

**EFFECT OF LEECH THERAPY ON BODY COMPOSITION
PARAMETERS**

NAZIHAH BINTI AHMAD

**RESEARCH REPORT SUBMITTED
IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE
DEGREE OF MASTER OF ENGINEERING (BIOMEDICAL)**

2012

ABSTRACT

Leech therapy treatment is one of the complimentary and alternative medicine that has been categorized as one of the ancient method in treating diseases. Locally unpopular this treatment still has its own believer that practices it for the sake of bloodletting treatment that claims to be successful. Therefore, a series of study should be conducted in order to prove the aforementioned claim by using the bioimpedance analysis. Bioimpedance analysis is way of measuring the fat and fat free mass in much more convenience way. This measurement is normally used by nutritionist as this invasive method is very suitable to determine the health of a person which directly affected by the composition of the fat in the body that can be further subdivide into water, mineral and protein constituents. The result could be used to measure the effectiveness of the leech therapy treatment as the readings and changes are taken into consideration before and after the treatment. Thus, using engineering tools to analyze the result can prove the effect of this therapy quantitatively.

ABSTRAK

Rawatan terapi lintah adalah salah satu kaedah perubatan sampingan dan alternatif yang telah dikategorikan sebagai salah satu kaedah kuno dalam merawat pelbagai penyakit. Secara am, walaupun rawatan ini kurang popular di kalangan penduduk tempatan ianya masih dipelopori oleh segilintir pengamal perubatan lintah yang percaya bahawa perubatan terapi lintah adalah cara yang berkesan dalam bidang perawatan. Oleh itu, beberapa siri kajian perlu dijalankan untuk membuktikan tuntutan yang dinyatakan di atas dengan menggunakan analisis bioimpedance. ‘Analisis Bioimpedance’ adalah cara mengukur jisim bebas lemak dan lemak dengan cara yang lebih mudah. Penggunaan cara ini biasanya digunakan oleh pakar pemakanan sebagai salah satu kaedah invasif yang sangat sesuai dalam menentukan kesihatan seseorang yang mempunyai kesan secara langsung dengan komposisi lemak dalam badan dan boleh diuraikan lagi dalam pembahagian komposisi badan dari segi kandungan air dalam badan, mineral dan protein. Hasilnya boleh digunakan untuk mengukur keberkesanan rawatan terapi lintah melalui bacaan dan perubahan yang diambil kira sebelum dan selepas rawatan lintah. Oleh itu, menggunakan alat-alat kejuruteraan untuk menganalisis hasilnya dapat membuktikan kesan terapi ini secara kuantitatif.

**UNIVERSITI MALAYA
ORIGINAL LITERARY WORK DECLARATION**

Name of Candidate: **NAZIHAH AHMAD**

Registration/Matric No: **KGL 100004**

Name of Degree: **Master of Engineering (Biomedical)**

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

EFFECT OF LEECH THERAPY ON BODY COMPOSITION PARAMETERS

Field of Study: **HEALTH AND BIOIMPEDANCE**

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:

ACKNOWLEDGEMENTS

In the name of Allah the most gracious and merciful, I would like to say thank you god for his love and blessing to me in order to complete this project.

First and foremost, I would want to express the appreciation towards my supervisor Assoc. Prof. Dr. Wan Mohd Azhar for his time and guidance through the time period of this project execution. Also, most gratitude to those who have been directly and indirectly involve in helping out the study process from the start to the end.

Not to forget a big thank you to family and friends who always been there to support all along these period continuously.

