COMPARISON OF VARIOUS EQUATIONS TO CALCULATE SERUM OSMOLALITY

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CANDIDATE'S DECLARATION

I hereby declare that this research report is prepared by me, based on research work led by my supervisor, Associate Professor Dr Pavai Sthaneshwar, Clinical Chemical Pathologist, Department Pathology, Faculty of Medicine, University Malaya.

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ABSTRACT

Background : Serum osmolality is often measured in laboratory by cryoscopic technique, which is the reference method. However, in clinical setting, routine measurement of serum osmolality is not always feasible at bedside. In normal subjects, sodium, potassium glucose, and urea are the primary circulating solutes. If no other solutes are present in serum at high millimolar concentrations, then these solute concentrations can be used to predict the measured osmolality. The osmolal gap (OG) is the difference between measured osmolality and the calculated osmolality. The major use of OG is to screen for the possible presence of exogenous toxic substances and to screen for cases of alcohol intoxication. However, many equations for the calculation of have been proposed. The purpose of this study is to compare the calculated osmolality using various formulae with the measured osmolality in order to determine which calculated formula fit best with actual measured osmolality.

Materials and Methods : Serum osmolality results which was done during the period of January 2015 to December 2015 were extracted from the laboratory information system (LIS). Serum osmolality that was performed simultaneously with renal and liver function tests, serum electrolytes and plasma glucose were included for the study. Serum osmolality measured for patients with the history of drug abuse and poisoning were excluded from the study. 405 serum osmolality results were chosen for the study and were divided into two groups. Group 1 included 205 data with normal serum osmolality, renal, liver function tests and plasma glucose level less than 7.8 mmol/L. For the second group (n = 200), data with low serum osmolality (n=90) and high serum osmolality (n=80) and normal serum osmolality (n=30) were included. The first group data were to identify which equation correlated well with the measured osmolality and the second group data to study the performance of equation that correlated well with the measured osmolality.

Results : Of the 19 formulae studied only four were identified as optimal by having the mean OG ≤ 2 mOsm/kg. The Smithline-Gardner formula (2Na+ Glu + BUN) showed the smallest osmolal gap with the mean bias of 0.3 mOsm/kg. This formula was observed to be the best fit between measured and calculated osmolality. The Dorwart-Chalmers formula which has been incorporated in many autoanalysers for calculation of osmolality equation underestimates the osmolality compared to the measured osmolality and gave inferior results.

Conclusion: Based on our results, we recommend Smithline-Gardner formula to be used by clinicians and laboratories for the calculation of osmolal gap, on the basis that (i) OG gap is close to zero, (ii) it is simple, easy to calculate at bedside for hospitalised patients and (iii) can be easily incorporated in the Laboratory Information System (LIS).

Keywords: measured osmolality; calculated osmolality; osmolal gap; regression analysis

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LIST OF ABBREVIATIONS

Na	: sodium
Glu	: glucose
K	: potassium
Mg	: magnesium
iCa	: ionised calcium
Cl	:chloride
HCO_3^-	: bicarbonate
CO	: Calculated Osmolality
MO	: Measured Osmolality
OG	: Osmolar gap
SD	: Standard Deviation
CV	: Coefficient of variation
CI	: Confidence Interval
r	: Coefficient regression
mOsm/kg	: miliOsmoles per kilogram
mmol/L	: millimoles per litre
rpm	: revolutions per minute
rcf	: relative centrifugal force
uL	: microlitre
Na2 EDTA tube	: Disodium Ethylenediamine tetraacetic acid tube

CHAPTER 1

INTRODUCTION

Osmolality is a measure of the number of dissolved solute particles per kilogram of solvent. It is determined by the number and not by the nature of the particles in solution. Dissolved solutes change the physical properties of solutions; they increase the osmotic pressure and decrease freezing point. The osmolality of the physiological fluids tends to be dominated by small molecules which are present in high concentrations. In normal serum, the osmolality depends mainly on the concentration of the five major osmotic solutes; Na^+, Cl^-, $HCO3^-$, which are of ionic nature and glucose and urea that are non-ionic.[1,2] Since the sodium ions can be assumed to be counterbalanced by an anion, the dependence of serum osmolality on electrolyte concentration may be considered to be a function of sodium, glucose and urea.[2]

Serum osmolality is a useful initial test for investigating the cause of body fluid imbalance and in identifying a raised osmolal gap for suspected poisoning. However, in a clinical setting, the routine measurement of serum osmolality is not feasible at bedside in the intensive care unit. In these situations, calculation of serum osmolality is often favoured than directly measuring serum osmolality.

