regional population norms for EQ-5D-3L are needed for these type of studies due to great socio economic disparities across regions (Huang et al., 2017).

Overall, the mean QoL score was lower than those reporting using EQ-5D-3L for older populations among Vietnamese, Dutch, Italian, Australians and Germans (Clemens, Begum, Harper, Whitty, & Scuffham, 2014; Golicki & Niewada, 2017; Hinz, Kohlmann, Stobel-Richter, Zenger, & Brahler, 2014; Mangen, Huijts, Bonten, & de Wit, 2017). The differences in the values of QoL could be due to variations in the population sampled and the value sets employed (Parkin, Rice, & Devlin, 2010). For

instance, the Vietnamese group consisted of more than 65 years older participants and used Thailand tariff to calculate QoL. In addition to use of different national tariffs, different response styles due to social and cultural background and different reference levels all influence the final EQ-5D indices score (Mangen, Bolkenbaas, et al., 2017). According to Janssen et al (2018), the difference is mainly the prior living standards of a country explaining the observed cross-country differences in general health. Hence, a direct comparison of QoL scores with other countries is hampered by these cross-country differences (Janssen et al., 2018).

When considering gender differences of QoL, male participants showed the higher values than female participants and it was not statistically significant. Similar results could be seen in the study conducted by Hernandez-Galiot & Goni, (2017). This is due to a result of the effects of gender equitable policies, laws and programmes in the health sector, gender equitable attitudes relating to health and equitable health care practices of Sri Lankan society (Gunawardena, 2014). However, several previous studies found that males had significantly higher QoL than females (Chen, Tsai, Lin, & Wang, 2017; Hajian-Tilaki, Heidari, & Hajian-Tilaki, 2017; Mangen, Huijts, Bonten, & de Wit, 2017) . This might be a reason that lower QoL in older women is mainly due to a higher prevalence of disability and chronic conditions (Orfila et al., 2006). In addition to biological sex differences, social and cultural factors that shape gender roles may explain the differences in health perception between sexes (Belon, G Lima, & Ba Barros, 2014).

The proportion of older persons with problems of functioning by domain and by sex is also very crucial (Kirchengast & Haslinger, 2008). Among the total participants, usual activities was the most frequently reported complaint. This is line with the study of

Craig, Pickard, and Lubetkin (2014). In our study sample, females reported limitations with regard to usual activities more frequently than did males. In male participants, the higher frequency of reported problem was with regard to pain/discomfort. Golicki and Niewada (2017) found similar gender-specific differences in QoL within the Polish population. Similarly, Huang et al. (2017) found pain/discomfort as the most prevalent problems faced by males in their study. Both laboratory and clinical studies evidenced the existence of gender differences in experiencing of pain (Huang et al., 2017).

6.5.1. Mobility

The number of middle old participants had the highest poor QoL in mobility dimension and very old participants showed the lowest proportion in poor QoL. Mobility includes all forms of movements including basic ambulation, transferring from a bed to a chair, etc.(Satariano et al., 2012). It is obvious that aging limits the mobility of the individual. However, a possible reason for lowering the poor QoL in mobility dimension among very old persons in our study might be due to family support. Family support has a great effect on mobility of older persons (Cornman, Goldman, Gleib, Weinstein, & Chang, 2003).

Among our participants, more females had poor QoL in mobility than males. This finding is line with a previous study finding, which reported a larger proportion of females than males stated that they had some difficulty with movement (Karin Josefsson, Marie Andersson, & Erikstedt, 2016). The possible reason for low QoL of mobility among females is the low level of oestrogen concentration which leads to as osteoarthritis, a common disease which affects all joint tissues (Roman-Blas, Castañeda, Largo, & Herrero-Beaumont, 2009).

6.5.2. Self-care activities

In self-care dimension of QoL, the highest number of middle old participants had the poor QoL whereas low proportion of very old persons had poor QoL. More than half (59.9%) of very old persons did not have any chronic disease which limit their self-care ability. Participants in other age groups had more chronic diseases than very old participants. Also, these very old persons might get assistance in their self-care activities from family members. There is a significant negative relationship between an increase in social support and decrease in self-care activity (Ahmad Sharoni et al., 2015).

Both genders showed the similar number in self-care dimension of QoL. Regardless of gender, all the older persons may do their self-care activities such as washing themselves and dressings by own.

6.5.3. Usual care

Usual care dimension of QoL refers to activities such as work, study, house work, family or leisure activities. In this dimension also, the large number of middle old participants reported poor QoL. The higher number of female participants in our study showed poor QoL in usual care dimension. Previous studies suggested that males are more physically active and engaged in leisure-time activities than females (Burton & Turrell, 2000; Monteiro et al., 2003; Oman, Reed, & Ferrara, 1999). Generally, in Sri Lankan society, females have central roles in family work rather than work, study or leisure activities while males would go out, work and support the family. This might be a probable cause for the large number of females having poor QoL in usual care activity dimension.

6.5.4. Pain/discomfort

Chronic pain is often perceived as an age-related condition (Sale, Gignac, & Hawker, 2006). As in all the other dimensions of QoL, the larger number of middle old participants had poor QoL in pain/discomfort dimension compared to young old and very old persons. More male participants in our study reported poor QoL in this dimension. Contrast to our findings, female participants were more likely to report pain in a Singapore study (Satghare et al., 2016). The difference might be due to different pain coping strategies among older persons.

6.5.5. Anxiety/depression

Depression and anxiety is very common among older persons (Vink et al., 2009). The larger number of middle old participants of our study showed the poor QoL in anxiety/depression dimension. The lowest proportion of very old persons showed poor QoL in anxiety/depression. This might be due to religious practices of very old participants. It has been found that religious practices appear to correlate with mental health (Koenig, 2012). Here also, males showed the high proportion of poor QoL. Generally, females engage in more religious activities than males in Sri Lanka. Hence their QoL in anxiety/depression may increase. Religiosity/spirituality and personal beliefs directly related to alleviation of the conditions like depression (Agorastos, Demiralay, & Huber, 2014).

6.6. Factors associated with Quality of Life among older persons

Sociodemographic, physiological, psychological, life style and dietary factors associated with Quality of Life are discussed in this section. In addition, association between nutritional status measured by MNA and Quality of Life is discussed.

6.6.1. Socio demographic

6.6.1.1 Age

Aging is a complex phenomenon. However, it has become an important factor for Quality of Life of older persons (Galiana et al., 2016; Kularatna et al., 2014). Quality of Life of older persons depends on various geriatric pathologies which affect physical, psychological, cognitive and social well-being of older persons (De Luca d'Alessandro et al., 2011). The ageing process implies an increase in the prevalence of cognitive deterioration and its impact on QoL. In line with previous studies, the present study reported a negative association between age and QoL of older persons (Nguyen, 2017). In contrast Miranda, Soares, and Silva (2016) reported older age was associated with a better perception of QoL. Biological aging is generally accompanied by decline in one or more of a person's abilities in the physical and cognitive domains. (Michael, Colditz, Coakley, & Kawachi, 1999). Declining in one or more of a person's abilities is associated with reductions in QoL (White, Wojcicki, & McAuley, 2009).

6.6.1.2 Gender

Previous studies showed that gender had an effect on QoL of older persons. Our study did not show any significant association between gender and QoL. The possible reason for that may be the feeling of dependence of those females and they were more on medical treatment than males in the same study (Kirchengast & Haslinger, 2008). Khaje-Bishak et al. (2014) showed the contrast finding.

6.6.1.3 Marital status

Marital status was considered as a factor associated with QoL in many studies. One recent study showed married older persons had greater QoL than others (Han, Park, Kim, Kim, & Park, 2014). The authors reported that this may improve mental health compared with those who were single, divorce or widowed due to the social relationship with the spouse. However, marital status of our study did not show any association with QoL. This finding is consistent with a recent study (Onunkwor et al., 2016).

6.6.1.4 Income

It is documented that better income could positively affect QoL (Kumar, Majumdar, & G, 2014). This explained that better economic status was necessary to meet basic needs of life. However, our study did not show a significant association between income and QoL. The majority of them were below the poverty line and they might not be satisfied with their income. The similar findings can be seen in the study conducted by Onunkwor et al. (2016) as their majority of the participants only relied on pensions and it was not associated with QoL.

6.6.1.5 Level of education

Level of education was significantly associated with QoL of older persons in previous studies (Onunkwor et al., 2016; Uchmanowicz et al., 2016). In our study, it was associated only in univariate analysis. In another Sri Lankan study, the similar association could be established (Kularatna et al., 2014). The highly educated older persons are more likely to engage in healthy behaviours which could improve their QoL. Coping mechanisms and social relationships are very strong among older persons who have high education level (Christensen, Schmidt, Kriegbaum, Hougaard, & Holstein, 2006; Lasheras, Patterson, Casado, & Fernandez, 2001). Further, educational achievement increases self-esteem which is one of the most important factors influencing the promotion of quality of life (Edgerton et al., 2012)

6.6.2. Physiological

6.6.2.1 Chronic diseases

Evidence from studies suggest that chronic co-morbidity had significantly lower QoL of older persons (Onunkwor et al., 2016). These chronic illnesses affect the older individual negatively causing physical disability and emotional disability (Somrongthong et al., 2016). Previous studies showed the association between disease conditions and poor QoL among older persons (Groessler et al., 2007; Onunkwor et al., 2016). Our participants did not show association between diseases and poor QoL. Similarly, Somrongthong et al. (2016) reported that diseases may not affect the QoL of older persons. Further scholars have mentioned that QoL is not solely dependent on diseases and the level of illness acceptance is important in improving QoL (Lorig et al., 2008; Schols et al., 2004).

6.6.2.2 Tooth loss and dentures

Tooth loss and denture wearing have a major impact on QoL of a person, especially the oral health related QoL. Tooth loss negatively influences the individual's quality of life, mainly when it affects their well-being and appearance (Ide et al., 2006; Saintrain & de Souza, 2012). Previous studies showed that tooth loss negatively associated with QoL of older persons (Haag, Peres, Balasubramanian, & Brennan, 2017; Mack et al., 2005). In our study, tooth loss was negatively associated with QOL of older persons in univariate analysis. However, it was not significantly associated with QoL when adjusted for confounding factors. The reason behind the association of tooth loss with QoL may be the fact that presence of teeth helped these individuals in chewing and helped in pronunciation. Most importantly, it might be very helpful in facial appearance (Holmen et al., 2012). However, Rodrigues, Oliveira, Vargas, Moreira, and e Ferreira (2012) reported no association between tooth loss and QoL.

Further, evidence of studies showed that wearing dentures improved QoL of older persons (Srisilapanan et al., 2016). In our study, wearing dentures was positively associated with QoL. This may be due to improved oral functions and aesthetics for older persons in our study (Yen et al., 2015a). Nevertheless, Inoue et al. (2011) reported that dentures had a minimal effect on Quality of Life of older persons.

6.6.3. Psychological

Depression, anxiety and cognitive impairment associated with QoL of older persons (Chen & Chen, 2017). Many studies found the association between depression and QoL

(Borowiak & Kostka, 2004a; Heller et al., 2014; Pyne et al., 1997b; Sivertsen et al., 2015). Cognitive impairment was also strongly associated with QoL of older persons (Maki et al., 2014; Teng et al., 2012). These psychological factors impair functioning in a number of areas, including work functioning, social functioning, and health (Wells et al., 1989).

6.6.4. Lifestyle

6.6.4.1 Physical activity

Physical activity improves muscle fitness and lowers rate of motility thereby improve QoL (Halaweh et al., 2015; Vagetti et al., 2014). Older people involve in physical activities are associated with lower prevalence of disease conditions (Paterson et al., 2007). Further, it promotes healthy aging and plays an important role in improving Quality of Life among older persons (Acree et al., 2006). Moderate intensity physical activities promote health status, improve treatment of many diseases which increase the Quality of Life (Pedersen & Saltin, 2006). Physical activity has been consistently associated with enhanced quality of life (QOL) in older persons. In our study, high physical activity was significantly associated with QoL. Similar findings could be observed in the previous studies (Miranda et al., 2016; Phillips, Wojcicki, & McAuley, 2013). Regular physical activity might help in relieving various psychological conditions such as tension, anxiety, depression and anger result in increasing QoL (De Mello et al., 2013; Stults-Kolehmainen & Sinha, 2014). Evidences suggest that physical activity has a protective effect on functional limitations as we age (Keysor, 2003; McAuley et al., 2007). The intensity of physical activity may play a key role in this regard (Aldana, Sutton, Jacobson, & Quirk, 1996). Also, , a precise physical activity measurement to be

used for older persons is very difficult due to physiological and cognitive changes that occur with ageing (Kowalski, Rhodes, Naylor, Tuokko, & MacDonald, 2012).

6.6.4.2 Alcohol consumption

Various previous studies found association with alcohol consumption and QoL among older persons. They pointed out that alcohol consumption was more likely to accept death and dying and thereby improve QoL (Somrongsong et al., 2016). Similar findings were reported by Chan et al. (2009). Our study did not show any association between alcohol consumption and QoL. The small number of alcohol drinkers might be the cause for our findings. Similarly, Santos et al. (2014) reported no association between alcohol consumption and QoL of older persons.

6.4.5 Dietary

Healthy diets play an important role in keeping older persons in good health. It is very essential to improve Quality of Life (Magarey et al., 2006). Evidence of the study showed the association between healthy diets and QoL (McNaughton et al., 2012). Declining skeletal mass and muscle strength greatly contribute to reduce QoL of older persons (Nowson & O'Connell, 2015). Maintaining muscle mass is very crucial in optimal health especially in this population. Hence, older persons require greater than minimal amounts of dietary protein (Tang et al., 2014). Some epidemiological evidences suggest that vegetarians had higher bone loss than non-vegetarians due to the limited quantities of protein, calcium, and phosphorus in their diet (Ellis, Holesh, & Ellis, 1972; Mazess & Mather, 1974). However, in our study vegetarian diet was not associated with QoL.

6.4.6 Nutritional status

It is well documented that there is a relationship between nutritional status and Quality of Life of older persons (Kostka et al., 2014). A previous study reported that Quality of Life was significantly reduced in older men and women at risk of malnutrition (Kvamme, Olsen, Florholmen, & Jacobsen, 2011). In our study, we measured nutritional status using MNA-SF. Although we could not find any association with nutritional status and QoL, it was included in the multivariate analysis to see any association on QoL when adjusted for confounders. However, no any association between nutritional status and QoL was found in the present study.

6.7 Integrating quantitative and qualitative findings

Findings from both datasets support that age as a risk factor for malnutrition among older persons. In qualitative findings, the majority of the participants talked about the age associated factors which directly affect their dietary preparation, consumption and digestion. Due to aging, they were reluctant to have hard foods, they need more gravy curries and they drink water while having their foods to ease the swallowing.

In the quantitative findings, the majority of our participants' income was low. In line with this finding, majority of the malnourished older persons reported that they were having financial burden to purchase foods. Few persons who received pensions had the capability of purchasing foods. Some of them rely on other sources such as gardening to get their vegetables. However, the majority of them were financially supported by their children while few of them received government subsidies such as 'pin padi' and 'Samurdhi'.

The quantitative data showed that the majority of the participants lived with their family members and the number of people living with was a protective factor of at risk of malnutrition. The qualitative findings showed that our participants enjoyed their meals with others. Taking meals with others increased their happiness and food intake. Some of the participants claimed that they took more foods when they had their meals with grand kids. Further, some of the malnourished older persons in the qualitative phase highlighted that they took less foods when they were alone. Sometimes, they waited for family members so that they could have their meals together with the family members.

Fifty five percent of our participants were having chronic illnesses in the quantitative findings. More than half of them were on medication treatment for various diseases. Hypertension was reported as a risk factor for malnutrition. Malnourished individual responses are congruent to the quantitative findings and reported that majority of the participants had chronic illnesses. They routinely took the medications. They worried about their health. Some of them followed prescribed diets such as low salt and low coconut milk. Few of them were advised to take less amount of foods due to disease conditions.

The majority of participants in our study was depressed. Although no quantitative findings exist to clarify the depression related to malnutrition, we realized, from the qualitative data, some participants spent a whole day without foods when they had any psychological problem. Living alone during day time, demise of spouse and children, family issues such as financial constraints and issues with children made their psychological status worst. Although it was found that the odds ratio of alcohol consumption was 4.06 in the quantitative findings, it was not reported in the interviews.

However, this variable may be a proxy for other underline factor. For example, taking alcohol may partly explain one of the ways out of loneliness. Alcohol consumption is socially not acceptable in Sri Lanka. It might be a reason for not reporting during focus group discussions.

Food taboos and food restrictions were greatly affected malnutrition among our participants in the qualitative section. Participants reported that they did not consume certain foods due to taboos and food restrictions owing to certain disease conditions. This may influence the amount, frequency and quality of nutrients. Even though, this is not identified in the quantitative section, this might be a reason behind the health literacy of our participants. Nearly ten percent of them did not have formal education. The majority of the participants were poor. Poverty and low education level might affect the health literacy of our participants.

6.8 Limitations and strengths of the study

6.8.1 Limitations

There are few limitations of this study which need to be addressed. First, the participants of this study were restricted to those from one district; as such, caused must be exercised in generalizing the results. For the generalizability of the results for the community-dwelling older persons in Sri Lanka, the study should have involved more participants from different regions and districts. Also, the majority of the participants were Sinhalese thus the sample is not a representative of whole community-dwelling older persons. Almost half of the participants consisted of 'young old' and other old categories are not adequately represented in our findings. Further, inferences to the

wider general older persons are further restricted by our exclusion of physically disable older persons who may have been more likely to be nutritionally compromised. Thus, the prevalence of malnutrition may have been under-reported and it limits the generalizability of the findings to older persons in general.

Another limitation is that the high percentage of female participation and eligible male participants declined to participate in the study and therefore the sample may not fully represent the eligible population. The present research did not correlate the collected data with dietary intake, weight gain or BMI changes that might have helped in understanding the impact of them on malnutrition.