Nazihah Ahmad

CONTENT

ABSTRACT.....	ii
ABSTRAK.....	iii
ORIGINAL LITERARY WORK DECLARATION.....	iv
ACKNOWLEDGEMENT.....	v
CONTENT.....	vi
LIST OF FIGURES.....	x
LIST OF TABLES.....	xi

Chapter 1: Introduction

1.1 Background	1
1.2 Research problem and problem statement	2
1.3 Objectives	2
1.4 Hypothesis	2
1.5 Scope of the Study	2
1.6 Significance of the study.....	2

Chapter 2: Literature Review

2.0 Modern Medicine vs. Complementary and Alternative Medicine (CAM)	3
2.1 Modern medicine	
2.1.1 Surgery	4
2.1.2 Pill/ tablets/ capsules	4
2.1.3 Medicine tools	5
2.2 CAM	
2.2.1 Diets and supplements.....	5
2.2.2 Botanicals products.....	6

2.2.3 Unconventional agents.....	6
2.2.4 Traditional medicine	7
2.2.5 Energy healing	9
2.3 Leeching/ hirudotherapy in ancient time	
2.3.1 Leeches	9
2.3.2 Mechanism of Hirudotherapy	11
2.3.2.1: Application in Soft Tissue Hematomas	12
2.3.2.2: Application in Tissue Flap Reconstructions	12
2.3.2.3: Application in the Setting of Severe Soft Tissue Injury and Surgical Replantation	13
2.4 Body composition	
2.4.1 Body composition models	16
2.4.1.1 Two component model	16
2.4.1.2 Three component model	17
2.4.1.3 Four component model	17
2.4.1.4 Six component model	17
2.4.2 Body composition measurement	
2.4.2.1 Hydrodensitometry	18
2.4.2.2. Anthropometry	19
2.4.2.3 Bioelectrical Impedance	19
2.4.2.4 Air displacement Plethysmography (ADP)	20
2.4.2.5 Hydrometry	21
2.4.2.6 Dual energy X-ray absorptiometry (DXA)	21
2.4.2.7 Neutron activation analysis (NAA)	21
2.4.2.8 Whole body counting of potassium	22
2.4.2.9 Computed tomography	22

2.4.2.10 Magnetic resonance imaging (MRI)	23
2.5 Bioelectrical impedance analysis (BIA)	
2.5.1 BIA principles	23
2.5.1.1 Body impedance (Z)	24
2.5.1.2 Volume and body composition	24
2.5.1.3 Calculation of body composition	25
2.5.2 BIA models and approaches	26
2.5.2.1 Single frequency BIA (SF-BIA).....	26
2.5.2.1.1 Series model.....	26
2.5.2.1.2 Parallel model	26
2.5.2.2 Multi-frequency BIA (MF-BIA)	27
2.5.2.2.1 Bioelectrical impedance spectroscopy (BIS).27	
2.5.2.2.2 Segmental model	27
2.5.2.2.3 Localized bioelectrical impedance analysis .28	
2.5.2.2.4 Bioelectrical impedance vector analysis (BIVA)	
.....	28
2.6 Statistical test	
2.6.1 T-test	29
2.6.1.1 Independent t-test	29
2.6.1.2 Dependent t-test	29
2.6.1.3 One sample t-test	30
2.6.2 ANOVA	30
2.6.2.1 One way ANOVA	30
2.6.2.2. Two-way ANOVA	30
Chapter 3: Methodology	
3.0 Introduction	31

3.1 Subjects / patient	32
3.2 Measurement setup	32
3.3 Data measurement	33
3.4 Statistical analysis	
3.4.1 Bar graph	34
3.4.2 Descriptive statistics	34
3.4.3 Independent sample t-test.....	35
3.4.4 Paired sample t-test	35
3.4.5 ANOVA	35
Chapter 4: Results	
4.0 Statistical analysis.....	36
4.2 Demographic data.....	44
4.3 Analysis of Bioimpedance parameter.....	61
4.4 Comparison of bioimpedance parameter.....	75
4.5 Interaction of Bioimpedance Parameters with Demographic Variables....	83
Chapter 5: Discussion	96
Chapter 3: Conclusion	105
References.....	104
Appendices.....	113