Osmolal gap (OG) is the difference between the measured osmolality and calculated osmolality based on the major commonly measured osmotically active particles.[3,4] The major use of OG is to screen for the possible presence of exogenous toxic substances in patients in an emergency department or intensive care unit.[5-10] Osmolal gap can also be used to screen for cases of alcohol intoxication where ethanol testing may not be immediately available.[11]

For the calculation of serum osmolality different formulae, up to 36 have been published (Table 1) and there is no consensus over the most accurate one to be used in routine practice. Most of the published formulae are based on sodium, urea and glucose.[5 12]

In 1975, Dorwart and Chalmers reviewed 13 formulae and concluded that only four formulae, that utilised sodium, glucose and urea, had the highest correlation and the lowest standard deviation (SD) of difference when compared with the measured osmolality.[13 14] A simplified formula was proposed by them based on linear regression analysis: Calculated osmolality = 1.86(Sodium) + Glucose + Urea + 9. This formula is widely used to calculate the osmolality and has been incorporated in commercial analysers so that it can be reported with sodium, urea and glucose.[13 14]

However, there are issues of using Dorwart-Chalmer's formula to calculate osmolality; it tends to underestimate true osmolality of sample, whereby the measured osmolality exceeds the calculated osmolality.[14 15] Therefore, it is no longer recommended but still used to calculate serum osmolality automatically by the analyser.[14 15]

Smithline and Gardner used a factor of 2 as the osmotic coefficient of sodium chloride instead of 1.86.[16] This formula has been shown not to overestimate plasma osmolality as the other cations mainly potassium, calcium and magnesium as well as the constant of +9 are excluded from the calculation.[16] In 1984, Bhagat et al improvised the Dorwart's formula with the inclusion of potassium to propose a complex formula: Calculated osmolality = 1.86(Sodium+ Potassium) + Glucose + Urea + 10.[15]

However, this simple Smithline formula [2(Sodium) + Glucose + Urea] showed the best predictive performance of osmolar gap with lowest bias and good precision.[17 18] Nowadays it is the most commonly used in clinical settings for the calculation of serum osmolality.[17 18]

The best way for calculation of osmolality at bedside should be quick and convenient to be used in clinical practice.[16] However, there are only a few studies that determine which one of them provides the best results. Extended effort on validation equations also continue to be expanded over the years in the aim to achieve ultimate formula for calculated osmolarity.

Since 2012, the Australasian Society of Clinical Biochemists has held annual scientific workshops to assess the viability and harmonised reference intervals for common biochemical analytes.[19] Efforts had been made to harmonise the calculated parameters like osmolal gap, anion gap and albumin adjusted calcium. The Royal College of Pathologists of Australasian Quality Assurance Program (RCPAQAP) Chemical Pathology Calculated Results Program Survey revealed that 26 laboratories used simplified Bhagat formula and 12 laboratories use Smithline-Gardner formula for evaluation of calculated osmolarity. Using the data from RCPAQAP Liquid Serum Chemistry, Choy et al showed that the Smithline-Gardner formula provided the smallest osmolal gap which is close to zero with an SD of less than 4.[16] It was shown that this equation performed well across different analytical platforms.[16] They proposed this equation to be adopted as it is simple and can be used for rapid mental calculation at the bedside and automated laboratory reporting whenever measured osmolality is requested.[16]

The purpose of this study is to compare the calculated osmolality using formulae with the measured osmolality in order to determine which calculated formula fit best with actual measured osmolality.

osmolality.[14 15]Therefore, it is no longer recommended but still used to calculate serum osmolality automatically by the analyser. [14 15]

CHAPTER 2

MATERIALS AND METHOD

Serum osmolality results which was done during the period of January 2015 to December 2015 were extracted from the laboratory information system (LIS).Serum osmolality that was performed simultaneously with renal and liver function tests, serum electrolytes and plasma glucose were included for the study. Serum osmolality measured for patients with the history of poisoning were excluded from the study.

Whole blood samples were collected into 3.5-mL BD Vacutainer serum separator tube II Advance and 2.0 mL BD Vacutainer Sodium Fluoride Na2 EDTA tube and centrifuged at 3073 rpm (1900 rcf) for 5 minutes to acquire serum and plasma respectively. Sample was inspected for lipaemia. A 20 µL aliquot of serum sample was immediately transferred to sampler tip for osmolality determination. Measurement of osmolality was performed by freezing-point depression using Micro-Osmometer (Micro-Osmometer Model 3320) that has been calibrated with Clinitriol 290 Reference Solution.

Serum was analyzed for sodium and potassium by using a direct ion selective electrode. The blood urea nitrogen by using Roch-Ramel enzymatic reaction using urease and glutamate dehydrogenase. The plasma glucose was analyzed by using hexokinase enzymatic method. Analysis of the serum chemistry tests were performed using Siemens Advia® 2400 Chemistry Analyzer (Siemens Healthineers Global). All serum constituents were reported in standard international units.

All calculations are referred as calculated osmolality (mmol/L), Serum measurements directly done via freezing point depression will be referred as measured osmolality (mmol/kg). The osmolal gap was calculated as measured Osmolality (mmol/kg) minus calculated osmolality (mmol/L) and reported in standard international units.

Serum osmolality results which was done during the period of January 2015 to December 2015 were extracted from the laboratory information system (LIS). Serum osmolality that was performed simultaneously with renal and liver function tests, serum electrolytes and plasma glucose were included for the study. Serum osmolality measured for patients with the history of drug abuse and poisoning were excluded from the study. 405 serum osmolality results were chosen to study the relationship between the measured and calculated serum osmolality. The clinical diagnosis and other relevant information for these data were recorded from the case notes. The results were divided into two groups.

The Group 1 (n = 205) consists of data with normal serum osmolality, electrolytes, urea and also plasma glucose level less than 7.8 mmol/L. The first group data were to identify which equation correlated well with the measured osmolality. The second group (n = 200) which comprised of data with low serum osmolality (n=90) and high serum osmolality (n=80) and normal serum osmolality (n=30) were included. The Group 2 data was to study the performance of the formula which correlated well with the measured osmolality based on the Group 1.