In addition 53 of the questionnaires were incomplete and not included for the analysis. This may result in an underestimation of the malnutrition prevalence and Quality of Life. Another limitation of this study is its cross-sectional nature which does not allow establishing causal relationships between malnutrition and Quality of Life and all the described variables. Hence, longitudinal analyses are needed to examine temporal relationships of these variables with malnutrition and QOL. Gender-specific analysis was not conducted due to the inadequacy of sample size especially for males as it affects the power of the study. Well-nourished older persons was not recruited in the qualitative phase which may have broader perspectives on nutrition and malnutrition among older persons.

Moreover, in the current study, cognitive status was assessed by the researcher assuming participants could understand questionnaires when she visited homes, rather than an objective measure. Thus, it is possible that older persons underreported or were unaware of their memory problems. This may be responsible for information bias related to memory loss. Further, this study used several questionnaires and anthropometry measurements. Although these were completed by the researcher with

two assistants, not the participants, bias may be introduced due to respondent's fatigue. Further, the entire questionnaires were interviewer administered. Hence, recall bias may exist. Data related to components of the MNA-SF was self-reported and may either over- or under-represent the presence of risk factors included within the screening instrument. Further, physical activity was self-reported in our study and this may have been subject to a recall and social desirability bias.

6.8.2 Strengths

The current study has several strengths. First, this may be the first study assessing prevalence of malnutrition and its associated factors in Sri Lankan community-dwelling older population using a mixed method approach. The mixed methods approach provide a better understanding of the research problem as it can provide answer the research question from different perspectives. Secondly, multi stage sample with relatively large sample size make the results more representative of the population. Thirdly, the survey involved a multi-stage sampling with both stratification and clustering, which makes it easy to consider the clustering effects in data analyses by using complex sample analysis. Finally, validated questionnaire in Sinhala language and standard protocols were used to measure anthropometric measurements minimize the measurement bias.

6.9 Summary

Malnutrition is a major public health problem. The prevalence of malnutrition among older persons in Kandy district, Sri Lanka was 12.5% while the prevalence of at risk of malnutrition among them was 54.4% .The factors significantly associated with malnutrition were age, hypertension and alcohol usage. The number of household occupants was a protective factor for at risk of malnutrition. In the qualitative phase

factors affecting dietary patterns, factors affecting food choices, health status and psychological challenges were identified as main themes of factors related to malnutrition perceived by malnourished older persons. The level of Quality of Life of the participants was comparatively lower than the previous studies in Sri Lanka. Increasing age and high physical activity showed significant association with QoL of community-dwelling older persons in Kandy district, Sri Lanka. No association between malnutrition and QoL was identified among community-dwelling older persons in Kandy district.

CHAPTER 7: CONCLUSION

7.1 Introduction

This chapter synthesizes the conclusions from the findings of this thesis and present recommendations for nursing practice, public health service, religious activities and legal implementations. This study describes the extent of malnutrition among older persons who stay in a community setting in Sri Lanka and possible associated factors for malnutrition quantitatively and qualitatively. Further, this study, describes Quality of Life among the older persons and its associated factors.

7.2 Prevalence and factors associated with malnutrition and at risk of malnutrition

The prevalence of malnutrition among older persons in this study was 12.5% and the prevalence of at risk of malnutrition was 54.4%. The prevalence was measured using Mini Nutritional Assessment (MNA). Age, hypertension, and alcohol usage were associated with malnutrition. In the multivariate model, age (OR1.06; 95% CI 1.01, 1.11), hypertension (OR1.71; 95% CI 1.01, 2.89) and alcohol usage (OR4.06; 95% CI 1.17, 14.07), were significantly associated with malnutrition while number of people living with (OR0.91; 95% CI 0.85, 0.97) was associated with at risk of malnutrition significantly.

7.3 Factors associated with Quality of Life

The mean score of QoL of our participants was comparatively lower than the previous studies conducted in Sri Lanka. Increasing age and high physical activity of the participants showed significant association with the QoL.

7.4 Factors associated with malnutrition perceived by malnourished older persons

The malnourished older persons in our study perceived that numerous factors associated with their nutritional status. Loss of appetite, physical activity/inactivity, food preparation, gender roles, eating with others were identified as factors affecting their dietary patterns. Factors identified as food choices were based on their knowledge and taboos. These older persons perceived various psychological changes affected their nutritional status such as mood change, loneliness, family issues and loss of children/spouse.

7.4 Recommendations

The findings of our study suggest the following recommendations for nursing practice, public health service, religious activities and legal implementations

7.4.1 Nursing service

The study highlights the important community problem among older persons in Sri Lanka. The majority of the participants in our study were at risk of malnutrition. That means most of the participants were at risk for malnutrition but they did not show any

signs and symptoms of malnutrition. All the above findings of the study highlight the need for increased knowledge and awareness, as well as routines in community practice regarding nutritional screening among older persons in Sri Lanka. Also, routine screening should be done for identifying those at risk of malnutrition. This routine screening can be incorporated with screening medical conditions. Moreover, the findings of our study can be used in stimulating the nutritional intervention programs in the community to alleviate malnutrition among older persons.

As the mean QoL score is relatively lower among this population, the finding of this study could be used as a reference which can enable decision makers to identify the health care needs of this population; and monitor the effectiveness of policy alterations and provide future investments on health care.

Currently, 232 Public Health Nursing Sisters (PHNS) work in the community in Sri Lanka attached to Medical Offices of Health (MOH offices). The number of nurses who work in Sri Lankan hospital is 42,420 in 2015. Currently, there are no community nurses in Sri Lanka. PHNSs are responsible for community health programs. Hence, they can incorporate older people's nutritional educational programs with other health related programs in the community.

Nurses who work in hospitals have various responsibilities including health education. Most of the hospitals have health education and promoting units which are headed by health educating nurses. These nurses do health education for inward and out patients in the hospitals. Therefore, nurses in the hospitals can also take necessary actions to improve the nutritional status of older persons through increasing knowledge and awareness of malnutrition of older persons. Furthermore, nurses launch more outreach

health programs and health awareness programs in communities throughout the country. Therefore, they can take these opportunities to make the public aware on malnutrition and poor Quality of Life of older persons.

In addition to the nutritional programs, nurses can do more on improving mobility, self-care activities and usual care activities of older persons. They can make use of family members' involvement to do such activities. Also, nurses can do various non pharmacological therapies to alleviate pain/discomfort of older persons in the community such as heat or ice therapy, massage therapy to help relax tight muscles and decrease pain, physical therapy to teaches them exercises to help improve movement and strength. The relaxation techniques such as aromatherapy can also be implemented by nurses. Further, meditation, yoga and guided imaginary techniques can be taught by nurses to alleviate pain/discomfort of older persons thereby improve their Quality of Life.

Moreover, nurses can promote spiritual activities to reduce anxiety/depression of older persons in the community. With the help of family members, nurses can do some spiritual activities to reduce anxiety/depression of older persons to improve their Quality of Life. Few strategies nurses can implement are practicing compassionate presence (being supportive to older persons in physical, emotional and spiritual sufferings), listening to their fears, hopes, pain, and dreams and involving more religious activities.

More importantly, the findings of our study show the necessity of having community health nurses/public health nurses in Sri Lanka. Although we have 202 nurses per 100,000 population in Sri Lanka, all of them work in the curative side. As highlighted by

American Nurses Association, public health nurses involve working with communities and populations and focusing on primary prevention and health promotion. Therefore, this is the high time to establish public health nursing service in Sri Lanka to prevent malnutrition among this vulnerable group and enhance their Quality of Life.

7.4.2 Public health services

7.4.2.1 Malnutrition screening

More than half of the community-dwelling older persons were at risk of malnutrition while 12.5% of them were malnourished. Due to the adverse effects of malnutrition, reducing the number of malnourished older persons is very crucial. Identifying at risk of malnutrition at the early stage is very helpful to improve their nutritional status. Then, health care professionals should initiate and continue the screening of this population for malnutrition risk factors frequently, especially before they become malnourished. In Sri Lanka, currently, there is no any screening programs for older persons in the community. Hence, public health authorities can use the evidence from our study and make policies to implement such programs in the community.

Our study reports various factors associated with malnutrition among older persons. The public health sector can take these into account and formulate targeted nutritional intervention programs for older persons at the community level. Also, they need to focus on promoting mobility such as helping them to resolve their walking problems, self-care activities such as washing and dressing themselves, and usual care such as work, study, home and family activities, leisure time activities and outings to improve the Quality of Life of the older persons. Further, public health programs can focus on routine pain/discomfort assessments and implement pain management programs for older persons in the community.

7.4.2.2 Educational programs

Evidences have shown that educational programs can change the dietary habits and then improve the nutritional status of older persons. Hence, appropriate education programs can be launched in order to improve the nutritional status of this population. Life style modifications such as reducing alcohol consumptions, proper hypertension management are recommended for this population. Food taboos are more prevalent in the community settings. Hence, reinforcement of older persons' knowledge on the importance of various foods is very crucial. Although, dietary habits were not assessed extensively in this study, individual dietary advices can be given to the people by a multidisciplinary team including Medical officer for Health (MOH), Public Health Nursing Sisters (PHNS), and Midwives at the community level. Vegetarian older persons should be educated on taking balanced diets. They can be encouraged to have mixed diets with various nuts, seeds, vegetables etc to improve their nutritional status then QoL. However, availability and accessibility of such foods should be considered. Face-to-face and mass media approaches can be launched to educate older persons regarding the nutritious foods. Developing a food guide for Sri Lankan older persons is another educational strategy which can be implemented by administrators. These food guide can be developed in a variety of graphical forms such as food wheel, pyramid, target, plate and standard block.

7.4.2.3 Food subsidies

Public health sector can launch food subsidy programs at least for identified malnourished older persons to improve their nutritional status. In Sri Lanka, such programs are available for pregnant and lactating mothers, as well as under five children

such as providing “Thripasha” and “Poshana Malla” free of charge. Although the vision of such programs is displayed as to create a non malnourished, prosperous, proud and healthy nation out of Sri Lankan general public, still, older persons are neglected (Sivashankar & Thalagala, 2017). Hence, it is very crucial to implement the said programs for older persons as the prevalence of malnutrition and at risk of malnutrition are comparatively high among community dwelling older persons in Sri Lanka. In addition, income security through the government welfare policy can be implemented for older persons especially who are diagnosed as malnourished.

7.4.3 Religious activities

In Sri Lankan culture, the majority of older persons go to temples, Kovils to do religious activities frequently. All these programs are helpful in alleviating anxiety/depression which directly related to nutritional status and Quality of Life among older persons in the community. Most of the Buddhist older persons do activities such as observe Sil, meditation and donating foods on poya days. Therefore, such activities can be promoted by facilitating through social supportive networks in the community. Government and non-government organizations can take responsibilities in this regard. They may be helpful in resource sharing and decision making of older persons which directly affect the QoL.

7.4.4 Legal implementations

Although the Sri Lankan government has attempted to influence families in caring their older ones through “the Protection of the Rights of Elders Act” which defines the responsibilities of adults towards the older persons, stating that “children shall not

neglect their parents wilfully, and it shall be the duty and the responsibility of children to provide care for, and to look into the needs of, their parents”. However, the government needs to make necessary actions to assess the effectiveness of this provision such as monitoring all older persons and identify the neglected older parents by their children in the community through the responsible officer (Elder's Rights Promotion Officer) attached to each divisional secretariat office.

Family support is very crucial in improving nutritional status and Quality of Life of the older persons. Therefore, family members can be educated and supported in this regard by the government. Families are the cornerstone of all human societies. Family is the place where older persons find more encouragement, comfort and security. Hence, family members have the primary responsibility in caring their older ones. They can assist the older persons in various ways. In terms of nutritional care, they can provide nutritious foods while considering the preferences. They can help older ones to remove food taboos and make them aware of nutritious foods. To improve the Quality of Life of older persons in the family, family members can support them to maintain their mobility activities, self-care activities and usual care activities. Further, they can implement numerous pain relieving methods to alleviate pain of the older ones. The family members can assist older ones in their medications. Also, family members have a role in assisting their older ones in their spiritual activities such as religious functions.

7.4.5 Further research

A prospective study is recommended. The prospective study provides evidence and insight into the underlying factors contributing to the improvement of malnutrition and at risk of malnutrition as well as Quality of Life. In addition, we recommend country wide large scale researches on malnutrition and Quality of Life among older persons.

Further, our results can be used for nutritional interventional studies in the community. We suggest such interventional studies to reduce the malnutrition and improve the Quality of Life among older persons in the community. Moreover, we suggest further qualitative studies among well-nourished older persons. It might be very helpful to identify strategies to reduce malnutrition among older persons.

7.5 Summary

The prevalence of malnutrition among older persons in this study is 12.5% and the prevalence of at risk of malnutrition was 54.4%. Age, hypertension and alcohol usage are significantly associated with malnutrition while the number of people living with is associated with at risk of malnutrition significantly. Malnourished older persons perceived that factors affecting dietary patterns, factors affecting food choices, health status and psychological challenges were related to their malnutrition. The level of quality of Life among the study participants is poor. Being young old and middle old and wearing dentures showed significant positive association between QoL. Only vegetarian diets significantly increases the odds of QoL. Based on the findings of the study, recommendations for nursing service and public health services were described. Further researches such as prospective, large scale population based and interventional studies were suggested. Qualitative studies among well-nourished older persons are also recommended.

REFERENCES

- Abas, M., Hotopf, M., & Prince, M. (2002). Depression and mortality in a high-risk population. 11-Year follow-up of the Medical Research Council Elderly Hypertension Trial. *Br J Psychiatry*, 181, 123-128.
- Abdelrahman, H. M. M., & Elawam, A. E. E. (2012). Nutritional Status in Community-dwelling older population in an Egyptian Urban Area. *The Journal of Aging Research & Clinical Practice*.
- Acree, L. S., Longfors, J., Fjeldstad, A. S., Fjeldstad, C., Schank, B., Nickel, K. J., . . . Gardner, A. W. (2006). Physical activity is related to quality of life in older adults. *Health Qual Life Outcomes*, 4, 37.
- Adamson, A. J., Collerton, J., Davies, K., Foster, E., Jagger, C., Stamp, E., . . . Kirkwood, T. (2009). Nutrition in advanced age: dietary assessment in the Newcastle 85+ study. *European Journal of Clinical Nutrition*, 63 Suppl 1, S6-18.
- Agarwal, A. K. (1989). Religion and mental health. *Indian Journal of Psychiatry*, 31(3), 185-186.
- Agarwalla, R., Saikia, A. M., & Baruah, R. (2015). Assessment of the nutritional status of the elderly and its correlates. *Journal of Family and Community Medicine*, 22(1), 39-43.
- Agorastos, A., Demiralay, C., & Huber, C. G. (2014). Influence of religious aspects and personal beliefs on psychological behavior: focus on anxiety disorders. *Psychology Research and Behavior Management*, 7, 93-101.
- Agrawal, V. K., Basannar, D. R., Sing, R. P., Dutt, M., Abraham, D., & Mustafa, M. S. (2006). Coronary risk factors in a rural community. *Indian Journal of Public Health*, 50.
- Ahmad Sharoni, S. K., Shdaifat, E. A., Mohd Abd Majid, H. A., Shohor, N. A., Ahmad, F., & Zakaria, Z. (2015). Social support and self-care activities among the elderly patients with diabetes in Kelantan. *Malaysian Family Physician : the Official Journal of the Academy of Family Physicians of Malaysia*, 10(1), 34-43.
- Ahmed, T., & Haboubi, N. (2010). Assessment and management of nutrition in older people and its importance to health. *Clinical Interventions in Aging*, 5, 207-216.
- Aich, T. K. (2013). Buddha philosophy and western psychology. *Indian Journal of Psychiatry*, 55(Suppl 2), S165-S170.

- Akin, S., Mucuk, S., Ozturk, A., Mazicioglu, M., Gocer, S., Arguvanli, S., & Safak, E. D. (2015). Muscle function-dependent sarcopenia and cut-off values of possible predictors in community-dwelling Turkish elderly: calf circumference, midarm muscle circumference and walking speed. *European Journal of Clinical Nutrition*, 69(10), 1087-1090.
- Akın, S., Mucuk, S., Öztürk, A., Mazıcıoğlu, M., Göçer, Ş., Arguvanlı, S., . . . Şafak, E. D. (2015). Muscle function-dependent sarcopenia and cut-off values of possible predictors in community-dwelling Turkish elderly: calf circumference, midarm muscle circumference and walking speed. *European Journal of Clinical Nutrition*, 69(10), 1087-1090.
- Alexopoulos, G. S., Buckwalter, K., Olin, J., Martinez, R., Wainscott, C., & Krishnan, K. R. (2002). Comorbidity of late life depression: an opportunity for research on mechanisms and treatment. *Biol Psychiatry*, 52(6), 543-558.
- Alkerwi, A. a., Vernier, C., Sauvageot, N., Crichton, G. E., & Elias, M. F. (2015). Demographic and socioeconomic disparity in nutrition: application of a novel Correlated Component Regression approach. *BMJ Open*, 5(5).
- Alvarenga, L. N., Kiyan, L., Bitencourt, B., & Wanderley, K. d. S. (2009). Repercussões da aposentadoria na qualidade de vida do idoso. *Revista da Escola de Enfermagem da USP*, 43, 796-802.
- Amarantos, E., Martinez, A., & Dwyer, J. (2001). Nutrition and quality of life in older adults. *Journals of Gerontology. Series A: Biological Sciences and Medical Sciences*, 56 Spec No 2, 54-64.
- Amarya, S., Singh, K., & Sabharwal, M. (2015). Changes during aging and their association with malnutrition. *Journal of Clinical Gerontology and Geriatrics*, 6(3), 78-84.
- Ananthesh, B. G., Bathija, G. V., & Bant, D. D. (2016). A community based cross-sectional study to assess malnutrition among elderly population residing in urban and rural areas of a district in Karnataka, India. 2016, 4(1), 8.
- Andre, M. B., Dumavibhat, N., Ngatu, N. R., Eitoku, M., Hirota, R., & Sukanuma, N. (2013). Mini Nutritional Assessment and functional capacity in community-dwelling elderly in rural Luozi, Democratic Republic of Congo. *Geriatr Gerontol Int*, 13(1), 35-42.
- . *Annual Health Bulletin*. (2015). Ministry of Health, Nutrition and Indigenous Medicine.