LIST OF FIGURE	Page
Figure 2.1: Leech.....	11
Figure 2.2: Application of hirudotherapy to tissue flap reconstruction	15
Figure 2.3: Application of hirudotherapy in a case of digital replantation.....	16
Figure. 2.4: Two chamber bod pod system.....	22
Figure 2.5: CT scan.....	25
Figure 3.1: Flowchart of study.....	35
Figure 3.2 Placement of electrodes at hand.....	37
Figure 3.3 Placement of electrodes at leg.....	37
Figure 4.1: Bar graph for subject's gender.....	42
Figure 4.2: Bar graph for subject's marital status.....	43
Figure 4.3: Bar graph for range of subject's age.....	44
Figure 4.4: Bar graph for subject's occupation.....	45
Figure 4.5: Bar graph for number of leech therapy treatment.....	46
Figure 4.6: Bar graph for subject's daily activity.....	47
Figure 4.7: Bar graph for BMI readings	48

LIST OF TABLES	Page
Table 2.1: Major enzymes important in leech.....	11
Table 4.0: Bioimpedance parameter.....	36
Table 4.1 Statistics Comparison of Main Bioimpedance Parameters.....	45
Table 4.2 Statistics Comparison of Secondary Bioimpedance Parameters.....	46
Table 4.3 Statistics Comparison of Main Bioimpedance Parameters for Female... ..	47
Table 4.4 Statistics Comparison of Secondary Bioimpedance Parameters for Female.....	48
Table 4.5 Statistics Comparison of Main Bioimpedance Parameters For Male.....	49
Table 4.6 Statistics Comparison of Secondary Bioimpedance Parameters For Male.....	50
Table 4.7 Statistics Comparison of Main Bioimpedance Parameters For BMI Group 1.....	51
Table 4.8 Statistics Comparison of Secondary Bioimpedance Parameters For BMI Group 1.....	52
Table 4.9 Statistics Comparison of Main Bioimpedance Parameters For BMI Group 2.....	53
Table 4.10 Statistics Comparison of Secondary Bioimpedance Parameters For BMI Group 2.....	54
Table 4.11 Statistics Comparison of Main Bioimpedance Parameters For BMI Group 3.....	55
Table 4.12 Statistics Comparison of Secondary Bioimpedance Parameters For BMI Group 3.....	56
Table 4.13 Statistics Comparison of Main Bioimpedance Parameters For BMI Group 4.....	57
Table 4.14 Statistics Comparison of Secondary Bioimpedance Parameters for BMI Group 4.....	58
Table 4.15 Statistics Comparison of Main Bioimpedance Parameters For BMI Group 5.....	59
Table 4.16 Statistics Comparison of Secondary Bioimpedance Parameters For BMI Group 5.....	60
Table: 4.17 Overall Comparisons of Bioimpedance Parameters before and After Treatment.....	62

Table: 4.18 Comparisons of Main Bioimpedance Parameters before and After Treatment between Genders.....	63
Table: 4.19 Comparisons of Secondary Bioimpedance Parameters before and After Treatment between Genders.....	64
Table: 4.20 Comparisons of Main Bioimpedance Parameters before and After Treatment Between BMI Group.....	65
Table: 4.21 Comparisons of Secondary Bioimpedance Parameters before and After Treatment Between BMI Group.....	66
Table: 4.22 Comparisons of Main Bioimpedance Parameters Before and After Treatment Between Age Group.....	67
Table: 4.23 Comparisons of Secondary Bioimpedance Parameters Before and After Treatment Between Age Group.....	68
Table: 4.24 Comparisons of Main Bioimpedance Parameters Before and After Treatment between Diseases Group.....	69
Table: 4.25 Comparisons of Secondary Bioimpedance Parameters Before and After Treatment Between Diseases Group.....	70
Table: 4.26 Comparisons of Main Bioimpedance Parameters before and after Treatment Between occupations Group.....	71
Table: 4.27 Comparisons of Secondary Bioimpedance Parameters Before and After Treatment between Occupation Group.....	72
Table: 4.28 Comparisons of Main Bioimpedance Parameters before and after Treatment between numbers of Treatment Group.....	73
Table: 4.29 Comparisons of Secondary Bioimpedance Parameters Before and After Treatment between numbers of Treatment Group.....	74
Table 4.30 Comparisons of Main Bioimpedance Parameters before Treatment for Female age group 1.....	75
Table 4.31 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female Age group 1.....	76
Table 4.32 Comparisons of Main Bioimpedance Parameters after Treatment for Female Age group 1.....	76
Table 4.33 Comparisons of Secondary Bioimpedance Parameters after Treatment For Female Age group 1.....	77
Table 4.34 Comparisons of Main Bioimpedance Parameters before Treatment for male age group 1.....	77