Statistical analysis

The results are presented as the mean ± SD. Statistical analysis for the comparison of multiple methods which is an extension of the Bland-Altman plot for more than 2 methods and Passing-Bablok regression analysis were conducted using MedCalc for Windows Version 15.0 (Medcalc Software, Ostend,Belgium)

CHAPTER 3

RESULTS

Serum sodium, potassium, blood urea nitrogen, plasma glucose and measured osmolality levels of the group 1 were (mean $\pm$ SD) 139 $\pm$ 1.99 mmol/L, 4.0 $\pm$ 0.36 mmol/L, 5.0 $\pm$ 1.17 mmol/L, 6.0 $\pm$ 0.99 mmol/L, and 288 $\pm$ 4.68 mOsm/kg respectively. Calculated osmolality using 19 different formulae (Table 1) and the osmolal gap (OG) are shown in Table 2. Of the 19 formulae, only Formula 1, 13, 17 and 19 were identified as optimal by having the mean OG $\leq$ 2 mOsm/kg (Table 2). The smallest OG was seen with Smithline-Gardner formula (Formula 1 in Table 1). The mean bias was 0.3mOsm/kg. Comparison of the median of measured and calculated osmolality was performed by Wilcoxon test for paired samples (Table 2). The best result was achieved for with the use of Formula 1.

Figure 1 (A –D) showed that the Bland-Altman plot for the four formulae for which the OG was $\leq$ 2 mOsm/kg. More than 95% of the results were within the confidence interval (mean + 1.96SD)

Passing–Bablok regression analysis for the Formula 1, 13, 17 and 19 yielded the equations shown in Table 3, (Figure 2 A - D) where variable y stands for calculated osmolality and x for measured osmolality. The confidence intervals for the slope and the intercept include the values 1 and 0, respectively except for the Formula 13. This indicates that the calculated osmolality by these formulae correlated well with the measured osmolality.

For the group 2, serum sodium, potassium, blood urea nitrogen and plasma glucose levels were (mean $\pm$ SD) 130 $\pm$ 9.72 mmol/L, 4.0 $\pm$ 0.95 mmol/L, 9.0 $\pm$ 9.18mmol/L, 12 $\pm$ 10.10 mmol/L respectively. Of the formulae which showed OG $\leq$2 mOsm/kg, the Smithline-Gardner (Formula 1) and Bhagat (Formula 19) formulae are relatively simple to calculate than Formula 17. Hence, Passing-Bablok analysis was performed for the comparison of measured osmolality and the calculated osmolality by the Formula 1 and 19. The analysis yielded similar results. (Figure 3 A - B)