- Appollonio, I., Carabellese, C., Frattola, A., & Trabucchi, M. (1997). Influence of dental status on dietary intake and survival in community-dwelling elderly subjects. *Age and Ageing*, 26(6), 445-456.
- Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. (2004). *Lancet*, 363(9403), 157-163.
- Arambepola, C. (2004). *Abdominal obesity and its association with selected risk factors of coronary heart disease in an adult population in the district of Colombo* (MD (Community Medicine)), Postgraduate Institute of Medicine, University of Colombo, Colombo.
- Ariyawardana, A., Athukorala, A. D., & Arulanandam, A. (2006). Effect of betel chewing, tobacco smoking and alcohol consumption on oral submucous fibrosis: a case-control study in Sri Lanka. *Journal of Oral Pathology and Medicine*, 35(4), 197-201.
- Arokiasamy, J. T. (1997). Social problems and care of the elderly. *Med J Malaysia*, 52(3), 231-237.
- Artacho, R., Lujano, C., Sanchez-Vico, A. B., Vargas Sanchez, C., Gonzalez Calvo, J., Bouzas, P. R., & Ruiz-López, M. D. (2014). Nutritional status in chronically-ill elderly patients. Is it related to quality of life? *The Journal of Nutrition, Health & Aging*, 18(2), 192-197.
- Atiq, R. (2006). Common Themes and Issues in Geriatric Psychotherapy. *Psychiatry (Edgmont)*, 3(6), 53-56.
- Atkins, J., Naismith, S. L., Luscombe, G. M., & Hickie, I. B. (2013). Psychological distress and quality of life in older persons: relative contributions of fixed and modifiable risk factors. *BMC Psychiatry*, 13(1), 249.
- Bahat, G., Tufan, F., Saka, B., Akin, S., Ozkaya, H., Yucel, N., . . . Karan, M. A. (2012). Which body mass index (BMI) is better in the elderly for functional status? *Archives of Gerontology and Geriatrics*, 54(1), 78-81.
- Balestroni, G., & Bertolotti, G. (2012). [EuroQol-5D (EQ-5D): an instrument for measuring quality of life]. *Monaldi Arch Chest Dis*, 78(3), 155-159.
- Barcelo, M., Torres, O., Mascaro, J., Francia, E., Cardona, D., & Ruiz, D. (2013). Assessing nutritional status in the elderly evaluation of Chumlea equations for weight. *Nutricion Hospitalaria*, 28(2), 314-318.

- Barczi, S. R., Sullivan, P. A., & Robbins, J. (2000). How should dysphagia care of older adults differ? Establishing optimal practice patterns. *Seminars in Speech and Language, 21*(4), 347-361.
- Barua, A., Ghosh, M. K., Kar, N., & Basilio, M. A. (2011). Prevalence of depressive disorders in the elderly. *Annals of Saudi Medicine, 31*(6), 620-624.
- Beekman, A. T., Penninx, B. W., Deeg, D. J., de Beurs, E., Geerling, S. W., & van Tilburg, W. (2002). The impact of depression on the well-being, disability and use of services in older adults: a longitudinal perspective. *Acta Psychiatr Scand, 105*(1), 20-27.
- Belon, A. P., G Lima, M., & Ba Barros, M. (2014). Gender differences in healthy life expectancy among Brazilian elderly. *Health and Quality of Life Outcomes, 12*(1), 88.
- Benítez Brito, N., Suárez Llanos, J. P., Fuentes Ferrer, M., Oliva García, J. G., Delgado Brito, I., Pereyra-García Castro, F., . . . Palacio Abizanda, E. (2016). Relationship between Mid-Upper Arm Circumference and Body Mass Index in Inpatients. *PloS One, 11*(8), e0160480.
- Bernstein, M., & Munoz, N. (2012). Position of the Academy of Nutrition and Dietetics: food and nutrition for older adults: promoting health and wellness. *J Acad Nutr Diet, 112*(8), 1255-1277.
- Berthoud, H. R. (2011). Metabolic and hedonic drives in the neural control of appetite: who is the boss? *Current Opinion in Neurobiology, 21*(6), 888-896.
- Bollwein, J., Volkert, D., Diekmann, R., Kaiser, M. J., Uter, W., Vidal, K., . . . Bauer, J. M. (2013). Nutritional status according to the mini nutritional assessment (MNA(R)) and frailty in community dwelling older persons: a close relationship. *The Journal of Nutrition, Health & Aging, 17*(4), 351-356.
- Bonnefoy, M., Jauffret, M., Kostka, T., & Jusot, J. F. (2002). Usefulness of calf circumference measurement in assessing the nutritional state of hospitalized elderly people. *Gerontology, 48*(3), 162-169.
- Boosalis, M. G., & Stiles, N. J. (1995). Nutritional assessment in the elderly: biochemical analyses. *Clinical Laboratory Science, 8*(1), 31-33.
- Borowiak, E., & Kostka, T. (2004a). Predictors of quality of life in older people living at home and in institutions. *Aging Clin, 16*.

- Borowiak, E., & Kostka, T. (2004b). Predictors of quality of life in older people living at home and in institutions. *Aging Clinical and Experimental Research*, 16(3), 212-220.
- Boscatto, E. C., Duarte Mde, F., Coqueiro Rda, S., & Barbosa, A. R. (2013). Nutritional status in the oldest elderly and associated factors. *Rev Assoc Med Bras (1992)*, 59(1), 40-47.
- Bose, K., Ganguly, S., Mamtaz, H., Mukhopadhyay, A., & Bhadra, M. (2006). High prevalence of undernutrition among adult Kora Mudi tribals of Bankura District, West Bengal, India. *Anthropological Science*, 114(1), 65-68.
- Boulos, C., Salameh, P., & Barberger-Gateau, P. (2013). The AMEL study, a cross sectional population-based survey on aging and malnutrition in 1200 elderly Lebanese living in rural settings: protocol and sample characteristics. *BMC Public Health*, 13, 573-573.
- Boulos, C., Salameh, P., & Barberger-Gateau, P. (2016a). Malnutrition and frailty in community dwelling older adults living in a rural setting. *Clinical Nutrition*, 35(1), 138-143.
- Boulos, C., Salameh, P., & Barberger-Gateau, P. (2016b). Social isolation and risk for malnutrition among older people. *Geriatr Gerontol Int*.
- Boulos, C., Salameh, P., & Barberger-Gateau, P. (2017). Social isolation and risk for malnutrition among older people. *Geriatr Gerontol Int*, 17(2), 286-294.
- Brenes, G. A., Guralnik, J. M., Williamson, J. D., Fried, L. P., Simpson, C., Simonsick, E. M., & Penninx, B. W. (2005). The influence of anxiety on the progression of disability. *Journal of the American Geriatrics Society*, 53(1), 34-39.
- Brenes, G. A., Penninx, B. W., Judd, P. H., Rockwell, E., Sewell, D. D., & Wetherell, J. L. (2008). Anxiety, depression and disability across the lifespan. *Aging Ment Health*, 12(1), 158-163.
- Brown, N. A., Levine, J. L., & Zenilman, M. E. (2011). Age-Related Changes in the Gastrointestinal Tract. In R. A. Rosenthal, M. E. Zenilman & M. R. Katlic (Eds.), *Principles and Practice of Geriatric Surgery* (pp. 711-727). New York, NY: Springer New York.
- Brownie, S. (2006). Why are elderly individuals at risk of nutritional deficiency? *International Journal of Nursing Practice*, 12(2), 110-118.

- Bulsara, C. (2015). Using A Mixed Methods Approach to Enhance And Validate Your Research.
- Bunout, D. (1999). Nutritional and metabolic effects of alcoholism: their relationship with alcoholic liver disease. *Nutrition*, 15(7-8), 583-589.
- Burkert, N. T., Muckenhuber, J., Großschädl, F., Rásky, É., & Freidl, W. (2014). Nutrition and Health – The Association between Eating Behavior and Various Health Parameters: A Matched Sample Study. *PloS One*, 9(2), e88278.
- Burns, A., Lawlor, B., & Craig, S. (2002). Rating scales in old age psychiatry. *British Journal of Psychiatry*, 180, 161-167.
- Burns, V. F., Lavoie, J.-P., & Rose, D. (2012). Revisiting the Role of Neighbourhood Change in Social Exclusion and Inclusion of Older People. *Journal of Aging Research*, 2012, 12.
- Burton, N. W., & Turrell, G. (2000). Occupation, hours worked, and leisure-time physical activity. *Preventive Medicine*, 31(6), 673-681.
- Cai, H., Mcneilly, A. S., Luttrell, L. M., & Martin, B. (2012). Endocrine Function in Aging. *International Journal of Endocrinology*, 2012, 3.
- Cao, W., Guo, C., Ping, W., Tan, Z., Guo, Y., & Zheng, J. (2016). A Community-Based Study of Quality of Life and Depression among Older Adults. *International Journal of Environmental Research and Public Health*, 13(7), 693.
- Cereda, E., Pedrolli, C., Klersy, C., Bonardi, C., Quarleri, L., Cappello, S., . . . Caccialanza, R. (2016). Nutritional status in older persons according to healthcare setting: A systematic review and meta-analysis of prevalence data using MNA®. *Clinical Nutrition*.
- Chan, A. M., von Mühlen, D., Kritz-Silverstein, D., & Barrett-Connor, E. (2009). Regular alcohol consumption is associated with increasing quality of life and mood in older men and women: The Rancho Bernardo Study. *Maturitas*, 62(3), 294-300.
- Charles, S., & Carstensen, L. L. (2010). Social and Emotional Aging. *Annual Review of Psychology*, 61, 383-409.
- Chatters, L. M., Taylor, R. J., Woodward, A. T., & Nicklett, E. J. (2015). Social support from church and family members and depressive symptoms among older African Americans. *American Journal of Geriatric Psychiatry*, 23(6), 559-567.

- Chavarro-Carvajal, D., Reyes-Ortiz, C., Samper-Ternent, R., Arciniegas, A. J., & Gutierrez, C. C. (2015). Nutritional assessment and factors associated to malnutrition in older adults: a cross-sectional study in Bogota, Colombia. *Journal of Aging and Health*, 27(2), 304-319.
- Chen, C. C., Bai, Y. Y., Huang, G. H., & Tang, S. T. (2007a). Revisiting the concept of malnutrition in older people. *Journal of Clinical Nursing*, 16(11), 2015-2026.
- Chen, C. C., Schilling, L. S., & Lyder, C. H. (2001). A concept analysis of malnutrition in the elderly. *Journal of Advanced Nursing*, 36(1), 131-142.
- Chen, C. C. H., Bai, Y. Y., Huang, G. H., & Tang, S. T. (2007b). Revisiting the concept of malnutrition in older people. *Journal of Clinical Nursing*, 16.
- Chen, H.-M., & Chen, C.-M. (2017). Factors Associated with Quality of Life Among Older Adults with Chronic Disease in Taiwan. *International Journal of Gerontology*, 11(1), 12-15.
- Chen, P.-L., Tsai, Y.-L., Lin, M.-H., & Wang, J. (2017). Gender differences in health promotion behaviors and quality of life among community-dwelling elderly. *Journal of Women & Aging*, 1-16.
- Chen, T.-h., Li, L., & Kochen, M. M. (2005). A systematic review: How to choose appropriate health-related quality of life (HRQOL) measures in routine general practice? *Journal of Zhejiang University. Science. B*, 6(9), 936-940.
- Chen, Z., Yang, G., Offer, A., Zhou, M., Smith, M., Peto, R., . . . Whitlock, G. (2012). Body mass index and mortality in China: a 15-year prospective study of 220 000 men. *International Journal of Epidemiology*, 41(2), 472-481.
- Chilima, D. M., & Ismail, S. J. (2007). Nutrition and handgrip strength of older adults in rural Malawi. *Public Health Nutrition*, 4(1), 11-17.
- Chiolero, A., Faeh, D., Paccaud, F., & Cornuz, J. (2008). Consequences of smoking for body weight, body fat distribution, and insulin resistance. *American Journal of Clinical Nutrition*, 87(4), 801-809.
- Chiolero, A., Jacot-Sadowski, I., Faeh, D., Paccaud, F., & Cornuz, J. (2007). Association of cigarettes smoked daily with obesity in a general adult population. *Obesity (Silver Spring)*, 15(5), 1311-1318.
- Christensen, U., Schmidt, L., Kriegbaum, M., Hougaard, C. O., & Holstein, B. E. (2006). Coping with unemployment: does educational attainment make any difference? *Scand J Public Health*, 34(4), 363-370.

- Chung, T.-H., Kwon, Y.-J., Shim, J.-Y., & Lee, Y.-J. (2016). Association between serum triglyceride to high-density lipoprotein cholesterol ratio and sarcopenia in elderly Korean males: The Korean National Health and Nutrition Examination Survey. *Clinica Chimica Acta*, 463, 165-168.
- Clemens, S., Begum, N., Harper, C., Whitty, J. A., & Scuffham, P. A. (2014). A comparison of EQ-5D-3L population norms in Queensland, Australia, estimated using utility value sets from Australia, the UK and USA. *Qual Life Res*, 23(8), 2375-2381.
- Conwell, Y., Duberstein, P. R., & Caine, E. D. (2002). Risk factors for suicide in later life. *Biol Psychiatry*, 52(3), 193-204.
- Cornman, J. C., Goldman, N., Gleib, D. A., Weinstein, M., & Chang, M.-C. (2003). Social Ties and Perceived Support. *Journal of Aging and Health*, 15(4), 616-644.
- Craig, B. M., Pickard, A. S., & Lubetkin, E. I. (2014). Health problems are more common, but less severe when measured using newer EQ-5D versions. *J Clin Epidemiol*, 67(1), 93-99.
- Creswell, J. W. (2003). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*: SAGE Publications.
- Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five approaches (2nd ed.)*. : Thousand Oaks, CA: Sage.
- Creswell, J. W. (2014). *Research Design Qualitative, Quantitative, and Mixed Methods Approaches*: SAGE Publications, Inc.
- Cruz-Jentoft, A. J., Landi, F., Topinkova, E., & Michel, J. P. (2010). Understanding sarcopenia as a geriatric syndrome. *Current Opinion in Clinical Nutrition and Metabolic Care*, 13(1), 1-7.
- Cuervo, M., Ansorena, D., Garcia, A., Gonzalez Martinez, M. A., Astiasaran, I., & Martinez, J. A. (2009). [Assessment of calf circumference as an indicator of the risk for hyponutrition in the elderly]. *Nutricion Hospitalaria*, 24(1), 63-67.
- Cunningham, W. E., Burtonw, T. M., Hawes-Dawson, J., Kington, R. S., & Hays, R. D. (1999). Use of relevancy ratings by target respondents to develop health-related quality of life measures: An example with African-American elderly. *Quality of Life Research*, 8(8), 749-768.

- Cupisti, A., D'Alessandro, C., Finato, V., Del Corso, C., Catania, B., Caselli, G. M., & Egidi, M. F. (2017). Assessment of physical activity, capacity and nutritional status in elderly peritoneal dialysis patients. *BMC Nephrology*, 18(1), 180.
- Dale, B., & Söderhamn, U. (2015). Nutritional self-care among a group of older home-living people in rural Southern Norway. *Journal of Multidisciplinary Healthcare*, 8, 67-74.
- Daniels, S. R. (2009). The use of BMI in the clinical setting. *Pediatrics*, 124 Suppl 1, S35-41.
- De Luca d'Alessandro, E., Bonacci, S., & Giraldi, G. (2011). Aging populations: the health and quality of life of the elderly. *Clinica Terapeutica*, 162(1), e13-18.
- De Marchi, R. J., Hugo, F. N., Hilgert, J. B., & Padilha, D. M. P. (2008). Association between oral health status and nutritional status in south Brazilian independent-living older people. *Nutrition*, 24(6), 546-553.
- de Oliveira, T. R., & Frigerio, M. L. (2004). Association between nutrition and the prosthetic condition in edentulous elderly. *Gerodontology*, 21(4), 205-208.
- De Silva, & Indralal, W. (2006). The Graying of India: Population Ageing in the Context of Asia – Rajagopal Dhar Chakraborti. *Singapore Journal of Tropical Geography*, 27(3), 347-348.
- de Silva, A., Ranasinghe, T., & Abeykoon, P. (2016). Universal health coverage and the health Sustainable Development Goal: achievements and challenges for Sri Lanka. *WHO South East Asia J Public Health*, 5(2), 82-88.
- De Silva, W. I. (1994). How serious is ageing in Sri Lanka and what can be done about it? *Asia Pac Popul J*, 9(1), 19-36.
- Debsharma, B. (2013). Nutritional Status of the Elderly Female in a Municipal Town of West Bengal. *Int J Cur Res Rev*, 5(16), 38-43.
- Deng, X., Dong, P., Zhang, L., Tian, D., Zhang, L., Zhang, W., . . . Hu, G. (2017). Health-related quality of life in residents aged 18 years and older with and without disease: findings from the First Provincial Health Services Survey of Hunan, China. *BMJ Open*, 7(9), e015880.
- DeSilva, W. I. (2007). *A population projection of Sri Lanka for the new millennium 2001-2101 trends and implications*. Colombo: Institute for Health Policy.