Table 4.35 Comparisons of Secondary Bioimpedance Parameters before Treatment for Male Age group 1.....	78
Table 4.36 Comparisons of Main Bioimpedance Parameters after Treatment for Male Age group 1.....	78
Table 4.37 Comparisons of Secondary Bioimpedance Parameters after Treatment for Male Age group 1.....	79
Table 4.38 Comparisons of Main Bioimpedance Parameters before Treatment for Female age group 2.....	115
Table 4.39 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female Age group 2.....	115
Table 4.40 Comparisons of Main Bioimpedance Parameters after Treatment for Female Age group 2.....	116
Table 4.41 Comparisons of Secondary Bioimpedance Parameters after Treatment For Female Age group 2	116
Table 4.42Comparisons of Main Bioimpedance Parameters before Treatment for male age group 2.....	117
Table 4.43 Comparisons of Secondary Bioimpedance Parameters before Treatment for Male Age group 2.....	117
Table 4.44 Comparisons of Main Bioimpedance Parameters after Treatment for Male Age group 2.....	118
Table 4.45 Comparisons of Secondary Bioimpedance Parameters after Treatment for Male Age group 2.....	118
Table 4.46 Comparisons of Main Bioimpedance Parameters before Treatment for Female age group 3.....	119
Table 4.47 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female Age group 3.....	119
Table 4.48 Comparisons of Main Bioimpedance Parameters after Treatment for Female Age group 3.....	120
Table 4.49 Comparisons of Secondary Bioimpedance Parameters after Treatment For Female Age group 3.....	120
Table 4.50 Comparisons of Main Bioimpedance Parameters before Treatment for Female age group 4.....	121
Table 4.51 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female Age group 4.....	122

Table 4.52 Comparisons of Main Bioimpedance Parameters after Treatment for Female Age group 4.....	122
Table 4.53 Comparisons of Secondary Bioimpedance Parameters after Treatment For Female Age group 4.....	123
Table 4.54 Comparisons of Main Bioimpedance Parameters before Treatment for male age group 4.....	123
Table 4.55 Comparisons of Secondary Bioimpedance Parameters before Treatment for Male Age group 4.....	124
Table 4.56 Comparisons of Main Bioimpedance Parameters after Treatment for Male Age group 4.....	124
Table 4.57 Comparisons of Secondary Bioimpedance Parameters after Treatment for Male Age group 4.....	125
Table 4.58 Comparisons of Main Bioimpedance Parameters before Treatment for Female age group 5.....	125
Table 4.59 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female Age group 5.....	126
Table 4.60 Comparisons of Main Bioimpedance Parameters after Treatment for Female Age group 5.....	126
Table 4.61 Comparisons of Secondary Bioimpedance Parameters after Treatment For Female Age group 5.....	127
Table 4.62 Comparisons of Main Bioimpedance Parameters before Treatment for male age group 5.....	127
Table 4.63 Comparisons of Secondary Bioimpedance Parameters before Treatment for Male Age group 5.....	128
Table 4.64 Comparisons of Main Bioimpedance Parameters after Treatment for Male Age group 5.....	128
Table 4.65 Comparisons of Secondary Bioimpedance Parameters after Treatment for Male Age group 5.....	129
Table 4.66 Comparisons of Main Bioimpedance Parameters before Treatment or Female BMI group 1.....	80
Table 4.67 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female BMI group 1.....	81
Table 4.68 Comparisons of Main Bioimpedance Parameters after Treatment for Female BMI group 1.....	81