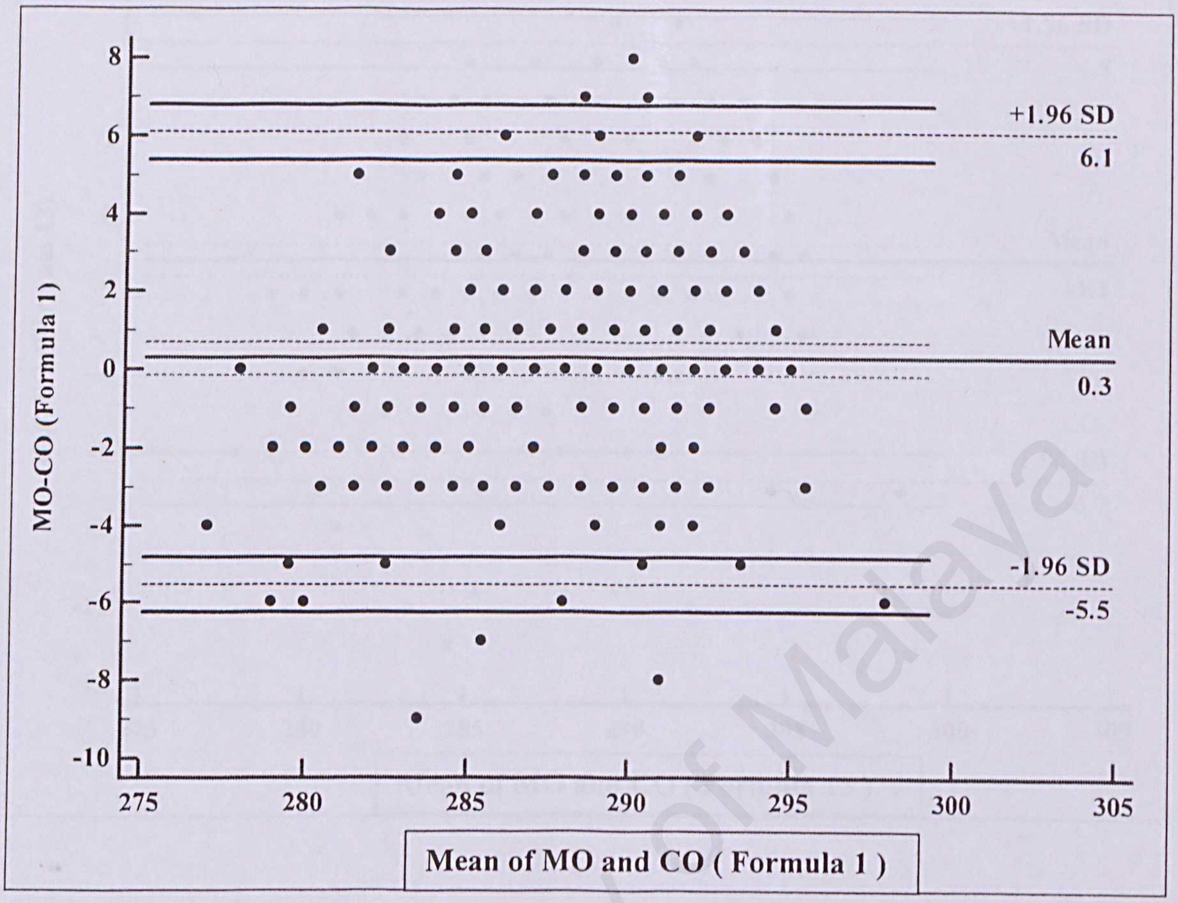

Figure 1A Bland-Atlman plot between measured osmolality (MO)and calculated osmolality (CO) (Formula 1) for Group 1

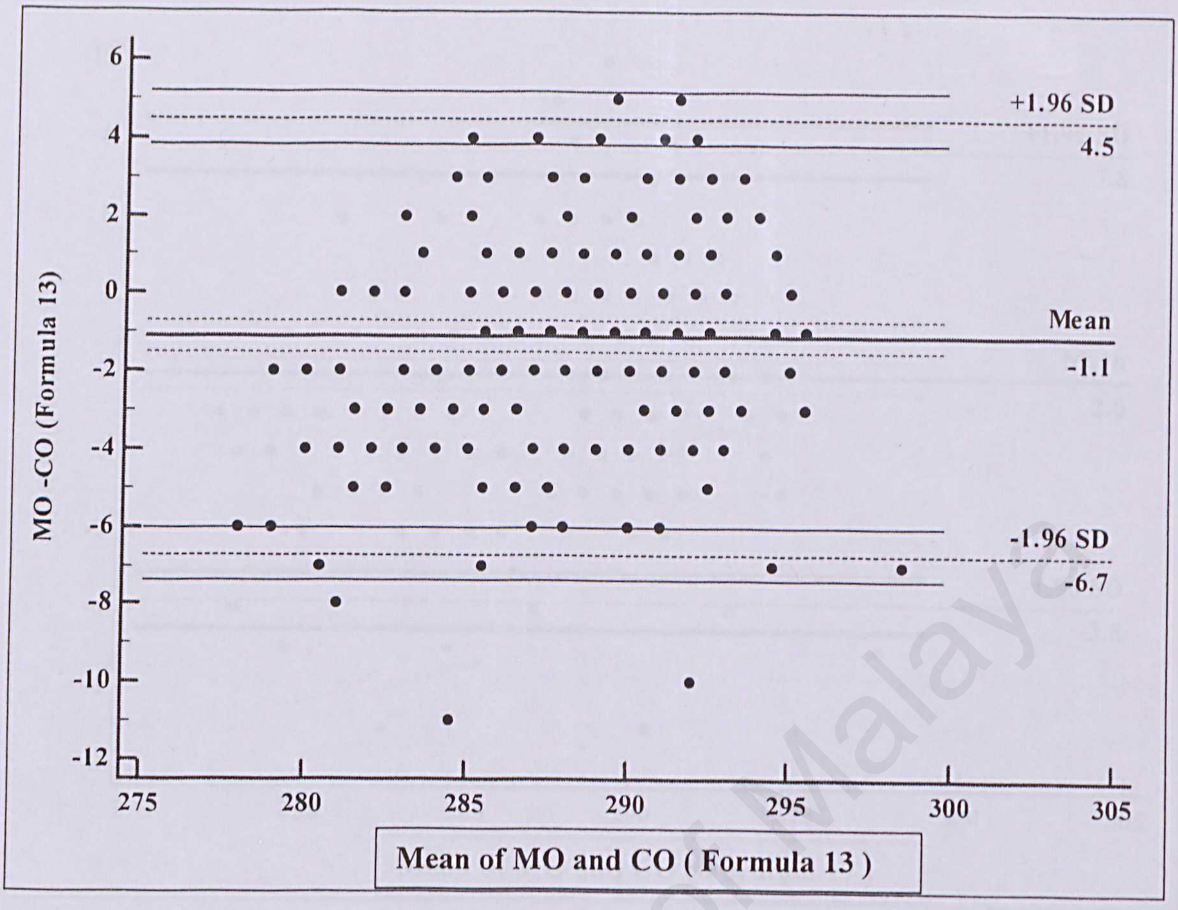

Figure 1B Bland-Atlman plot between measured osmolality(MO) and calculated osmolality(CO) (Formula 13) for Group 1