- Dibari, F., Bahwere, P., Le Gall, I., Guerrero, S., Mwaniki, D., & Seal, A. (2012). A qualitative investigation of adherence to nutritional therapy in malnourished adult AIDS patients in Kenya. *Public Health Nutrition*, 15(2), 316-323.
- Dittmann-Kohli, F. (2008). The Construction of Meaning in Old Age: Possibilities and Constraints. *Ageing and Society*, 10(3), 279-294.
- Djernes, J. K. (2006). Prevalence and predictors of depression in populations of elderly: a review. *Acta Psychiatrica Scandinavica*, 113(5), 372-387.
- Docking, R. E., Fleming, J., Brayne, C., Zhao, J., Macfarlane, G. J., & Jones, G. T. (2011). Epidemiology of back pain in older adults: prevalence and risk factors for back pain onset. *Rheumatology*, 50(9), 1645-1653.
- Dodds, R. M., Syddall, H. E., Cooper, R., Kuh, D., Cooper, C., & Sayer, A. A. (2016). Global variation in grip strength: a systematic review and meta-analysis of normative data. *Age and Ageing*, 45(2), 209-216.
- Donini, L. M., Neri, B., De Chiara, S., Poggiogalle, E., & Muscaritoli, M. (2013). Nutritional Care in a Nursing Home in Italy. *PloS One*, 8(2), e55804.
- Donini, L. M., Poggiogalle, E., Pinto, A., Giusti, A. M., & del Balzo, V. (2015). Chapter 20 - Malnutrition in the Elderly A2 - Martin, Colin R. In V. R. Preedy (Ed.), *Diet and Nutrition in Dementia and Cognitive Decline* (pp. 211-222). San Diego: Academic Press.
- Donmez, L., Gokkoca, Z., & Dedeoglu, N. (2005). Disability and its effects on quality of life among older people living in Antalya city center, Turkey. *Arch Gerontol Geriatr*, 40(2), 213-223.
- Dos Santos, C. A., Ribeiro, A. Q., Rosa, C. d. O. B., & Ribeiro, R. d. C. L. (2015). [Depression, cognitive deficit and factors associated with malnutrition in elderly people with cancer]. *Ciência & Saúde Coletiva*, 20(3), 751-760.
- Doumit, J. H., Nasser, R. N., & Hanna, D. R. (2014). Nutritional and health status among nursing home residents in Lebanon: comparison across gender in a national cross sectional study. *BMC Public Health*, 14, 629-629.
- Edgerton, J. D., Roberts, L. W., & von Below, S. (2012). Education and Quality of Life. In K. C. Land, A. C. Michalos & M. J. Sirgy (Eds.), *Handbook of Social Indicators and Quality of Life Research* (pp. 265-296). Dordrecht: Springer Netherlands.

- El Zoghbi, M., Boulos, C., Al Hajje, A., Saleh, N., Awada, S., Rachidi, S., . . . Salameh, P. (2013). Associations between cognitive function and nutritional status in elderly: a cross-sectional study in three institutions of Beirut – Lebanon. *Geriatric Mental Health Care, 1*.
- Ellershaw, J., & Ward, C. (2003). Care of the dying patient: the last hours or days of life. *BMJ : British Medical Journal, 326*(7379), 30-34.
- Ellis, F. R., Holesh, S., & Ellis, J. W. (1972). Incidence of osteoporosis in vegetarians and omnivores. *Am J Clin Nutr, 25*(6), 555-558.
- Engward, H., & Davis, G. (2015). Being reflexive in qualitative grounded theory: discussion and application of a model of reflexivity. *Journal of Advanced Nursing, 71*(7), 1530-1538.
- Eri, L. M., & Tveter, K. J. (1992). Measuring the quality of life of patients with benign prostatic hyperplasia. Assessment of the usefulness of a new quality of life questionnaire specially adapted to benign prostatic hyperplasia patients. *Eur Urol, 21*(4), 257-262.
- Esmayel, E. M. M., Eldarawy, M. M., Hassan, M. M. M., Hassanin, H. M., Reda Ashour, W. M., & Mahmoud, W. (2013). Nutritional and Functional Assessment of Hospitalized Elderly: Impact of Sociodemographic Variables. *Journal of Aging Research, 2013*, 7.
- Eysteinsdottir, T., Thorsdottir, I., Gunnarsdottir, I., & Steingrimsdottir, L. (2012). Assessing validity of a short food frequency questionnaire on present dietary intake of elderly Icelanders. *Nutrition Journal, 11*(1), 12.
- Faller, J. W., Melo, W. A. d., Versa, G. L. G. S., & Marcon, S. S. (2010). Qualidade de vida de idosos cadastrados na estratégia saúde da família de Foz do Iguaçu-PR. *Escola Anna Nery, 14*, 803-810.
- Fares, D., Rodrigues Barbosa, A., Ferreti Borgatto, A., Silva Coqueiro, R. d., & Henrique Fernandes, M. (2012). Factors associated with nutritional status of the elderly in two regions of Brazil. *Revista da Associação Médica Brasileira (English Edition), 58*(4), 434-441.
- Feldblum, I., German, L., Castel, H., Harman-Boehm, I., & Shahr, D. R. (2011). Individualized nutritional intervention during and after hospitalization: the nutrition intervention study clinical trial. *Journal of the American Geriatrics Society, 59*(1), 10-17.
- Fernando, D. F. (1980). The continuing fertility decline in Sri Lanka. *J Biosoc Sci, 12*(1), 51-60.

- Fernando, W. H. K. N., & Wijesinghe, D. G. N. G. (2010). Assessment of Nutritional Status and Disease Prevalence among Elderly Population in Elderly Homes in Kandy. *Tropical Agricultural Research*, 21(3), 229 - 237.
- Finlay, L. (2002). Negotiating the swamp: the opportunity and challenge of reflexivity in research practice. *Qualitative Research*, 2(2), 209-230.
- Flanagan, D., Fisher, T., Murray, M., Visvanathan, R., Charlton, K., Thesing, C., . . . Walther, K. (2012). Managing undernutrition in the elderly Prevention is better than cure. *Australian Family Physician*, 41, 695-699.
- Francis, J. J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccles, M. P., & Grimshaw, J. M. (2010). What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychology & Health*, 25(10), 1229-1245.
- Frangos, E., Trombetti, A., Graf, C. E., Lachat, V., Samaras, N., Vischer, U. M., . . . Herrmann, F. R. (2016). Malnutrition in Very Old Hospitalized Patients: A New Etiologic Factor of Anemia? *The Journal of Nutrition, Health & Aging*, 20(7), 705-713.
- Franzén, K., Saveman, B.-I., & Blomqvist, K. (2007). Predictors for Health Related Quality of Life in Persons 65 Years or Older with Chronic Heart Failure. *European Journal of Cardiovascular Nursing*, 6(2), 112-120.
- Frid, H., Thors Adolfsson, E., Rosenblad, A., & Nydahl, M. (2013). Agreement between different methods of measuring height in elderly patients. *Journal of Human Nutrition & Dietetics*, 26(5), 504-511.
- Friedman, B., Heisel, M. J., & Delavan, R. L. (2005). Psychometric properties of the 15-item geriatric depression scale in functionally impaired, cognitively intact, community-dwelling elderly primary care patients. *Journal of the American Geriatrics Society*, 53(9), 1570-1576.
- Furuta, M., & Yamashita, Y. (2013). Oral Health and Swallowing Problems. *Current Physical Medicine and Rehabilitation Reports*, 1(4), 216-222.
- Galiana, L., Guti, #xe9, rrez, M., Sancho, P., Francisco, E.-H., . . . M. (2016). Socio-Demographic Variables and Successful Aging of the Angolan Elderly. *Scientifica*, 2016, 10.
- Garcia, M. F., Meireles, M. S., Führ, L. M., Donini, A. B., & Wazlawik, E. (2013). Relationship between hand grip strength and nutritional assessment methods used of hospitalized patients. *Revista de Nutrição*, 26, 49-57.

- Gerritsen, A. E., Allen, P. F., Witter, D. J., Bronkhorst, E. M., & Creugers, N. H. J. (2010). Tooth loss and oral health-related quality of life: a systematic review and meta-analysis. *Health and Quality of Life Outcomes*, 8, 126-126.
- Gholizadeh, L., Yazdi, K., Dehghan Nayeri, N., & Mohammadi, E. (2016). Nutritional care of elderly patients in acute care settings: A qualitative study. *Geriatrics & Gerontology International*, 16(3), 374-379.
- Gielen, E., Verschueren, S., O'Neill, T. W., Pye, S. R., O'Connell, M. D., Lee, D. M., . . . Boonen, S. (2012). Musculoskeletal frailty: a geriatric syndrome at the core of fracture occurrence in older age. *Calcified Tissue International*, 91(3), 161-177.
- Giovannelli, J., Coevoet, V., Vasseur, C., Gheysens, A., Basse, B., & Houyengah, F. (2015). How can screening for malnutrition among hospitalized patients be improved? An automatic e-mail alert system when admitting previously malnourished patients. *Clinical Nutrition*, 34(5), 868-873.
- Glisky, E. L. (2007). Changes in Cognitive Function in Human Aging. In R. DR (Ed.), *Brain Aging: Models, Methods, and Mechanisms*. Boca Raton (FL): CRC Press/Taylor & Francis.
- Golicki, D., & Niewada, M. (2017). EQ-5D-5L Polish population norms. *Archives of Medical Science : AMS*, 13(1), 191-200.
- Green, S. M., & Watson, R. (2006). Nutritional screening and assessment tools for older adults: literature review. *Journal of Advanced Nursing*, 54.
- Grembiale, R., Naty, S., & Ursini, F. (2010). Chronic obstructive pulmonary disease (COPD) treatment in the elderly. *BMC Geriatrics*, 10(1), L83.
- Groessl, E. J., Kaplan, R. M., Rejeski, W. J., Katula, J. A., King, A. C., Frierson, G., . . . Pahor, M. (2007). Health-related quality of life in older adults at risk for disability. *American Journal of Preventive Medicine*, 33(3), 214-218.
- Guccione, A. A., Felson, D. T., Anderson, J. J., Anthony, J. M., Zhang, Y., Wilson, P. W., . . . Kannel, W. B. (1994). The effects of specific medical conditions on the functional limitations of elders in the Framingham Study. *Am J Public Health*, 84(3), 351-358.
- Guigoz, Y. (2006). The mini nutritional assessment (MNA®) Review of the literature – What does tell us? *The Journal of Nutrition, Health & Aging*, 10.

- Haag, D. G., Peres, K. G., Balasubramanian, M., & Brennan, D. S. (2017). Oral Conditions and Health-Related Quality of Life: A Systematic Review. *Journal of Dental Research*, 96(8), 864-874.
- Hackert, T., Schütte, K., & Malfertheiner, P. (2014). The Pancreas: Causes for Malabsorption. *Viszeralmedizin*, 30(3), 190-197.
- Hadler, N. M. (1992). Knee pain is the malady--not osteoarthritis. *Ann Intern Med*, 116(7), 598-599.
- Hailemariam, H., Singh, P., & Fekadu, T. (2016). Evaluation of mini nutrition assessment (MNA) tool among community dwelling elderly in urban community of Hawassa city, Southern Ethiopia. *BMC Nutrition*, 2(1), 11.
- Hajian-Tilaki, K., Heidari, B., & Hajian-Tilaki, A. (2017). Are gender differences in health-related quality of life attributable to sociodemographic characteristics and chronic disease conditions in elderly people? *International Journal of Preventive Medicine*, 8(1), 95-95.
- Halaweh, H., Willen, C., Grimby-Ekman, A., & Svantesson, U. (2015). Physical Activity and Health-Related Quality of Life Among Community Dwelling Elderly. *Journal of Clinical Medicine Research*, 7(11), 845-852.
- Hallaj, F. A. (2015). Assessment of the nutritional status of residents in homes for the elderly in Lattakia, Syrian Arab Republic. *Eastern Mediterranean Health Journal*, 21(10), 753-761 759p.
- Han, K.-T., Park, E.-C., Kim, J.-H., Kim, S. J., & Park, S. (2014). Is marital status associated with quality of life? *Health and Quality of Life Outcomes*, 12, 109.
- Hartvigsen, J., Christensen, K., & Frederiksen, H. (2003). Back pain remains a common symptom in old age. a population-based study of 4486 Danish twins aged 70-102. *Eur Spine J*, 12(5), 528-534.
- Hartvigsen, J., Christensen, K., & Frederiksen, H. (2004). Back and neck pain exhibit many common features in old age: a population-based study of 4,486 Danish twins 70-102 years of age. *Spine (Phila Pa 1976)*, 29(5), 576-580.
- He, Y., Li, Y., Lai, J., Wang, D., Zhang, J., Fu, P., . . . Qi, L. (2013). Dietary patterns as compared with physical activity in relation to metabolic syndrome among Chinese adults. *Nutrition, Metabolism and Cardiovascular Diseases*, 23(10), 920-928.

- Heller, T., Fisher, D., Marks, B., & Hsieh, K. (2014). Interventions to promote health: Crossing networks of intellectual and developmental disabilities and aging. *Disability and Health Journal*, 7(1), S24-S32.
- Hernandez-Galiot, A., & Goni, I. (2017). Quality of life and risk of malnutrition in a home-dwelling population over 75 years old. *Nutrition*, 35, 81-86.
- Hickson, M. (2006). Malnutrition and ageing. *Postgraduate Medical Journal*, 82(963), 2-8.
- Hickson, M., & Frost, G. (2003). A comparison of three methods for estimating height in the acutely ill elderly population. *Journal of Human Nutrition & Dietetics*, 16(1), 13-20.
- Higashiguchi, T., Arai, H., Claytor, L. H., Kuzuya, M., Kotani, J., Lee, S. D., . . . Peng, N. (2017). Taking action against malnutrition in Asian healthcare settings: an initiative of a Northeast Asia Study Group. *Asia Pacific Journal of Clinical Nutrition*, 26(2), 202-211.
- Hinz, A., Kohlmann, T., Stobel-Richter, Y., Zenger, M., & Brahler, E. (2014). The quality of life questionnaire EQ-5D-5L: psychometric properties and normative values for the general German population. *Qual Life Res*, 23(2), 443-447.
- Hoeymans, N., van Lindert, H., & Westert, G. P. (2005). The health status of the Dutch population as assessed by the EQ-6D. *Qual Life Res*, 14(3), 655-663.
- Holmen, A., Stromberg, E., Hagman-Gustafsson, M. L., Wardh, I., & Gabre, P. (2012). Oral status in home-dwelling elderly dependent on moderate or substantial supportive care for daily living: prevalence of edentulous subjects, caries and periodontal disease. *Gerodontology*, 29(2), e503-511.
- Horsman, J., Furlong, W., Feeny, D., & Torrance, G. (2003). The Health Utilities Index (HUI®): concepts, measurement properties and applications. *Health and Quality of Life Outcomes*, 1, 54-54.
- Houghton, C., Hunter, A., & Meskell, P. (2012). Linking aims, paradigm and method in nursing research. *Nurse Researcher*, 20(2), 34-39.
- Hsu, W.-C., Tsai, A. C., & Wang, J.-Y. (2016). Calf circumference is more effective than body mass index in predicting emerging care-need of older adults – Results of a national cohort study. *Clinical Nutrition*, 35(3), 735-740.

- Huang, W., Yu, H., Liu, C., Liu, G., Wu, Q., Zhou, J., . . . Xu, X. (2017). Assessing Health-Related Quality of Life of Chinese Adults in Heilongjiang Using EQ-5D-3L. *Int J Environ Res Public Health*, 14(3).
- Hyun, H. S., & Lee, I. (2014). [Nutritional status and risk factors for malnutrition in low-income urban elders]. *Journal of the Korean Academy of Nursing*, 44(6), 708-716.
- Ide, R., Yamamoto, R., & Mizoue, T. (2006). The Japanese version of the Oral Health Impact Profile (OHIP)--validation among young and middle-aged adults. *Community Dental Health*, 23(3), 158-163.
- Idler, E. L., McLaughlin, J., & Kasl, S. (2009). Religion and the Quality of Life in the Last Year of Life. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 64B(4), 528-537.
- Iizaka, S., Sanada, H., Matsui, Y., Furue, M., Tachibana, T., Nakayama, T., . . . Miyachi, Y. (2011). Serum albumin level is a limited nutritional marker for predicting wound healing in patients with pressure ulcer: Two multicenter prospective cohort studies. *Clinical Nutrition*, 30(6), 738-745.
- Incalzi, R. A., Scarlata, S., Pennazza, G., Santonico, M., & Pedone, C. (2014). Chronic Obstructive Pulmonary Disease in the elderly. *European Journal of Internal Medicine*, 25(4), 320-328.
- Indrani Pieris, & Caldwellb, B. (1997). Gender and health in Sri Lanka. *Health Transition Review*, 7, 171-185.
- Inoue, M., John, M. T., Tsukasaki, H., Furuyama, C., & Baba, K. (2011). Denture quality has a minimal effect on health-related quality of life in patients with removable dentures. *Journal of Oral Rehabilitation*, 38(11), 818-826.
- Isenring, E. A., Bauer, J. D., Banks, M., & Gaskill, D. (2009). The Malnutrition Screening Tool is a useful tool for identifying malnutrition risk in residential aged care. *J Hum Nutr Diet*, 22(6), 545-550.
- Ivankova, N. V., Creswell, J. W., & Stick, S. L. (2006). Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice. *Field Methods*, 18(1), 3-20.
- Izawa, S., Enoki, H., Hasegawa, J., Hirose, T., & Kuzuya, M. (2014). Factors associated with deterioration of mini nutritional assessment-short form status of nursing home residents during a 2-year period. *Journal of Nutrition, Health & Aging*, 18(4), 372-377.