Table 4.69 Comparisons of Secondary Bioimpedance Parameters after Treatment For Female BMI group 1.....	82
Table 4.70 Comparisons of Main Bioimpedance Parameters before Treatment for male BMI group 1.....	82
Table 4.71 Comparisons of Secondary Bioimpedance Parameters before Treatment for Male BMI group 1.....	83
Table 4.72 Comparisons of Main Bioimpedance Parameters after Treatment for Male BMI group 1.....	83
Table 4.73 Comparisons of Secondary Bioimpedance Parameters after Treatment for Male BMI group 1.....	84
Table 4.74 Comparisons of Main Bioimpedance Parameters before Treatment for Female BMI group 2.....	130
Table 4.75 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female BMI group 2.....	130
Table 4.76 Comparisons of Main Bioimpedance Parameters after Treatment for Female BMI group 2.....	131
Table 4.77 Comparisons of Secondary Bioimpedance Parameters after Treatment For Female BMI group 2.....	131
Table 4.78 Comparisons of Main Bioimpedance Parameters before Treatment for male BMI group 2.....	132
Table 4.79 Comparisons of Secondary Bioimpedance Parameters before Treatment for Male BMI group 2.....	132
Table 4.80 Comparisons of Main Bioimpedance Parameters after Treatment for Male BMI group 2.....	133
Table 4.81 Comparisons of Secondary Bioimpedance Parameters after Treatment for Male BMI group 2.....	133
Table 4.82 Comparisons of Main Bioimpedance Parameters before Treatment for Female BMI group 3.....	134
Table 4.83 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female BMI group 3.....	134
Table 4.84. Comparisons of Main Bioimpedance Parameters after Treatment for Female BMI group 3.....	135
Table 4.85 Comparisons of Secondary Bioimpedance Parameters after Treatment For Female BMI group 3.....	135

Table 4.86 Comparisons of Main Bioimpedance Parameters before Treatment for Male BMI group 3.....	136
Table 4.87 Comparisons of Secondary Bioimpedance Parameters before Treatment for Male BMI group 3.....	136
Table 4.88 Comparisons of Main Bioimpedance Parameters after Treatment for Male BMI group 3.....	137
Table 4.89 Comparisons of Secondary Bioimpedance Parameters after Treatment for Male BMI group 3.....	137
Table 4.90 Comparisons of Main Bioimpedance Parameters before Treatment for Female BMI group 4.....	138
Table 4.91 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female BMI group 4.....	138
Table 4.92 Comparisons of Main Bioimpedance Parameters after Treatment for Female BMI group 4.....	139
Table 4.93 Comparisons of Secondary Bioimpedance Parameters after Treatment For Female BMI group 4.....	139
Table 4.94 Comparisons of Main Bioimpedance Parameters before Treatment for male BMI group 4.....	140
Table 4.95 Comparisons of Secondary Bioimpedance Parameters before Treatment for Male BMI group 4.....	140
Table 4.96 Comparisons of Main Bioimpedance Parameters after Treatment for Male BMI group 4.....	141
Table 4.97 Comparisons of Secondary Bioimpedance Parameters after Treatment for Male BMI group 4.....	141
Table 4.98 Comparisons of Main Bioimpedance Parameters before Treatment for Female BMI group 5.....	142
Table 4.99 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female BMI group 5.....	142
Table 4.100 Comparisons of Main Bioimpedance Parameters after Treatment for Female BMI group 5.....	143
Table 4.101 Comparisons of Secondary Bioimpedance Parameters after Treatment For Female BMI group 5.....	143
Table 4.102 Interaction of Main Bioimpedance Parameters before Treatment for Female.....	85