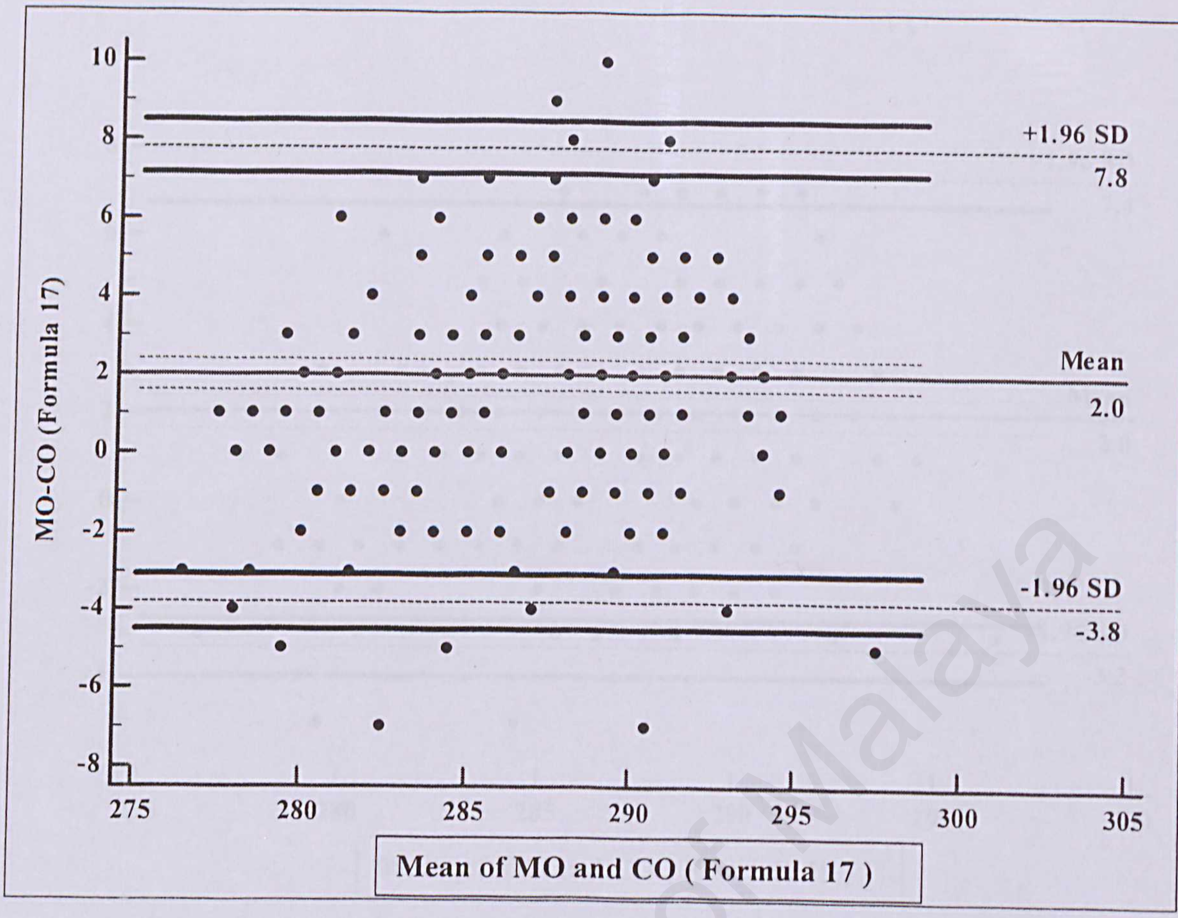

Figure 1C Bland-Atlman plot between measured osmolality (MO) and calculated osmolality (CO) (Formula 17) for Group 1