- Jaba, E., Balan, C., & Robu, I. B. (2013). The Assessment of Health Care System Performance based on the Variation of Life Expectancy. *Procedia - Social and Behavioral Sciences*, 81, 162-166.
- Jacobs, J. M., Hammerman-Rozenberg, R., Cohen, A., & Stessman, J. (2006). Chronic back pain among the elderly: prevalence, associations, and predictors. *Spine (Phila Pa 1976)*, 31(7), E203-207.
- Jamaiyah, H., Geeta, A., Safiza, M. N., Wong, N. F., Kee, C. C., Ahmad, A. Z., . . . Faudzi, A. (2008). Reliability and technical error of calf circumference and mid-half arm span measurements for nutritional status assessment of elderly persons in Malaysia. *Malaysian Journal of Nutrition*, 14(2), 137-150.
- Jamir, L., Kalaivani, M., Nongkynrih, B., Misra, P., & Gupta, S. K. (2013). Relationship between arm span and height among elderly persons in a rural area of Ballabgarh, Haryana. *Indian Journal of Medical Specialities*, 4(2), 248-253.
- Janssen, M. F., Szende, A., Cabases, J., Ramos-Goñi, J. M., Vilagut, G., & König, H. H. (2018). Population norms for the EQ-5D-3L: a cross-country analysis of population surveys for 20 countries. *The European Journal of Health Economics*.
- Jansson, K. A., Nemeth, G., Granath, F., Jonsson, B., & Blomqvist, P. (2009). Health-related quality of life (EQ-5D) before and one year after surgery for lumbar spinal stenosis. *Journal of Bone and Joint Surgery (British Volume)*, 91(2), 210-216.
- Jayalath, W. A. T. A., & Kumara, S. K. G. P. H. (2011). *Assessment of Nutritional Status of Elderly Hospitalised Patients According to Their Co-Morbid Conditions and Educational Levels Using Mini Nutrition Assessment Tool*. Paper presented at the Peradeniya University Research Sessions, Sri Lanka, Sri Lanka. http://www.bapen.org.uk/must_report.html
- Jayasinghe, N. R., & Foster, J. H. (2011). Deliberate self-harm/poisoning, suicide trends. The link to increased alcohol consumption in Sri Lanka. *Arch Suicide Res*, 15(3), 223-237.
- Jayawardena, R., Byrne, N. M., Soares, M. J., Katulanda, P., & Hills, A. P. (2013). Food consumption of Sri Lankan adults: an appraisal of serving characteristics. *Public Health Nutr*, 16(4), 653-658.
- Jayawardena, R., Byrne, N. M., Soares, M. J., Katulanda, P., Yadav, B., & Hills, A. P. (2013). High dietary diversity is associated with obesity in Sri Lankan adults: an evaluation of three dietary scores. *BMC Public Health*, 13(1), 314.

- Jayawardena, R., Ranasinghe, P., Byrne, N. M., Soares, M. J., Katulanda, P., & Hills, A. P. (2012). Prevalence and trends of the diabetes epidemic in South Asia: a systematic review and meta-analysis. *BMC Public Health*, 12.
- Jayawardena, R., Thennakoon, S., Byrne, N., Soares, M., Katulanda, P., & Hills, A. (2014). Energy and nutrient intakes among Sri Lankan adults. *International Archives of Medicine*, 7, 34-34.
- Ji, L., Meng, H., & Dong, B. (2012). Factors associated with poor nutritional status among the oldest-old. *Clinical Nutrition*, 31(6), 922-926.
- Jin, K. (2010). Modern Biological Theories of Aging. *Aging and Disease*, 1(2), 72-74.
- Johansson. (2008). Comparison of nutrient intake between different dietary assessment methods in elderly male volunteers. *Nutrition & Dietetics*, 65(4), 266-271.
- Joshipura, K. J., Willett, W. C., & Douglass, C. W. (1996). The impact of edentulousness on food and nutrient intake. *Journal of the American Dental Association*, 127(4), 459-467.
- Jun, L., Yuan-yuan, C., Lin, Z., Yong-gang, L., Chen, W., Lu, J., . . . Wang, C. (2016). Laboratory nutritional parameters predict one-year mortality in elderly patients with intertrochanteric fracture. *Asia Pacific Journal of Clinical Nutrition*, 25(3), 457-463.
- Kaaks, R., Ferrari, P., Ciampi, A., Plummer, M., & Riboli, E. (2002). Uses and limitations of statistical accounting for random error correlations, in the validation of dietary questionnaire assessments. *Public Health Nutrition*, 5(6a), 969-976.
- Kabir, Z. N., Ferdous, T., Cederholm, T., Khanam, M. A., Streatfield, K., & Wahlin, A. (2006). Mini Nutritional Assessment of rural elderly people in Bangladesh: the impact of demographic, socio-economic and health factors. *Public Health Nutrition*, 9(8), 968-974.
- Kaiser, M., Bauer, J. M., R  msch, C., Uter, W., Guigoz, Y., & Cederholm, T. (2009). Validation of the Mini Nutritional Assessment   Short-Form (MNA-SF): a practical tool for identification of nutritional status. *J Nutr Health & Aging*, 13.
- Kaiser, M., Bauer, J. M., R  msch, C., Uter, W., Guigoz, Y., & Cederholm, T. (2010). Frequency of malnutrition in the elderly: a multinational perspective using the Mini Nutritional Assessment (MNA  ). *J Am Ger Soc*, 58.

- Kaiser, M. J., Bauer, J. M., Ramsch, C., Uter, W., Guigoz, Y., Cederholm, T., . . . Sieber, C. C. (2009). Validation of the Mini Nutritional Assessment Short-Form (MNA(R)-SF): A Practical Tool for Identification of Nutritional Status. *Journal of Nutrition, Health & Aging*, 13(9), 782-788.
- Kaluthanthri, K. D. M. S. (2014). *Aging and the changing role of the family in Sri Lanka (PhD Thesis)*. (Doctor of philosophy), The University of Adelaide
- Kamangar, F., Chow, W.-H., Abnet, C., & Dawsey, S. (2009). Environmental Causes of Esophageal Cancer. *Gastroenterology Clinics of North America*, 38(1), 27-vii.
- Karin Josefsson, Marie Andersson, & Erikstedt, A. (2016). Older adults' self-rated health and differences by age and gender: A quantitative study. *Healthy Aging Research*, 5(1).
- Katulanda, P., Constantine, G. R., Mahesh, J. G., Sheriff, R., Seneviratne, R. D. A., Wijeratne, S., . . . Matthews, D. R. (2008). Prevalence and projections of diabetes and pre-diabetes in adults in Sri Lanka—Sri Lanka diabetes, cardiovascular study (SLDCS). *Diabetic Medicine*, 25.
- Katulanda, P., Jayawardana, R., Ranasinghe, P., Rezvi Sheriff, M., & Matthews, D. R. (2013). Physical activity patterns and correlates among adults from a developing country: The Sri Lanka Diabetes and Cardiovascular Study. *Public Health Nutrition*, 16.
- Katulanda, P., Jayawardana, M. A., Sheriff, M. H., Constantine, G. R., & Matthews, D. R. (2010). Prevalence of overweight and obesity in Sri Lankan adults. *Obesity Reviews*, 11(11), 751-756.
- Katulanda, P., Ranasinghe, P., Jayawardana, R., Sheriff, R., & Matthews, D. (2012). Metabolic syndrome among Sri Lankan adults: prevalence, patterns and correlates. *Diabetology & Metabolic Syndrome*, 4.
- Keller, H. H. (1993). Malnutrition in Institutionalized Elderly: How and Why? *Journal of the American Geriatrics Society*, 41(11), 1212-1218.
- Keller, H. H. (2006). The SCREEN I (Seniors in the Community: Risk Evaluation for Eating and Nutrition) index adequately represents nutritional risk. *Journal of Clinical Epidemiology*, 59(8), 836-841.
- Keysor, J. J. (2003). Does late-life physical activity or exercise prevent or minimize disablement? A critical review of the scientific evidence. *Am J Prev Med*, 25(3 Suppl 2), 129-136.

- Khaje-Bishak, Y., Payahoo, L., Pourghasem, B., & Asghari Jafarabadi, M. (2014). Assessing the Quality of Life in Elderly People and Related Factors in Tabriz, Iran. *Journal of Caring Sciences*, 3(4), 257-263.
- Kiesswetter, E., Pohlhausen, S., Uhlig, K., Diekmann, R., Lesser, S., Heseker, H., . . . Volkert, D. (2013). Malnutrition is related to functional impairment in older adults receiving home care. *The Journal of Nutrition, Health & Aging*, 17(4), 345-350.
- Kim, I. L. H., Chun, H., & Kwon, J.-W. (2011). Gender Differences in the Effect of Obesity on Chronic Diseases among the Elderly Koreans. *Journal of Korean Medical Science*, 26(2), 250-257.
- King, M. A., & Pappas-Rogich, M. (2011). Faith community nurses: implementing Healthy People standards to promote the health of elderly clients. *Geriatric Nursing (New York, N.Y.)*, 32(6), 459-464.
- King, S., Exley, J., Parks, S., Ball, S., Bienkowska-Gibbs, T., MacLure, C., . . . Marjanovic, S. (2016). The use and impact of quality of life assessment tools in clinical care settings for cancer patients, with a particular emphasis on brain cancer: insights from a systematic review and stakeholder consultations. *Quality of Life Research*, 25, 2245-2256.
- Kirchengast, S., & Haslinger, B. (2008). Gender differences in health-related quality of life among healthy aged and old-aged Austrians: cross-sectional analysis. *Gender Med*, 5(3), 270-278.
- Knox, T. A., Zafonte-Sanders, M., Fields-Gardner, C., Moen, K., Johansen, D., & Paton, N. (2003). Assessment of Nutritional Status, Body Composition, and Human Immunodeficiency Virus—Associated Morphologic Changes. *Clinical Infectious Diseases*, 36(Supplement_2), S63-S68.
- Koenig, H. G. (2012). Religion, Spirituality, and Health: The Research and Clinical Implications. *ISRN Psychiatry*, 2012, 278730.
- Kondrup, J., Rasmussen, H. H., Hamberg, O., & Stanga, Z. (2003). Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. *Clinical Nutrition*, 22(3), 321-336.
- Konerding, U., Elkhuisen, S. G., Faubel, R., Forte, P., Malmström, T., Pavi, E., & Janssen, M. B. (2014). The validity of the EQ-5D-3L items: an investigation with type 2 diabetes patients from six European countries. *Health and Quality of Life Outcomes*, 12(1), 181.

- Konerding, U., Elkhuizen, S. G., Faubel, R., Forte, P., Malmstrom, T., Pavi, E., & Janssen, M. F. (2014). The validity of the EQ-5D-3L items: an investigation with type 2 diabetes patients from six European countries. *Health Qual Life Outcomes*, 12, 181.
- Koren-Hakim, T., Weiss, A., HersHKovitz, A., Otzrateni, I., Anbar, R., Gross Nevo, R. F., . . . Beloosesky, Y. Comparing the adequacy of the MNA-SF, NRS-2002 and MUST nutritional tools in assessing malnutrition in hip fracture operated elderly patients. *Clinical Nutrition*.
- Kostka, J., Borowiak, E., & Kostka, T. (2014). Nutritional status and quality of life in different populations of older people in Poland. *European Journal of Clinical Nutrition*, 68(11), 1210-1215.
- Kowalski, K., Rhodes, R., Naylor, P. J., Tuokko, H., & MacDonald, S. (2012). Direct and indirect measurement of physical activity in older adults: a systematic review of the literature. *Int J Behav Nutr Phys Act*, 9, 148.
- Kruizenga, H. M., Seidell, J. C., de Vet, H. C. W., Wierdsma, N. J., & van Bokhorst-de van der Schueren, M. A. (2005). Development and validation of a hospital screening tool for malnutrition: the short nutritional assessment questionnaire (SNAQ). *Clinical Nutrition*, 24(1), 75-82.
- Krzyminska-Siemaszko, R., Mossakowska, M., Skalska, A., Klich-Raczka, A., Tobis, S., Szybalska, A., . . . Wieczorowska-Tobis, K. (2015). Social and economic correlates of malnutrition in Polish elderly population: the results of PolSenior study. *The Journal of Nutrition, Health & Aging*, 19(4), 397-402.
- Kularatna, S., Chen, G., Byrnes, J., & Scuffham, P. A. (2017). Mapping Sri Lankan EQ-5D-3L to EQ-5D-5L Value Sets. *Value Health Reg Issues*, 12, 20-23.
- Kularatna, S., Whitty, J. A., Johnson, N. W., Jayasinghe, R., & Scuffham, P. A. (2014). EQ-5D-3L Derived Population Norms for Health Related Quality of Life in Sri Lanka. *PLoS One*, 9(11), e108434.
- Kularatna, S., Whitty, J. A., Johnson, N. W., & Scuffham, P. A. (2013). Study protocol for valuing EQ-5D-3L and EORTC-8D health states in a representative population sample in Sri Lanka. *Health and Quality of Life Outcomes*, 11(1), 149.
- Kulathunga, M., Umayal, S., Somaratne, S., Srikanth, S., Kathriarachchi, S., & De Silva, K. (2010). Validation of the Geriatric Depression Scale for an elderly Sri Lankan clinic population. *Indian Journal of Psychiatry*, 52(3), 254-256.

- Kumar, S. G., Majumdar, A., & G, P. (2014). Quality of Life (QOL) and Its Associated Factors Using WHOQOL-BREF Among Elderly in Urban Puducherry, India. *J Clin Diagn Res*, 8(1), 54-57.
- Kunzmann, U., Little, T. D., & Smith, J. (2000). Is age-related stability of subjective well-being a paradox? Cross-sectional and longitudinal evidence from the Berlin Aging Study. *Psychol Aging*, 15(3), 511-526.
- Kuzuya, M., Izawa, S., Enoki, H., Okada, K., & Iguchi, A. (2007). Is serum albumin a good marker for malnutrition in the physically impaired elderly? *Clinical Nutrition*, 26(1), 84-90.
- Kuzuya, M., Kanda, S., Koike, T., Suzuki, Y., & Iguchi, A. (2005). Lack of correlation between total lymphocyte count and nutritional status in the elderly. *Clinical Nutrition*, 24(3), 427-432.
- Kvamme, J.-M., Olsen, J. A., Florholmen, J., & Jacobsen, B. K. (2011). Risk of malnutrition and health-related quality of life in community-living elderly men and women: The Tromsø study. *Quality of Life Research*, 20(4), 575-582.
- Lahiri, S., Biswas, A., Santra, S., & Lahiri, S. K. (2015). Assessment of nutritional status among elderly population in a rural area of West Bengal, India. *Int J Med Sci Public Health*, 4(4), 569-572.
- Lamy, M., Mojon, P., Kalykakis, G., Legrand, R., & Butz-Jorgensen, E. (1999). Oral status and nutrition in the institutionalized elderly. *Journal of Dentistry*, 27(6), 443-448.
- Lasheras, C., Patterson, A. M., Casado, C., & Fernandez, S. (2001). Effects of education on the quality of life, diet, and cardiovascular risk factors in an elderly Spanish community population. *Experimental Aging Research*, 27(3), 257-270.
- Leblanc, D. R., Schneider, M., Angele, P., Vollmer, G., & Docheva, D. (2017). The effect of estrogen on tendon and ligament metabolism and function. *The Journal of Steroid Biochemistry and Molecular Biology*, 172(Supplement C), 106-116.
- Lee, Tsai, A. C., & Wang, J. Y. (2015). Need-based nutritional intervention is effective in improving handgrip strength and Barthel Index scores of older people living in a nursing home: a randomized controlled trial. *International Journal of Nursing Studies*, 52(5), 904-912.
- Lemos, C. F., Rodrigues, M. P., & Veiga, J. R. P. (2015). Family income is associated with quality of life in patients with chronic kidney disease in the pre-dialysis phase: a cross sectional study. *Health and Quality of Life Outcomes*, 13, 202.

- Leopoldino, A. A., Diz, J. B., Martins, V. T., Henschke, N., Pereira, L. S., Dias, R. C., & Oliveira, V. C. (2016). Prevalence of low back pain in older Brazilians: a systematic review with meta-analysis. *Rev Bras Reumatol Engl Ed*, 56(3), 258-269.
- Leslie, W., & Hankey, C. (2015). Aging, Nutritional Status and Health. *Healthcare*, 3(3), 648-658.
- Li, C., Ford, E. S., Zhao, G., & Mokdad, A. H. (2009). Associations of health risk factors and chronic illnesses with life dissatisfaction among U.S. adults: The Behavioral Risk Factor Surveillance System, 2006. *Preventive Medicine*, 49(2), 253-259.
- Lima, M. G., Barros, M. B. d. A., César, C. L. G., Goldbaum, M., Carandina, L., & Ciconelli, R. M. (2009). Impact of chronic disease on quality of life among the elderly in the state of São Paulo, Brazil: a population-based study. *Revista Panamericana de Salud Pública*, 25, 314-321.
- Lin, W.-Y., Pi-Sunyer, F. X., Liu, C.-S., Li, T.-C., Li, C.-I., Huang, C.-Y., & Lin, C.-C. (2009). Betel Nut Chewing Is Strongly Associated With General and Central Obesity in Chinese Male Middle-aged Adults. *Obesity (Silver Spring, Md.)*, 17(6), 1247-1254.
- Lin, W. Y., Chiu, T. Y., Lee, L. T., Lin, C. C., Huang, C. Y., & Huang, K. C. (2008). Betel nut chewing is associated with increased risk of cardiovascular disease and all-cause mortality in Taiwanese men. *American Journal of Clinical Nutrition*, 87.
- Lin, X.-J., Lin, I. M., & Fan, S.-Y. (2013). Methodological issues in measuring health-related quality of life. *Tzu Chi Medical Journal*, 25(1), 8-12.
- Lindgren, B. (2016). *The Rise in Life Expectancy, Health Trends among the Elderly, and the Demand for Health and Social Care: Working Paper*.
- Lochs, H., Allison, S. P., Meier, R., Pirlich, M., Kondrup, J., Schneider, S., . . . Pichard, C. (2006). Introductory to the ESPEN Guidelines on Enteral Nutrition: Terminology, definitions and general topics. *Clinical Nutrition*, 25(2), 180-186.
- Lombardo, S., Perera, B., Beaudry, L., Grad, J., Maselko, J., & Østbye, T. (2013). Use of and attitudes toward tobacco and alcohol among adults in southern Sri Lanka. *The Southeast Asian journal of tropical medicine and public health*, 44(5), 880-899.