Table 4.103 Interaction of Main Bioimpedance Parameters after Treatment for Female.....	86
Table 4.104 Comparisons of Secondary Bioimpedance Parameters before Treatment for Female.....	86
Table 4.105 Interactios of Secondary Bioimpedance Parameters after Treatment for Female.....	87
Table 4.106 Interaction of Main Bioimpedance Parameters before Treatment for Male.....	87
Table 4.107 Interaction of Main Bioimpedance Parameters after Treatment for Male.....	88
Table 4.108 Interactions of Secondary Bioimpedance Parameters before Treatment for Male.....	88
Table 4.109 Interactions of Secondary Bioimpedance Parameters after Treatment for Male.....	89
Table 4.110 Interaction of Main Bioimpedance Parameters before Treatment for Age Group1.....	89
Table 4.110 Interaction of Main Bioimpedance Parameters before Treatment for Age Group1.....	90
Table 4.112 Comparisons of Secondary Bioimpedance Parameters before Treatment for Age Group1.....	90
Table 4.113 Interactions of Secondary Bioimpedance Parameters after Treatment for Age Group1.....	91
Table 4.114 Interaction of Main Bioimpedance Parameters before Treatment for Age Group2.....	145
Table 4.115 Interaction of Main Bioimpedance Parameters after Treatment for Age Group2.....	145
Table 4.116 Interactions of Secondary Bioimpedance Parameters before Treatment for Age Group2.....	146
Table4.117 Interactions of Secondary Bioimpedance Parameters after Treatment for Age group 2.....	146
Table 4.118 Interaction of Main Bioimpedance Parameters before Treatment for Age Group3.....	147
Table 4.119 Interaction of Main Bioimpedance Parameters after Treatment for Age Group3.....	147

Table 4.120 Interaction of Secondary Bioimpedance Parameters before Treatment for Age Group3.....	148
Table 4.121 Interactions of Secondary Bioimpedance Parameters after Treatment for Age Group3.....	148
Table 4.122 Interaction of Main Bioimpedance Parameters before Treatment for Age Group4.....	149
Table 4.123 Interaction of Main Bioimpedance Parameters after Treatment for Age Group4.....	149
Table 4.124 Interactions of Secondary Bioimpedance Parameters before Treatment for Age Group4.....	150
Table 4.125 Interactions of Secondary Bioimpedance Parameters after Treatment for Age Group4.....	150
Table 4.126 Interaction of Main Bioimpedance Parameters before Treatment for Age Group5.....	151
Table 4.127 Interaction of Main Bioimpedance Parameters after Treatment for Age Group5.....	151
Table 4.128 Interactions of Secondary Bioimpedance Parameters before Treatment for Age Group5.....	152
Table 4.129 Interactions of Secondary Bioimpedance Parameters after Treatment for Age Group 5.....	152
Table 4.130 Interaction of Main Bioimpedance Parameters before Treatment for BMI group1.....	91
Table 4.131 Interaction of Main Bioimpedance Parameters after Treatment for BMI group1.....	92
Table 4.132 Interactions of Secondary Bioimpedance Parameters before Treatment for BMI group1.....	92
Table 4.133 Interactions of Secondary Bioimpedance Parameters after Treatment for BMI group1.....	93
Table 4.133 Interactions of Secondary Bioimpedance Parameters after Treatment for BMI group1.....	93
Table 4.134 Interaction of Main Bioimpedance Parameters before Treatment for BMI group2.....	153
Table 4.135 Interaction of Main Bioimpedance Parameters after Treatment for BMI group2.....	153