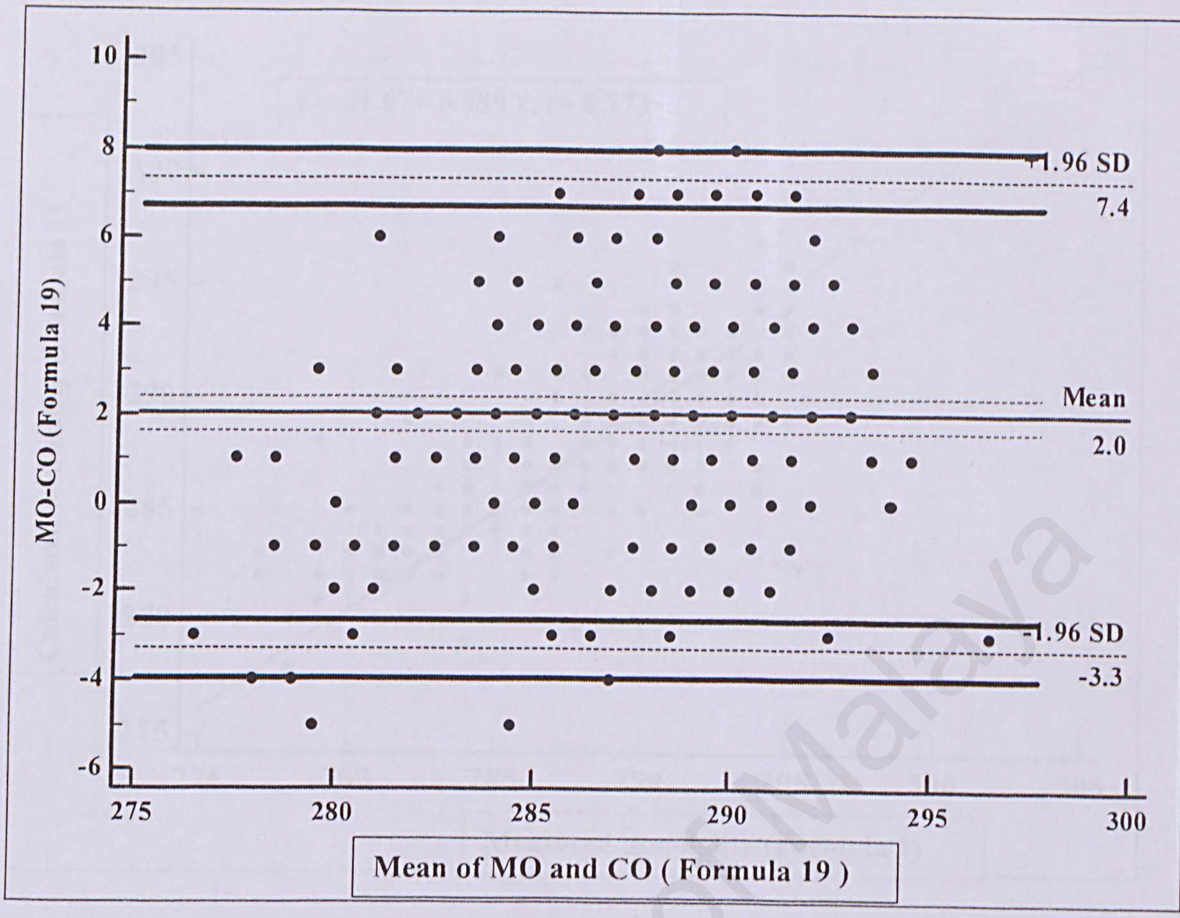

Figure 1D Bland-Atlman plot between measured osmolality (MO) and calculated osmolality (CO) (Formula 19) for Group 1

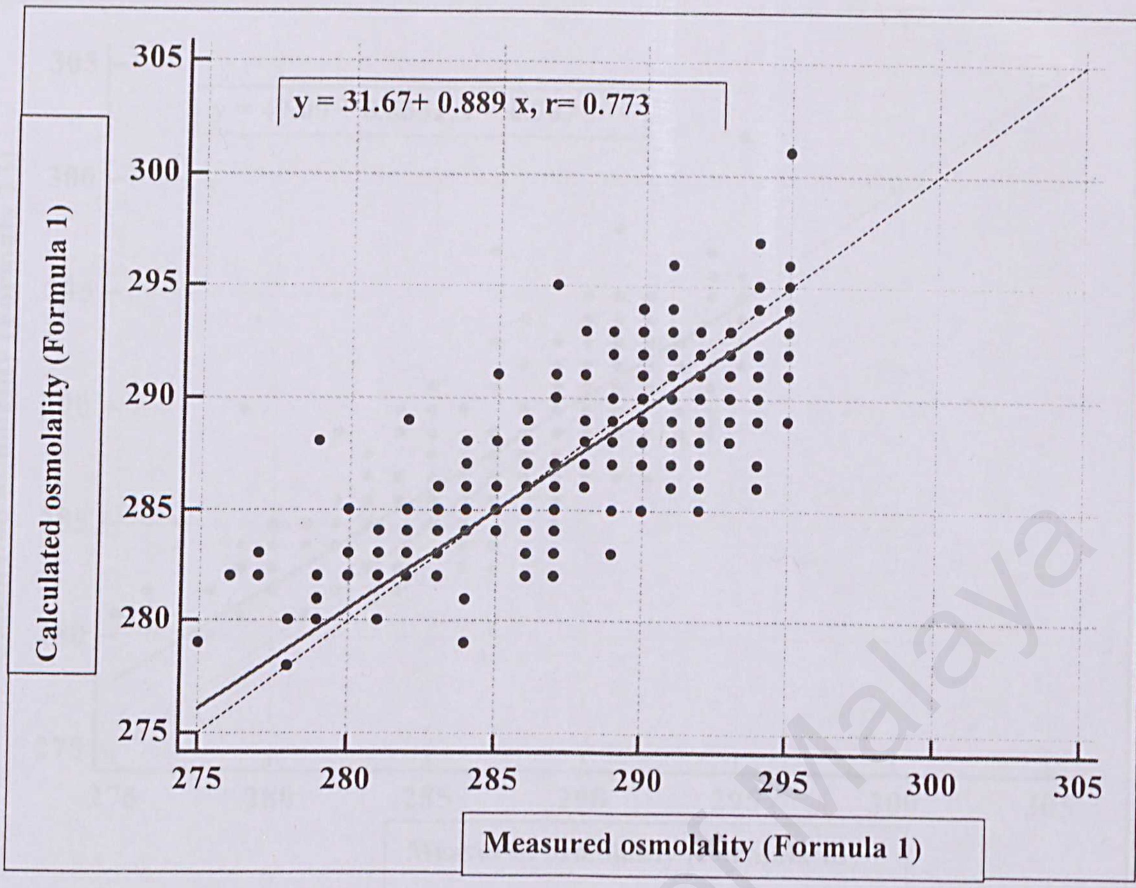

Figure 2A Passing-Bablok regression analysis between measured osmolality and calculated osmolality (Formula 1) for Group 1