- Longworth, L., Yang, Y., Young, T., Mulhern, B., Hernandez Alava, M., Mukuria, C., . . . Brazier, J. (2014). Use of generic and condition-specific measures of health-related quality of life in NICE decision-making: a systematic review, statistical modelling and survey. *Health Technology Assessment*, 18(9), 1-224.
- López-Contreras, M. J., Torralba, C., Zamora, S., & Pérez-Llamas, F. (2012). Nutrition and prevalence of undernutrition assessed by different diagnostic criteria in nursing homes for elderly people. *Journal of Human Nutrition & Dietetics*, 25(3), 239-246.
- Lorig, K. R., Ritter, P. L., Dost, A., Plant, K., Laurent, D. D., & McNeil, I. (2008). The Expert Patients Programme online, a 1-year study of an Internet-based self-management programme for people with long-term conditions. *Chronic Illn*, 4(4), 247-256.
- Ma, X., & McGhee, S. M. (2013). A cross-sectional study on socioeconomic status and health-related quality of life among elderly Chinese. *BMJ Open*, 3(2).
- Mack, F., Schwahn, C., Feine, J. S., Mundt, T., Bernhardt, O., John, U., . . . Biffar, R. (2005). The impact of tooth loss on general health related to quality of life among elderly Pomeranians: results from the study of health in Pomerania (SHIP-O). *Int J Prosthodont*, 18(5), 414-419.
- Mackintosh, M. A., & Hankey, C. R. (2001). Reliability of a nutrition screening tool for use in elderly day hospitals. *J Hum Nutr Diet*, 14(2), 129-136.
- Madden, A. M., & Smith, S. (2016). Body composition and morphological assessment of nutritional status in adults: a review of anthropometric variables. *Journal of Human Nutrition & Dietetics*, 29(1), 7-25.
- Madeira, T., Peixoto-Plácido, C., Goulão, B., Mendonça, N., Alarcão, V., Santos, N., . . . Clara, J. G. (2016). National survey of the Portuguese elderly nutritional status: study protocol. *BMC Geriatrics*, 16(1), 139-139.
- Madhu , Ashok, N. C., & Balasubramanian, S. (2014). Multinomial Logistic Regression Predicted Probability Map to Visualize The Influence Of Io-Economic Factors on Breast Cancer Occurrence in Southern Karnasoctaka *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XL-8.
- Magarey, A., McKean, S., & Daniels, L. (2006). Evaluation of fruit and vegetable intakes of Australian adults: the National Nutrition Survey 1995. *Australian and New Zealand Journal of Public Health*, 30(1), 32-37.

- Maki, Y., Yamaguchi, T., Yamagami, T., Murai, T., Hachisuka, K., Miyamae, F., . . . Yamaguchi, H. (2014). The impact of subjective memory complaints on quality of life in community-dwelling older adults. *Psychogeriatrics*, 14(3), 175-181.
- Makwana, B. R., Agarwal, V., & Makwana, R. (2014). Comparative evaluation of nutritional status of elderly dentulous and completely edentulous patients wearing complete dentures. *Indian Journal of Community Health*(Supp 2), 250-257% V 226.
- Malafarina, V., Uriz-Otano, F., Gil-Guerrero, L., & Iniesta, R. (2013). The anorexia of ageing: physiopathology, prevalence, associated comorbidity and mortality. A systematic review. *Maturitas*, 74(4), 293-302.
- Mangen, M.-J. J., Bolkenbaas, M., Huijts, S. M., van Werkhoven, C. H., Bonten, M. J. M., & de Wit, G. A. (2017). Quality of life in community-dwelling Dutch elderly measured by EQ-5D-3L. *Health and Quality of Life Outcomes*, 15, 3.
- Mangen, M. J., Huijts, S. M., Bonten, M. J., & de Wit, G. A. (2017). The impact of community-acquired pneumonia on the health-related quality-of-life in elderly. *BMC Infect Dis*, 17(1), 208.
- Marieb, E. N., & Hoehn, K. (2013). *Human anatomy and physiology (9th ed.)*. San Francisco: Pearson Benjamin Cummings.
- Mastronuzzi, T., Paci, C., Portincasa, P., Montanaro, N., & Grattagliano, I. (2015). Assessing the nutritional status of older individuals in family practice: Evaluation and implications for management. *Clinical Nutrition*, 34(6), 1184-1188.
- Mathew, A., Das, D., Sampath, S., Vijayakumar, M., Ramakrishnan, N., & Ravishankar, S. (2016). Prevalence and correlates of malnutrition among elderly in an urban area in Coimbatore. *Indian Journal of Public Health*, 60(2), 112-117.
- Mathus-Vliegen, E. M. (2012). Obesity and the elderly. *Journal of Clinical Gastroenterology*, 46(7), 533-544.
- Mattes, R. D., Hollis, J., Hayes, D., & Stunkard, A. J. (2005). Appetite: measurement and manipulation misgivings. *Journal of the American Dietetic Association*, 105(5 Suppl 1), S87-97.
- Mazess, R. B., & Mather, W. (1974). Bone mineral content of North Alaskan Eskimos. *Am J Clin Nutr*, 27(9), 916-925.

- McAuley, E., Morris, K. S., Doerksen, S. E., Motl, R. W., Liang, H., White, S. M., . . . Rosengren, K. (2007). Effects of change in physical activity on physical function limitations in older women: mediating roles of physical function performance and self-efficacy. *J Am Geriatr Soc*, 55(12), 1967-1973.
- McCall, R., & Cotton, E. (2001). The validation of a nursing nutritional assessment tool for use on acute elderly wards. *J Hum Nutr Diet*, 14(2), 137-148.
- McNaughton, S. A., Crawford, D., Ball, K., & Salmon, J. (2012). Understanding determinants of nutrition, physical activity and quality of life among older adults: the Wellbeing, Eating and Exercise for a Long Life (WELL) study. *Health and Quality of Life Outcomes*, 10(1), 109.
- Mellor, D., Russo, S., McCabe, M. P., Davison, T. E., & George, K. (2008). Depression training program for caregivers of elderly care recipients: implementation and qualitative evaluation. *J Gerontol Nurs*, 34(9), 8-15; quiz 16-17.
- Menezes Rde, M., Andrade, M. V., Noronha, K. V., & Kind, P. (2015). EQ-5D-3L as a health measure of Brazilian adult population. *Qual Life Res*, 24(11), 2761-2776.
- Michael, R., & Bron, A. J. (2011). The ageing lens and cataract: a model of normal and pathological ageing. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366(1568), 1278-1292.
- Michael, Y. L., Colditz, G. A., Coakley, E., & Kawachi, I. (1999). Health behaviors, social networks, and healthy aging: cross-sectional evidence from the Nurses' Health Study. *Qual Life Res*, 8(8), 711-722.
- Miles, M., & Huberman, A. (1994). *Qualitative data analysis: an expanded sourcebook*. London: Sage.
- Miller, C. (2009). *Nursing for wellness in older adults (5th ed.)*. Philadelphia: PA: Wolters Kluwer/Lippincott Williams & Wilkins
- . Ministry of Justice and Law Reforms in Sri Lanka. *Protection of the Rights of the Elders Act*. (2000). Colombo: Ministry of Justice and Law Reforms in Sri Lanka
- Miranda, L. C. V., Soares, S. M., & Silva, P. A. B. (2016). Qualidade de vida e fatores associados em idosos de um Centro de Referência à Pessoa Idosa. *Ciência & Saúde Coletiva*, 21, 3533-3544.

- Mohammed, A. H., & Khaleel, M. A. W. (2016). Assessment of Elderly's Nutritional status in Geriatric Homes at Al-Furat Al-Awasat Governorates. *Kufa Journal for Nursing Sciences*, 6(2), 1-8.
- Mojon, P., Budtz-Jorgensen, E., & Rapin, C. H. (1999). Relationship between oral health and nutrition in very old people. *Age and Ageing*, 28(5), 463-468.
- Monteiro, C. A., Conde, W. L., Matsudo, S. M., Matsudo, V. R., Bonsenor, I. M., & Lotufo, P. A. (2003). A descriptive epidemiology of leisure-time physical activity in Brazil, 1996-1997. *Revista Panamericana de Salud Publica*, 14(4), 246-254.
- Montejano Lozoya, A. R., Ferrer Diego, R. M., Clemente Marín, G., Martínez-Alzamora, N., Sanjuan Quiles, Á., & Ferrer Ferrándiz, E. (2014). Factores asociados al riesgo nutricional en adultos mayores autónomos no institucionalizados. *Nutricion Hospitalaria*, 30, 858-869.
- Morgan, D. L. (1998). *The Focus Group Guide Book*. Thousand Oaks: SAGE Publications.
- Moriya, S., Tei, K., Muramatsu, T., Murata, A., Muramatsu, M., Notani, K., . . . Miura, H. (2010). Self-assessed Impairment of Masticatory Ability and Lower Serum Albumin Levels Among Community-dwelling Elderly Persons. *International Journal of Gerontology*, 4(2), 89-95.
- Moy, F. M., Chang, E. W. H., & Kee, K. W. (2011). Predictors of Handgrip Strength among the Free Living Elderly in Rural Pahang, Malaysia. *Iranian Journal of Public Health*, 40(4), 44-53.
- Moy, F. M., Darus, A., & Hairi, N. N. (2015). Predictors of handgrip strength among adults of a rural community in Malaysia. *Asia-Pacific Journal of Public Health*, 27(2), 176-184.
- Naidoo, I., Charlton, K. E., Esterhuizen, T., & Cassim, B. (2015). High risk of malnutrition associated with depressive symptoms in older South Africans living in KwaZulu-Natal, South Africa: a cross-sectional survey. *Journal of Health, Population and Nutrition*, 33(1), 19.
- Nakanishi, N., Hino, Y., Ida, O., Fukuda, H., Shinsho, F., & Tataru, K. (1999). Associations between self-assessed masticatory disability and health of community-residing elderly people. *Community Dentistry and Oral Epidemiology*, 27(5), 366-371.

- Nazemi, L., Skoog, I., Karlsson, I., Hosseini, S., Mohammadi, M. R., Hosseini, M., . . . Baikpour, M. (2015). Malnutrition, Prevalence and Relation to Some Risk Factors among Elderly Residents of Nursing Homes in Tehran, Iran. *Iranian Journal of Public Health*, 44(2), 218-227.
- Neelemaat, F., Kruizenga, H. M., de Vet, H. C., Seidell, J. C., Butterman, M., & van Bokhorst-de van der Schueren, M. A. (2008). Screening malnutrition in hospital outpatients. Can the SNAQ malnutrition screening tool also be applied to this population? *Clinical Nutrition*, 27(3), 439-446.
- Neelemaat, F., Meijers, J., Kruizenga, H., van Ballegooijen, H., & van Bokhorst-de van der Schueren, M. (2011). Comparison of five malnutrition screening tools in one hospital inpatient sample. *Journal of Clinical Nursing*, 20(15-16), 2144-2152.
- Netuveli, G., & Blane, D. (2008). Quality of life in older ages. *Brit Med Bull*, 85.
- Nguyen, T. V. (2017). Difference in quality of life and associated factors among the elderly in rural Vietnam. 2017, 58(1), 9.
- Nor Azian, M. Z., Suzana, S., & Romzi, M. A. (2014). Sensitivity, Specificity, Predictive Value and Inter-Rater Reliability of Malnutrition Screening Tools in Hospitalised Adult Patients. *Malaysian Journal of Nutrition*, 20(2), 209-219.
- Nord, E. (1992). Methods for quality adjustment of life years. *Soc Sci Med*, 34(5), 559-569.
- Nordenram, G., Ljunggren, G., & Cederholm, T. (2001). Nutritional status and chewing capacity in nursing home residents. *Aging*, 13(5), 370-377.
- Norman, K., Stobaus, N., Gonzalez, M. C., Schulzke, J. D., & Pirlich, M. (2011). Hand grip strength: outcome predictor and marker of nutritional status. *Clinical Nutrition*, 30(2), 135-142.
- Noro, A., & Aro, S. (1996). Health-related quality of life among the least dependent institutional elderly compared with the non-institutional elderly population. *Quality of Life Research*, 5(3), 355-366.
- Nowson, C., & O'Connell, S. (2015). Protein Requirements and Recommendations for Older People: A Review. *Nutrients*, 7(8), 6874-6899.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory*: McGraw - Hill.

- Nygaard, H. A. (2008). Measuring body mass index (BMI) in nursing home residents: the usefulness of measurement of arm span. *Scandinavian Journal of Primary Health Care*, 26(1), 46-49.
- Ohayon, M. M., & Roth, T. (2003). Place of chronic insomnia in the course of depressive and anxiety disorders. *Journal of Psychiatric Research*, 37.
- Olfson, M., Shea, S., Feder, A., Fuentes, M., Nomura, Y., Gameroff, M., & Weissman, M. M. (2000). Prevalence of anxiety, depression, and substance use disorders in an urban general medicine practice. *Archives of Family Medicine*, 9(9), 876-883.
- Oman, D., Reed, D., & Ferrara, A. (1999). Do elderly women have more physical disability than men do? *American Journal of Epidemiology*, 150(8), 834-842.
- Omran, M. L., & Morley, J. E. (2000). Assessment of protein energy malnutrition in older persons, part I: History, examination, body composition, and screening tools. *Nutrition*, 16(1), 50-63.
- Ongan, D., & Rakicioglu, N. (2015). Nutritional status and dietary intake of institutionalized elderly in Turkey: a cross-sectional, multi-center, country representative study. *Archives of Gerontology and Geriatrics*, 61(2), 271-276.
- Ongan, D., & Rakıcıoğlu, N. (2015). Nutritional status and dietary intake of institutionalized elderly in Turkey: A cross-sectional, multi-center, country representative study. *Archives of Gerontology and Geriatrics*, 61(2), 271-276.
- Onishi, J., Suzuki, Y., Umegaki, H., Endo, H., Kawamura, T., & Iguchi, A. (2006). A comparison of depressive mood of older adults in a community, nursing homes, and a geriatric hospital: factor analysis of Geriatric Depression Scale. *J Geriatr Psychiatry Neurol*, 19(1), 26-31.
- Onunkwor, O. F., Al-Dubai, S. A. R., George, P. P., Arokiasamy, J., Yadav, H., Barua, A., & Shuaibu, H. O. (2016). A cross-sectional study on quality of life among the elderly in non-governmental organizations' elderly homes in Kuala Lumpur. *Health and Quality of Life Outcomes*, 14, 6.
- Orfila, F., Ferrer, M., Lamarca, R., Tebe, C., Domingo-Salvany, A., & Alonso, J. (2006). Gender differences in health-related quality of life among the elderly: the role of objective functional capacity and chronic conditions. *Soc Sci Med*, 63(9), 2367-2380.
- Ortega, R. M., Perez-Rodrigo, C., & Lopez-Sobaler, A. M. (2015). Dietary assessment methods: dietary records. *Nutricion Hospitalaria*, 31 Suppl 3, 38-45.

- Paiva, M. H. P. d., Pegorari, M. S., Nascimento, J. S., & Santos, Á. d. S. (2016). Fatores associados à qualidade de vida de idosos comunitários da macrorregião do Triângulo do Sul, Minas Gerais, Brasil. *Ciência & Saúde Coletiva*, 21, 3347-3356.
- Paker-Eichelkraut, H. S., Bai-Habelski, J. C., Overzier, S., Strathmann, S., Heseker, H., Stehle, P., & Lesser, S. (2013). Nutritional Status and Related Factors in Elderly Nursing Home Residents: Comparative Cross-Sectional Study in Migrants and Native Germans. *Journal of Nutrition in Gerontology and Geriatrics*, 32(4), 330-342.
- Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health*, 42(5), 533-544.
- Pan, B., Yuan, Z., Zou, J., Cook, D. M., & Yang, W. (2016). Elderly hospitalization and the New-type Rural Cooperative Medical Scheme (NCMS) in China: multi-stage cross-sectional surveys of Jiangxi province. *BMC Health Services Research*, 16(1), 436.
- Pan, X. I., Chahal, J. K., & Marie Ward, R. (2016). Quality of urban life among older adults in the world major metropolises: a cross-cultural comparative study. *Ageing and Society*, 1-21.
- Parkin, D., Rice, N., & Devlin, N. (2010). Statistical analysis of EQ-5D profiles: does the use of value sets bias inference? *Med Decis Making*, 30(5), 556-565.
- Paterson, D. H., Jones, G. R., & Rice, C. L. (2007). Ageing and physical activity: evidence to develop exercise recommendations for older adults. This article is part of a supplement entitled Advancing physical activity measurement and guidelines in Canada: a scientific review and evidence-based foundation for the future of Canadian physical activity guidelines co-published by Applied Physiology, Nutrition, and Metabolism and the Canadian Journal of Public Health. It may be cited as Appl. Physiol. Nutr. Metab. 32(Suppl. 2E) or as Can. J. Public Health 98(Suppl. 2). *Applied Physiology, Nutrition, and Metabolism*, 32(S2E), S69-S108.
- Patton, M. Q. (1990). *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*: Sage Publications.
- Pedersen, B. K., & Saltin, B. (2006). Evidence for prescribing exercise as therapy in chronic disease. *Scandinavian Journal of Medicine and Science in Sports*, 16 Suppl 1, 3-63.