Table 4.136 Interactions of Secondary Bioimpedance Parameters before Treatment for BMI group2.....	154
Table 4.137 Interactions of Secondary Bioimpedance Parameters after Treatment for BMI group2.....	154
Table 4.138 Interaction of Main Bioimpedance Parameters before Treatment for BMI group3.....	155
Table 4.139 Interaction of Main Bioimpedance Parameters after Treatment for BMI group3.....	155
Table 4.140 Interactions of Secondary Bioimpedance Parameters before Treatment for BMI group3.....	156
Table 4.141 Interactions of Secondary Bioimpedance Parameters after Treatment for BMI group 3.....	156
Table 4.142 Interaction of Main Bioimpedance Parameters before Treatment for BMI group4.....	157
Table 4.143 Interaction of Main Bioimpedance Parameters after Treatment for BMI group 4.....	157
Table 4.144 Interactions of Secondary Bioimpedance Parameters before Treatment for BMI group 4.....	158
Table 4.145 Interactions of Secondary Bioimpedance Parameters after Treatment for BMI group 4.....	158
Table 4.146 Interaction of Main Bioimpedance Parameters before Treatment for BMI group 5.....	159
Table 4.147 Interaction of Main Bioimpedance Parameters after Treatment for BMI group 5.....	159
Table 4.148 Interactions of Secondary Bioimpedance Parameters before Treatment for BMI group 5.....	160
Table 4.149 Interactions of Secondary Bioimpedance Parameters after Treatment for BMI group 5.....	160
Table 4.150 Interaction of Main Bioimpedance Parameters before Treatment for diseases group 1.....	93
Table 4.151 Interaction of Main Bioimpedance Parameters after Treatment for diseases group 1.....	94
Table 4.152 Interactions of Secondary Bioimpedance Parameters before Treatment for Diseases group 1.....	94

Table 4.153 Interactions of Secondary Bioimpedance Parameters after Treatment for diseases group 1.....	95
Table 4.154 Interaction of Main Bioimpedance Parameters before Treatment for diseases group 2.....	161
Table 4.155 Interaction of Main Bioimpedance Parameters after Treatment for Diseases group 2.....	161
Table 4.156 Interactions of Secondary Bioimpedance Parameters before Treatment for Diseases group 2.....	162
Table 4.157 Interactions of Secondary Bioimpedance Parameters after Treatment for diseases group 2.....	162
Table 4.158 Interaction of Main Bioimpedance Parameters before Treatment for diseases group 3.....	163
Table 4.159 Interaction of Main Bioimpedance Parameters after Treatment for diseases group 3.....	163
Table 4.160 Interactions of Secondary Bioimpedance Parameters before Treatment for Diseases group 3.....	164
Table 4.161 Interactions of Secondary Bioimpedance Parameters after Treatment for diseases group 3.....	164
Table 4.162 Interaction of Main Bioimpedance Parameters before Treatment for diseases group 4.....	165
Table 4.163 Interaction of Main Bioimpedance Parameters after Treatment for Diseases group 4.....	165
Table 4.164 Interactions of Secondary Bioimpedance Parameters before Treatment for Female Diseases group 4.....	166
Table 4.165 Interactions of Secondary Bioimpedance Parameters after Treatment for diseases group 4.....	166
Table 4.166 Interaction of Main Bioimpedance Parameters before Treatment for diseases group 5.....	167
Table 4.167 Interaction of Main Bioimpedance Parameters after Treatment for Male diseases group 5.....	167
Table 4.168 Interactions of Secondary Bioimpedance Parameters before Treatment for Diseases group 5.....	168
Table 4.169 Interactions of Secondary Bioimpedance Parameters after Treatment for diseases group 5.....	168

Table 4.170 Interaction of Main Bioimpedance Parameters before Treatment for diseases group 6.....	169
Table 4.171 Interaction of Main Bioimpedance Parameters after Treatment for Diseases group 6.....	169
Table 4.172 Interactions of Secondary Bioimpedance Parameters before Treatment for Diseases group 6.....	170
Table 4.173 Interactions of Secondary Bioimpedance Parameters after Treatment for Female diseases group 6.....	170