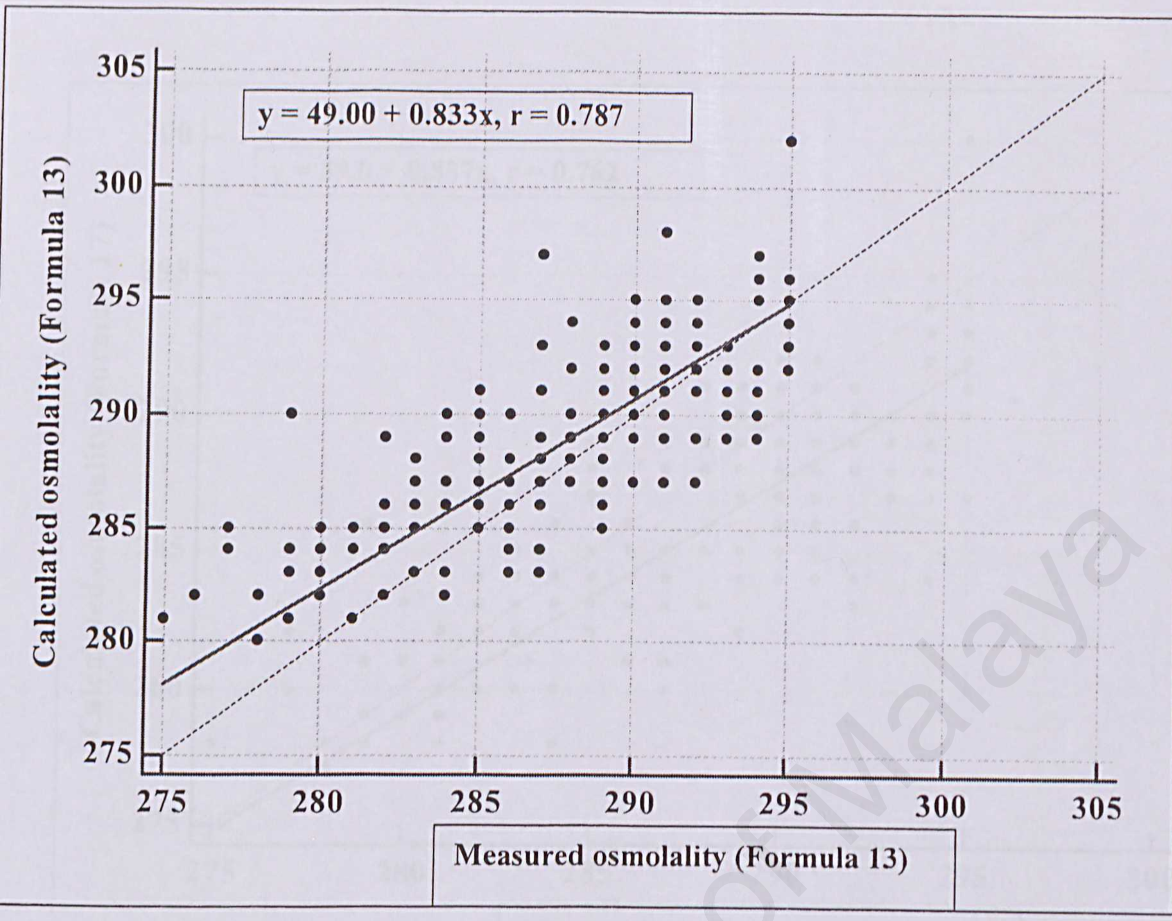

Figure 2B Passing-Bablok regression analysis between measured osmolality and calculated osmolality (Formula 13) for Group 1