- Perera, B., Fonseka, P., Ekanayake, R., & Lelwala, E. (2005). Smoking in adults in Sri Lanka: prevalence and attitudes. *Asia-Pacific Journal of Public Health*, 17(1), 40-45.
- Perera, W., Mwanri, L., Seneviratne, R. D. A., & Fernando, T. (2013). Family planning services in Sri Lanka: Clients' nonmedical expectations and the health systems responsiveness. 2013, 2(1), 6.
- Perez Rodrigo, C., Aranceta, J., Salvador, G., & Varela-Moreiras, G. (2015). Food frequency questionnaires. *Nutricion Hospitalaria*, 31 Suppl 3, 49-56.
- Perneger, T. V., Combescure, C., & Courvoisier, D. S. (2010). General population reference values for the French version of the EuroQol EQ-5D health utility instrument. *Value Health*, 13(5), 631-635.
- Peruzza, S., Sergi, G., Vianello, A., Pisent, C., Tiozzo, F., Manzan, A., . . . Enzi, G. (2003). Chronic obstructive pulmonary disease (COPD) in elderly subjects: impact on functional status and quality of life. *Respir Med*, 97(6), 612-617.
- Phillips, M. B., Foley, A. L., Barnard, R., Isenring, E. A., & Miller, M. D. (2010). Nutritional screening in community-dwelling older adults: a systematic literature review. *Asia Pacific Journal of Clinical Nutrition*, 19(3), 440-449.
- Pieterse, S., Manandhar, M., & Ismail, S. (2002). The association between nutritional status and handgrip strength in older Rwandan refugees. *European Journal of Clinical Nutrition*, 56(10), 933-939.
- Pietersma, S., de Vries, M., & van den Akker-van Marle, M. E. (2014). Domains of quality of life: results of a three-stage Delphi consensus procedure among patients, family of patients, clinicians, scientists and the general public. *Quality of Life Research*, 23(5), 1543-1556.
- Pilgrim, A., Robinson, S., Sayer, A. A., & Roberts, H. (2015). An overview of appetite decline in older people. *Nursing Older People*, 27(5), 29-35.
- Porter Starr, K. N., McDonald, S. R., & Bales, C. W. (2015). Nutritional Vulnerability in Older Adults: A Continuum of Concerns. *Current nutrition reports*, 4(2), 176-184.
- Portero-McLellan, K. C., Staudt, C., Silva, F. R., Delbue Bernardi, J. L., Baston Frenhani, P., & Leandro Mehri, V. A. (2010). The use of calf circumference measurement as an anthropometric tool to monitor nutritional status in elderly inpatients. *The Journal of Nutrition, Health & Aging*, 14(4), 266-270.

- Poulia, K. A., Yannakoulia, M., Karageorgou, D., Gamaletsou, M., Panagiotakos, D. B., Sipsas, N. V., & Zampelas, A. (2012). Evaluation of the efficacy of six nutritional screening tools to predict malnutrition in the elderly. *Clinical Nutrition, 31*(3), 378-385.
- Price, G. M., Uauy, R., Breeze, E., Bulpitt, C. J., & Fletcher, A. E. (2006). Weight, shape, and mortality risk in older persons: elevated waist-hip ratio, not high body mass index, is associated with a greater risk of death. *American Journal of Clinical Nutrition, 84*(2), 449-460.
- Prince, M., Bryce, R., Albanese, E., Wimo, A., Ribeiro, W., & Ferri, C. P. (2013). The global prevalence of dementia: a systematic review and metaanalysis. *Alzheimers Dement, 9*(1), 63-75.e62.
- Prince, M. J., Wu, F., Guo, Y., Gutierrez Robledo, L. M., O'Donnell, M., Sullivan, R., & Yusuf, S. (2015). The burden of disease in older people and implications for health policy and practice. *Lancet, 385*(9967), 549-562.
- Pyne, J. M., Patterson, T. L., Kaplan, R. M., Gillin, J. C., Koch, W. L., & Grant, I. (1997a). Assessment of the quality of life of patients with major depression. *Psychiatr Serv, 48*(2), 224-230.
- Pyne, J. M., Patterson, T. L., Kaplan, R. M., Gillin, J. C., Koch, W. L., & Grant, I. (1997b). Assessment of the quality of life of patients with major depression. *Psychiatric Services, 48*.
- Quail, J. M., Wolfson, C., & Lippman, A. (2011). Unmet need for assistance to perform activities of daily living and psychological distress in community-dwelling elderly women. *Can J Aging, 30*(4), 591-602.
- Rahimi, Z., Romi, F., Hedayatkordestani, S. H., Zh, H., & Hasanzadeh, H. (2012). The study of malnutrition in elderly people of Kurdistan in 2011. *Kidney Research and Clinical Practice, 31*(2), A67.
- Rajasi, R. S., Mathew, T., Nujum, Z. T., Anish, T. S., Ramachandran, R., & Lawrence, T. (2016). Quality of life and sociodemographic factors associated with poor quality of life in elderly women in Thiruvananthapuram, Kerala. *Indian Journal of Public Health, 60*(3), 210-215.
- Ranasinghe, C. D., Ranasinghe, P., Jayawardena, R., & Misra, A. (2013). Physical activity patterns among South-Asian adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity, 10*(1), 116.

- Ranasinghe, P., Jayawardana, M. A. N. A. A. D., Constantine, G. R., Sheriff, M. H. R., Matthews, D. R., & Katulanda, P. (2011). Patterns and correlates of adult height in Sri Lanka. *Economics and Human Biology*, 9(1), 23-29.
- Rasheed, S., & Woods, R. T. (2014). An investigation into the association between nutritional status and quality of life in older people admitted to hospital. *J Hum Nutr Diet*, 27(2), 142-151.
- Rathnayake, K., Madushani, P., & Silva, K. (2012). Use of dietary diversity score as a proxy indicator of nutrient adequacy of rural elderly people in Sri Lanka. *BMC Research Notes*, 5.
- Rathnayake, K. M., Wimalathunga, M., Weech, M., Jackson, K. G., & Lovegrove, J. A. (2015). High prevalence of undernutrition and low dietary diversity in institutionalised elderly living in Sri Lanka. *Public Health Nutrition*, 18(15), 2874-2880.
- Rathnayake, S., & Siop, S. (2015). Quality of life and its determinants among older people living in the rural community in Sri Lanka. *Indian Journal of Gerontology*, 29(2), 131-153.
- Rémond, D., Shahr, D. R., Gille, D., Pinto, P., Kachal, J., Peyron, M.-A., . . . Vergères, G. (2015). Understanding the gastrointestinal tract of the elderly to develop dietary solutions that prevent malnutrition. *Oncotarget*, 6(16), 13858-13898.
- Revicki, D. A. (1989). Health-related quality of life in the evaluation of medical therapy for chronic illness. *J Fam Pract*, 29(4), 377-380.
- Ribeiro, R. S., Rosa, M. I., & Bozzetti, M. C. (2011). Malnutrition and associated variables in an elderly population of Criciúma, SC. *Revista da Associação Médica Brasileira*, 57(1), 56-61.
- Richard A. Krueger, & Casey, M. A. (2009). *Focus Groups: A Practical Guide for Applied Research*: Sage.
- Rodrigues, Espinosa, M. M., Melo, C. D., Perracini, M. R., Fett, W. C. R., & Fett, C. A. (2014). New values anthropometry for classification of nutritional status in the elderly. *The Journal of Nutrition, Health & Aging*, 1-7.
- Rodrigues, S. M., Oliveira, A. C., Vargas, A. M., Moreira, A. N., & EF, E. F. (2012). Implications of edentulism on quality of life among elderly. *International Journal of Environmental Research and Public Health*, 9(1), 100-109.

- Rodrigues, S. M., Oliveira, A. C., Vargas, A. M. D., Moreira, A. N., & e Ferreira, E. F. (2012). Implications of Edentulism on Quality of Life among Elderly. *International Journal of Environmental Research and Public Health*, 9(1), 100-109.
- Roman-Blas, J. A., Castañeda, S., Largo, R., & Herrero-Beaumont, G. (2009). Osteoarthritis associated with estrogen deficiency. *Arthritis Research & Therapy*, 11(5), 241.
- Romero-Ortuno, R., Casey, A. M., Cunningham, C. U., Squires, S., Prendergast, D., Kenny, R. A., & Lawlor, B. A. (2011). Psychosocial and functional correlates of nutrition among community-dwelling older adults in Ireland. *The Journal of Nutrition, Health & Aging*, 15(7), 527-531.
- Rose, D. (1999). Economic determinants and dietary consequences of food insecurity in the United States. *J Nutr*, 129(2S Suppl), 517s-520s.
- Rubenstein, L. Z., Harke, J. O., Salvà, A., Guigoz, Y., & Vellas, B. (2011). Screening for undernutrition in geriatric practice: Developing the short-form mini-nutritional assessment (MNA-SF). *Journals of Gerontology. Series A: Biological Sciences and Medical Sciences*, 56.
- Ruidavets, J. B., Bataille, V., Dallongeville, J., Simon, C., Bingham, A., Amouyel, P., . . . Ferrieres, J. (2004). Alcohol intake and diet in France, the prominent role of lifestyle. *European Heart Journal*, 25(13), 1153-1162.
- Runcan, P. L. (2012). Elderly institutionalization and depression. *Procedia - Social and Behavioral Sciences*, 33(Supplement C), 109-113.
- Saintrain, M. V., & de Souza, E. H. (2012). Impact of tooth loss on the quality of life. *Gerodontology*, 29(2), e632-636.
- Sale, J. E., Gignac, M., & Hawker, G. (2006). How "bad" does the pain have to be? A qualitative study examining adherence to pain medication in older adults with osteoarthritis. *Arthritis and Rheumatism*, 55(2), 272-278.
- Samaraweera, D., & Maduwage, S. (2016). Meeting the current and future health-care needs of Sri Lanka's ageing population. *WHO South East Asia J Public Health*, 5(2), 96-101.
- Sansnee Jirojwong, Johnson, M., & Welch, A. (2014). *Research methods in nursing and midwifery : pathways to evidence-based practice*. South Melbourne, Vic: Oxford University Press.

- Santos, A. L. M. d., Amaral, T. M. d. S. P. F. d., & Borges, N. P. G. F. B. (2015). Undernutrition and associated factors in a Portuguese older adult community. *Revista de Nutrição*, 28, 231-240.
- Santos, G. V., Barreto, E. C., Santos, J. F. F., & Marchini, L. (2014). Alcohol and Quality of Life Among Social Groups for the Elderly in São José dos Campos, Brazil. *Applied Research in Quality of Life*, 9(2), 285-293.
- Satariano, W. A., Guralnik, J. M., Jackson, R. J., Marottoli, R. A., Phelan, E. A., & Prohaska, T. R. (2012). Mobility and Aging: New Directions for Public Health Action. *American Journal of Public Health*, 102(8), 1508-1515.
- Satghare, P., Chong, S. A., Vaingankar, J., Picco, L., Abdin, E., Chua, B. Y., & Subramaniam, M. (2016). Prevalence and Correlates of Pain in People Aged 60 Years and above in Singapore: Results from the WiSE Study. *Pain Research & Management*, 2016, 7852397.
- Schilp, J., Wijnhoven, H. A., Deeg, D. J., & Visser, M. (2011). Early determinants for the development of undernutrition in an older general population: Longitudinal Aging Study Amsterdam. *British Journal of Nutrition*, 106(5), 708-717.
- Schluskel, M. M., dos Anjos, L. A., de Vasconcellos, M. T., & Kac, G. (2008). Reference values of handgrip dynamometry of healthy adults: a population-based study. *Clinical Nutrition*, 27(4), 601-607.
- Schneider, Z. (2013). *Nursing & midwifery research : methods and appraisal for evidence-based practice / Zevia Schneider, Dean Whitehead, Doug Elliott ; [ancillary authors], Geri Lobiondo-Wood, Judith Haber*. Sydney: Mosby Elsevier.
- Schols, J. M., Crebolder, H. F., & van Weel, C. (2004). Nursing home and nursing home physician: the Dutch experience. *J Am Med Dir Assoc*, 5(3), 207-212.
- Schrader, E., Baumgartel, C., Gueldenzoph, H., Stehle, P., Uter, W., Sieber, C. C., & Volkert, D. (2014). Nutritional status according to Mini Nutritional Assessment is related to functional status in geriatric patients--independent of health status. *The Journal of Nutrition, Health & Aging*, 18(3), 257-263.
- Serra-Prat, M., Palomera, M., Gomez, C., Sar-Shalom, D., Saiz, A., Montoya, J. G., . . . Clave, P. (2012). Oropharyngeal dysphagia as a risk factor for malnutrition and lower respiratory tract infection in independently living older persons: a population-based prospective study. *Age and Ageing*, 41(3), 376-381.

- Setiati, S., Harimurti, K., Dewiasty, E., & Istanti, R. (2011). Predictors and scoring system for health-related quality of life in an Indonesian community-dwelling elderly population. *Acta Medica Indonesiana*, 43(4), 237-242.
- Sharma, G., & Goodwin, J. (2006). Effect of aging on respiratory system physiology and immunology. *Clinical Interventions in Aging*, 1(3), 253-260.
- Shaw, C., Fleuret, C., Pickard, J. M., Mohammed, K., Black, G., & Wedlake, L. (2015). Comparison of a novel, simple nutrition screening tool for adult oncology inpatients and the Malnutrition Screening Tool (MST) against the Patient-Generated Subjective Global Assessment (PG-SGA). *Supportive Care in Cancer*, 23(1), 47-54.
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*(22), 63-75.
- Shrivastava, S., Shrivastava, P., & Ramasamy, J. (2014). Assessment of nutritional status in the community and clinical settings. *Journal of Medical Sciences*, 34(5), 211-213.
- Shronts, E. P. (1993). Basic concepts of immunology and its application to clinical nutrition. *Nutrition in Clinical Practice*, 8(4), 177-183.
- Siddhisena, K. A. P. (2014). Ageing population and elderly care in Sri Lanka. School of Demography ANU College of Arts & Social Sciences: Australian National University.
- Sieber, C. C. (2006a). Nutritional screening tools--How does the MNA compare? Proceedings of the session held in Chicago May 2-3, 2006 (15 Years of Mini Nutritional Assessment). *The Journal of Nutrition, Health & Aging*, 10(6), 488-492; discussion 492-484.
- Sieber, C. C. (2006b). Nutritional screening tools – how does the MNA compare? *The Journal of Nutrition, Health & Aging*, 6.
- Silveira, T. M. G., de Sousa, J. B., Stringhini, M. L. F., Freitas, A. T. V. d. S., & Melo, P. G. (2014). NUTRITIONAL ASSESSMENT AND HAND GRIP STRENGTH OF CANDIDATES FOR SURGERY. *Arquivos Brasileiros de Cirurgia Digestiva : ABCD = Brazilian Archives of Digestive Surgery*, 27(2), 104-108.
- Simon Schreck, J. (2014). Reflections on Aging: Normal Developmental Process or Disease? *Perspectives on Gerontology*, 19(1), 44-46.

- Simsek, H., Meseri, R., Sahin, S., & Ucku, R. (2013). Prevalence of food insecurity and malnutrition, factors related to malnutrition in the elderly: A community-based, cross-sectional study from Turkey. *European Geriatric Medicine*, 4(4), 226-230.
- Sivashankar, J.T. & Thalagala, N., (2017). Effectiveness of a homemade supplementary food in the management of severe acute malnutrition in 2-5 year old children in the Kopay MOH area. *Journal of the Postgraduate Institute of Medicine*. 4(1), pp.E44 1–E4412.
- Sivertsen, H., Bjorklof, G. H., Engedal, K., Selbaek, G., & Helvik, A. S. (2015). Depression and Quality of Life in Older Persons: A Review. *Dementia and Geriatric Cognitive Disorders*, 40(5-6), 311-339.
- Slee, A., Birch, D., & Stokoe, D. (2015). A comparison of the malnutrition screening tools, MUST, MNA and bioelectrical impedance assessment in frail older hospital patients. *Clinical Nutrition*, 34(2), 296-301.
- Söderström, L., Thors Adolfsson, E., Rosenblad, A., Frid, H., Saletti, A., & Bergkvist, L. (2013). Mealtime habits and meal provision are associated with malnutrition among elderly patients admitted to hospital. *Clinical Nutrition*, 32(2), 281-288.
- Somrongthong, R., Hongthong, D., Wongchalee, S., & Wongtongkam, N. (2016). The Influence of Chronic Illness and Lifestyle Behaviors on Quality of Life among Older Thais. *BioMed Research International*, 2016, 7.
- Sparre-Sørensen, M., & Kristensen, G. N. (2016). Malnutrition related deaths. *Clinical Nutrition ESPEN*. Spirituality and aging. (2010). *Aging Health*, 6(6), 749-769.
- Springstroh, K. A., Gal, N. J., Ford, A. L., Whiting, S. J., & Dahl, W. J. (2016). Evaluation of Handgrip Strength and Nutritional Risk of Congregate Nutrition Program Participants in Florida. *Journal of Nutrition in Gerontology and Geriatrics*, 35(3), 193-208.
- Sri Lanka Addressing the Needs of an Aging Population* (2008). World Bank.
- Srisilapanan, P., Korwanich, N., Jienmaneechotchai, S., Dalodom, S., Veerachai, N., Vejvitee, W., & Roseman, J. (2016). Estimate of Impact on the Oral Health-Related Quality of Life of Older Thai People by the Provision of Dentures through the Royal Project. *International Journal of Dentistry*, 2016, 7. d
- Steffl, M., Bohannon, R. W., Petr, M., Kohlikova, E., & Holmerova, I. (2016). Alcohol consumption as a risk factor for sarcopenia - a meta-analysis. *BMC Geriatr*, 16, 99.

- Steiner, J. L., & Lang, C. H. (2014). Alcohol impairs skeletal muscle protein synthesis and mTOR signaling in a time-dependent manner following electrically stimulated muscle contraction. *J Appl Physiol* (1985), 117(10), 1170-1179.
- Strait, J. B., & Lakatta, E. G. (2012). Aging-associated cardiovascular changes and their relationship to heart failure. *Heart Failure Clinics*, 8(1), 143-164.
- Strickland, S. S., Veena, G. V., Houghton, P. J., Stanford, S. C., & Kurpad, A. V. (2003). Areca nut, energy metabolism and hunger in Asian men. *Annals of Human Biology*, 30(1), 26-52.
- Sullivan, D. H., Bopp, M. M., & Roberson, P. K. (2002). Protein-energy Undernutrition and Life-threatening Complications Among the Hospitalized Elderly. *Journal of General Internal Medicine*, 17(12), 923-932.
- Sultana, T., Karim, M. N., Ahmed, T., & Hossain, M. I. (2015). Assessment of Under Nutrition of Bangladeshi Adults Using Anthropometry: Can Body Mass Index Be Replaced by Mid-Upper-Arm-Circumference? *PloS One*, 10(4), e0121456.
- Sumanth, S., Bhat, K. M., & Bhat, G. S. (2008). Periodontal health status in pan chewers with or without the use of tobacco. *Oral Health Prev Dent*, 6(3), 223-229.
- Sura, L., Madhavan, A., Carnaby, G., & Crary, M. A. (2012). Dysphagia in the elderly: management and nutritional considerations. *Clinical Interventions in Aging*, 7, 287-298.
- Tabloski, P. (2014). Gerontological nursing (3rd ed). Upper Saddle River: NJ: Pearson Education.
- Taket, A. (2013). *The use of mixed methods in health research*. In Liamputtong, Pranee (ed), *Research methods in health*, . Melbourne, Vic: Oxford University Press
- Tang, M., McCabe, G. P., Elango, R., Pencharz, P. B., Ball, R. O., & Campbell, W. W. (2014). Assessment of protein requirement in octogenarian women with use of the indicator amino acid oxidation technique. *Am J Clin Nutr*, 99(4), 891-898.
- Tarqui-Mamani, C., Alvarez-Dongo, D., Espinoza-Oriundo, P., & Gomez-Guizado, G. (2014). Estado nutricional asociado a características sociodemográficas en el adulto mayor peruano. *Revista Peruana de Medicina Experimental y Salud Publica*, 31, 467-472.

- Teng, E., Tassniyom, K., & Lu, P. H. (2012). Reduced quality-of-life ratings in mild cognitive impairment: analyses of subject and informant responses. *Am J Geriatr Psychiatry*, 20(12), 1016-1025.
- Tessfamichael, D., Gete, A. A., & Wassie, M. M. (2014). High Prevalence of Undernutrition among Elderly People in Northwest Ethiopia: A Cross Sectional Study. *Journal of Nutrition Health Food Science*, 2(4), 1-5.
- Tomioka, K., Iwamoto, J., Saeki, K., & Okamoto, N. (2011). Reliability and Validity of the International Physical Activity Questionnaire (IPAQ) in Elderly Adults: The Fujiwara-kyo Study. *Journal of Epidemiology*, 21(6), 459-465.
- Tonstad, S., Butler, T., Yan, R., & Fraser, G. E. (2009). Type of vegetarian diet, body weight, and prevalence of type 2 diabetes. *Diabetes Care*, 32(5), 791-796.
- Torres, M. J., Dorigny, B., Kuhn, M., Berr, C., Barberger-Gateau, P., & Letenneur, L. (2014). Nutritional Status in Community-Dwelling Elderly in France in Urban and Rural Areas. *PloS One*, 9(8), e105137.
- Tsai, A. C., Chang, T.-L., Wang, Y.-C., & Liao, C.-Y. (2010). Population-Specific Short-Form Mini Nutritional Assessment with Body Mass Index or Calf Circumference Can Predict Risk of Malnutrition in Community-Living or Institutionalized Elderly People in Taiwan. *Journal of the American Dietetic Association*, 110(9), 1328-1334.
- Tsai, A. C., & Chang, T. L. (2011). Association of dental prosthetic condition with food consumption and the risk of malnutrition and follow-up 4-year mortality risk in elderly Taiwanese. *The Journal of Nutrition, Health & Aging*, 15(4), 265-270.
- Tsai, H.-J., & Chang, F.-K. (2017). Associations between body mass index, mid-arm circumference, calf circumference, and functional ability over time in an elderly Taiwanese population. *PloS One*, 12(4), e0175062.
- Tuso, P. J., Ismail, M. H., Ha, B. P., & Bartolotto, C. (2013). Nutritional Update for Physicians: Plant-Based Diets. *The Permanente Journal*, 17(2), 61-66.
- Uchmanowicz, B., Panaszek, B., Uchmanowicz, I., & Rosińczuk, J. (2016). Sociodemographic factors affecting the quality of life of patients with asthma. *Patient preference and adherence*, 10, 345-354.
- UN. (2015). United Nations World Population Ageing.

- Vagetti, G. C., Barbosa Filho, V. C., Moreira, N. B., Oliveira, V. d., Mazzardo, O., & Campos, W. d. (2014). Association between physical activity and quality of life in the elderly: a systematic review, 2000-2012. *Revista Brasileira de Psiquiatria*, 36, 76-88.
- van Bokhorst-de van der Schueren, M. A., Guaitoli, P. R., Jansma, E. P., & de Vet, H. C. (2014). A systematic review of malnutrition screening tools for the nursing home setting. *Journal of the American Medical Directors Association*, 15(3), 171-184.
- van Bokhorst-de van der Schueren, M. A., Lonterman-Monasch, S., de Vries, O. J., Danner, S. A., Kramer, M. H., & Muller, M. (2013). Prevalence and determinants for malnutrition in geriatric outpatients. *Clinical Nutrition*, 32(6), 1007-1011.
- van der Pols-Vijlbrief, R., Wijnhoven, H. A., Schaap, L. A., Terwee, C. B., & Visser, M. (2014). Determinants of protein-energy malnutrition in community-dwelling older adults: a systematic review of observational studies. *Ageing Res Rev*, 18, 112-131.
- Van Eyken, E., Van Camp, G., & Van Laer, L. (2007). The complexity of age-related hearing impairment: contributing environmental and genetic factors. *Audiol Neurotol*, 12(6), 345-358.
- van Gool, C. H., Kempen, G. I., Penninx, B. W., Deeg, D. J., Beekman, A. T., & van Eijk, J. T. (2003). Relationship between changes in depressive symptoms and unhealthy lifestyles in late middle aged and older persons: results from the Longitudinal Aging Study Amsterdam. *Age Ageing*, 32(1), 81-87.
- Vanderwee, K., Clays, E., Bocquaert, I., Gobert, M., Folens, B., & Defloor, T. (2010). Malnutrition and associated factors in elderly hospital patients: a Belgian cross-sectional, multi-centre study. *Clinical Nutrition*, 29(4), 469-476.
- Vandewoude, M., & VanGossum, A. (2013). Nutritional screening strategy in nonagenarians: the value of the MNA-SF (mini nutritional assessment short form) in NutriAction. *The Journal of Nutrition, Health & Aging*, 17.
- Vassallo, M. F., & Camargo, C. A., Jr. (2010). Potential mechanisms for the hypothesized link between sunshine, vitamin D, and food allergy in children. *Journal of Allergy and Clinical Immunology*, 126(2), 217-222.
- Vedantam, A., Subramanian, V., Rao, N. V., & John, K. R. (2010). Malnutrition in free-living elderly in rural south India: prevalence and risk factors. *Pub Health Nutr*, 9.

- Vedavalli Sachithanathan, Mohammed Buzgeia, Fadwa Awad , Rema Omran , & Faraj, A. (2012). Impact of nutrition education on the nutritional status. *Nutrition & Food Science*, 42(3), 173-180.
- Vellas, B., Guigoz, Y., Garry, P. J., Nourhashemi, F., Bennahum, D., Lauque, S., & Albarede, J. L. (1999). The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. *Nutrition*, 15(2), 116-122.
- Verbrugge, M., Beeckman, D., Van Hecke, A., Vanderwee, K., Van Herck, K., Clays, E., . . . Verhaeghe, S. (2013). Malnutrition and associated factors in nursing home residents: a cross-sectional, multi-centre study. *Clinical Nutrition*, 32(3), 438-443.
- Vink, D., Aartsen, M. J., Comijs, H. C., Heymans, M. W., Penninx, B. W., Stek, M. L., . . . Beekman, A. T. (2009). Onset of anxiety and depression in the aging population: comparison of risk factors in a 9-year prospective study. *American Journal of Geriatric Psychiatry*, 17(8), 642-652.
- Vithana, C., Linhart, C., Taylor, R., Morrell, S., & Azim, S. (2014). Trends in Sri Lankan cause-specific adult mortality 1950–2006. *BMC Public Health*, 14(1), 644.
- Vitorino, L. M., Paskulin, L. M., & Viana, L. A. (2012). Quality of life among older adults resident in long-stay care facilities. *Revista Latino-Americana de Enfermagem*, 20(6), 1186-1195.
- Wagner, P. R., Ascenço, S., & Wibeling, L. M. (2014). Hand grip strength in the elderly with upper limbs pain. *Revista Dor*, 15, 182-185.
- Walling, A. D., & Dickson, G. M. (2012). Hearing loss in older adults. *Am Fam Physician*, 85(12), 1150-1156.
- Wang, C., Chan, C., & Chi, I. (2014). Overview of Quality of Life Research in Older People with Visual Impairment. . *Advances in Aging Research*, 3, 79-84.
- Wang, T. F., Chen, Y. Y., Liou, Y. M., & Chou, C. (2014). Investigating tooth loss and associated factors among older Taiwanese adults. *Archives of Gerontology and Geriatrics*, 58(3), 446-453.
- Ware, J. E., Jr., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care*, 30(6), 473-483.

- Watson, S., Zhang, Z., & Wilkinson, T. J. (2010). Nutrition risk screening in community-living older people attending medical or falls prevention services. *Nutrition & Dietetics*, 67(2), 84-89.
- Watt, M. H., Perera, B., Østbye, T., Ranabahu, S., Rajapakse, H., & Maselko, J. (2014). Caregiving expectations and challenges among elders and their adult children in Southern Sri Lanka. *Ageing and Society*, 34(5), 838-858.
- Weinstein, B. E., Sirow, L. W., & Moser, S. (2016). Relating Hearing Aid Use to Social and Emotional Loneliness in Older Adults. *American Journal of Audiology*, 25(1), 54-61.
- Weinstein, J. R., & Anderson, S. (2010). THE AGING KIDNEY: PHYSIOLOGICAL CHANGES. *Advances in Chronic Kidney Disease*, 17(4), 302-307.
- Weiss, A., Beloosesky, Y., Schmilovitz-Weiss, H., Grossman, E., & Boaz, M. (2013). Serum total cholesterol: A mortality predictor in elderly hospitalized patients. *Clinical Nutrition*, 32(4), 533-537.
- Wells, K. B., Stewart, A., Hays, R. D., Burnam, M. A., Rogers, W., Daniels, M., . . . Ware, J. (1989). The functioning and well-being of depressed patients. Results from the Medical Outcomes Study. *JAMA*, 262(7), 914-919.
- Wham, C., Redwood, K., & Kerse, N. (2014). Validation of the nutrition screening tool 'Seniors in the Community: Risk Evaluation for Eating and Nutrition, version II' among octogenarians. *Journal of Nutrition, Health & Aging*, 18(1), 39-43.
- White, S. M., Wojcicki, T. R., & McAuley, E. (2009). Physical activity and quality of life in community dwelling older adults. *Health Qual Life Outcomes*, 7, 10.
- WHO. (1995). Physical status: the use and interpretation of anthropometry: World Health Organization, Expert Committee.
- WHO. (2002). Proposed working definition of an older person in Africa for the MDS Project Retrieved October 20, 2016
- WHO. (2015). Ageing and health. Retrieved December 2016
- Wig, N. N. (2001). World health day 2001. *Indian J Psychiatry*, 43(1), 1-4.

- Wijnhoven, H. A. H., Schilp, J., van Bokhorst-de van der Schueren, M. A. E., de Vet, H. C. W., Kruizenga, H. M., Deeg, D. J. H., . . . Visser, M. (2012). Development and validation of criteria for determining undernutrition in community-dwelling older men and women: The Short Nutritional Assessment Questionnaire 65+. *Clinical Nutrition*, 31(3), 351-358.
- Williams, J. A., Sink, K. M., Tooze, J. A., Atkinson, H. H., Cauley, J. A., Yaffe, K., . . . Houston, D. K. (2015). Low 25-hydroxyvitamin D concentrations predict incident depression in well-functioning older adults: the health, aging, and body composition study. *Journals of Gerontology. Series A: Biological Sciences and Medical Sciences*, 70(6), 757-763.
- Wilson, D. E., Van Vlack, T., Schievink, B. P., Doak, E. B., Shane, J. S., & Dean, E. (2014). Lifestyle Factors in Hypertension Drug Research: Systematic Analysis of Articles in a Leading Cochrane Report. *International Journal of Hypertension*, 2014, 10.
- Wilson, I. B., & Cleary, P. D. (1995). Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. *Jama*, 273(1), 59-65.
- The World Health Organization Quality of Life assessment (WHOQOL): position paper from the World Health Organization. (1995). *Social Science and Medicine*, 41(10), 1403-1409.
- Wu, Y., Pang, Z., Zhang, D., Jiang, W., Wang, S., Li, S., . . . Tan, Q. (2012). A cross-sectional analysis of age and sex patterns in grip strength, tooth loss, near vision and hearing levels in Chinese aged 50-74 years. *Archives of Gerontology and Geriatrics*, 54(2), e213-220.
- Wyka, J., Biernat, J., Mikołajczak, J., & Piotrowska, E. (2012). Assessment of dietary intake and nutritional status (MNA) in Polish free-living elderly people from rural environments. *Archives of Gerontology and Geriatrics*, 54(1), 44-49.
- Yekta, A. A., Fotouhi, A., Khabazkhoob, M., Hashemi, H., Ostadimoghaddam, H., Heravian, J., & Mehravaran, S. (2009). The prevalence of refractive errors and its determinants in the elderly population of Mashhad, Iran. *Ophthalmic Epidemiol*, 16(3), 198-203.
- Yen, Y.-Y., Lee, H.-E., Wu, Y.-M., Lan, S.-J., Wang, W.-C., Du, J.-K., . . . Hsu, K.-J. (2015a). Impact of removable dentures on oral health-related quality of life among elderly adults in Taiwan. *BMC Oral Health*, 15, 1.
- Yen, Y.-Y., Lee, H.-E., Wu, Y.-M., Lan, S.-J., Wang, W.-C., Du, J.-K., . . . Hsu, K.-J. (2015b). Impact of removable dentures on oral health-related quality of life among elderly adults in Taiwan. *BMC Oral Health*, 15(1), 1.

- Yoshida, M., Suzuki, R., & Kikutani, T. (2014). Nutrition and oral status in elderly people. *Japanese Dental Science Review*, 50(1), 9-14.
- Yoshimoto, S., Nagai, K., Shibata, E., Ueda, S., Ono, H., Tamaki, M., . . . Doi, T. (2017). Influential factors on serum albumin concentration in hospitalized chronic kidney disease patients. *Journal of Medical Investigation*, 64(1.2), 146-152.
- Yoshimura, K., Yamada, M., Kajiwar, Y., Nishiguchi, S., & Aoyama, T. (2013). Relationship between depression and risk of malnutrition among community-dwelling young-old and old-old elderly people. *Aging Ment Health*, 17(4), 456-460.
- Yu, R., Chau, P. H., McGhee, S. M., Cheung, W. L., Chan, K. C., Cheung, S. H., & Woo, J. (2012). Trends in Prevalence and Mortality of Dementia in Elderly Hong Kong Population: Projections, Disease Burden, and Implications for Long-Term Care. *International Journal of Alzheimer's Disease*, 2012, 6.
- Yueh, B., Shapiro, N., MacLean, C. H., & Shekelle, P. G. (2003). Screening and management of adult hearing loss in primary care: scientific review. *Jama*, 289(15), 1976-1985.
- Zhang, Y., & Jordan, J. M. (2010). Epidemiology of Osteoarthritis. *Clinics in geriatric medicine*, 26(3), 355-369.
- Zhao, D., Yu, K., Zhang, X., & Zheng, L. (2013). Digit Ratio (2D:4D) and Handgrip Strength in Hani Ethnicity. *PloS One*, 8(10), e77958.
- Ziylan, C., Haveman-Nies, A., van Dongen, E. J. I., Kremer, S., & de Groot, L. C. P. G. M. (2015). Dutch nutrition and care professionals' experiences with undernutrition awareness, monitoring, and treatment among community-dwelling older adults: a qualitative study. *BMC Nutrition*, 1(1), 38.

LIST OF PUBLICATIONS AND PAPERS PRESENTED

- Damayanthi, H. D. W. T., Moy, F. M., Abdullah, K. L., & Dharmaratne, S. D. (2018). Health related quality of life and its associated factors among community-dwelling older people in Sri Lanka: A cross-sectional study. *Archives of gerontology and geriatrics*, 76, 215-220.
- Damayanthi, H. D. W. T., Moy, F. M., Abdullah, K. L., & Dharmaratne, S. D. Assessing hand grip strength and its associated factors among community-dwelling elderly in Sri Lanka: A cross-sectional study. *Asian Nursing Research* (**Under review**)
- Damayanthi, H. D. W. T., Moy, F. M., Abdullah, K. L., & Dharmaratne, S. D. Prevalence of malnutrition and associated factors among community-dwelling older persons in Sri Lanka. *BMC Public Health* (**Under review**)
- Damayanthi, H. D. W. T., Moy, F. M., Abdullah, K. L., & Dharmaratne, S. D. A qualitative exploration of factors associated with malnutrition among community-dwelling malnourished older people in Sri Lanka. *Australasian Journal of Ageing* (**Under review**)
- Damayanthi, H. D. W. T., Moy, F. M., Abdullah, K. L., & Dharmaratne, S. D. Malnutrition and associated factors among community dwelling elderly in Sri Lanka, at the Consortium of Universities for Global Health (CUGH) 2017 Conference which will be held in Washington, DC, April 7 to 9, 2017 (**Poster presentation**)
- Damayanthi, H. D. W. T., Moy, F. M., Abdullah, K. L., & Dharmaratne, S. D. Factors associated with handgrip strength among community dwelling elderly in Sri Lanka, 4th Asian Health Literacy Association (AHLA) International Health Literacy Conference Vietnam 7-9 November 2016 (**Oral Presentation**)