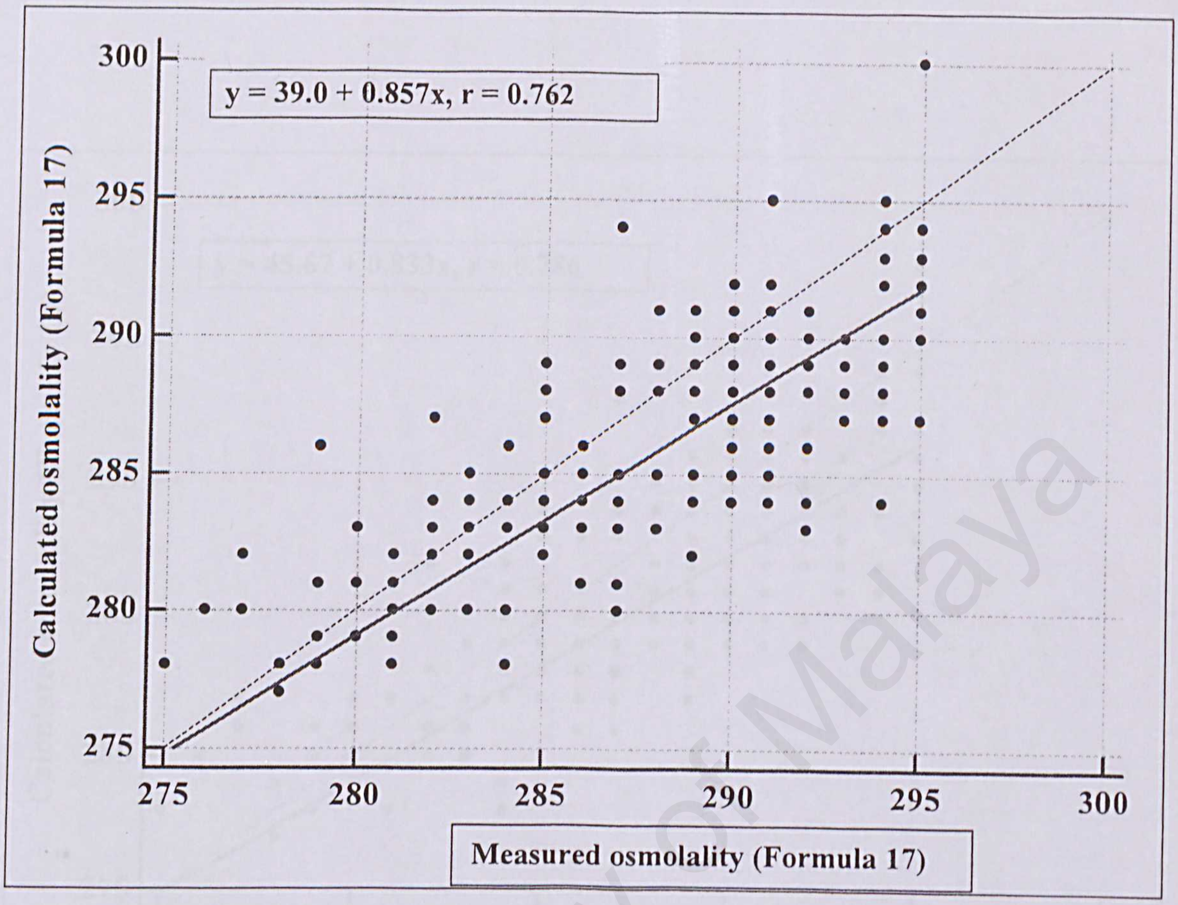

Figure 2C Passing-Bablok regression analysis between measured osmolality and calculated osmolality (Formula 17) for Group 1

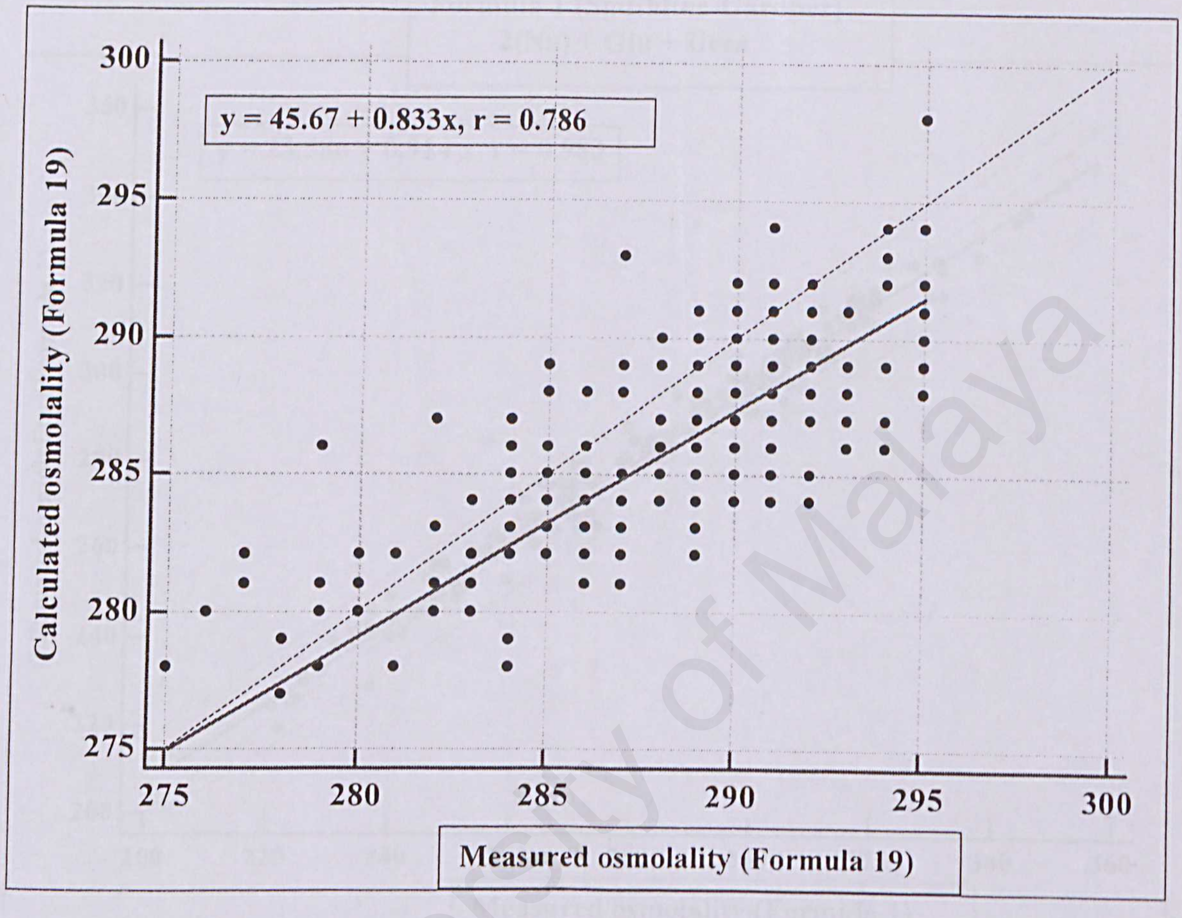

Figure 2D Passing-Bablok regression analysis between measured osmolality and calculated osmolality (Formula 19) for Group 1

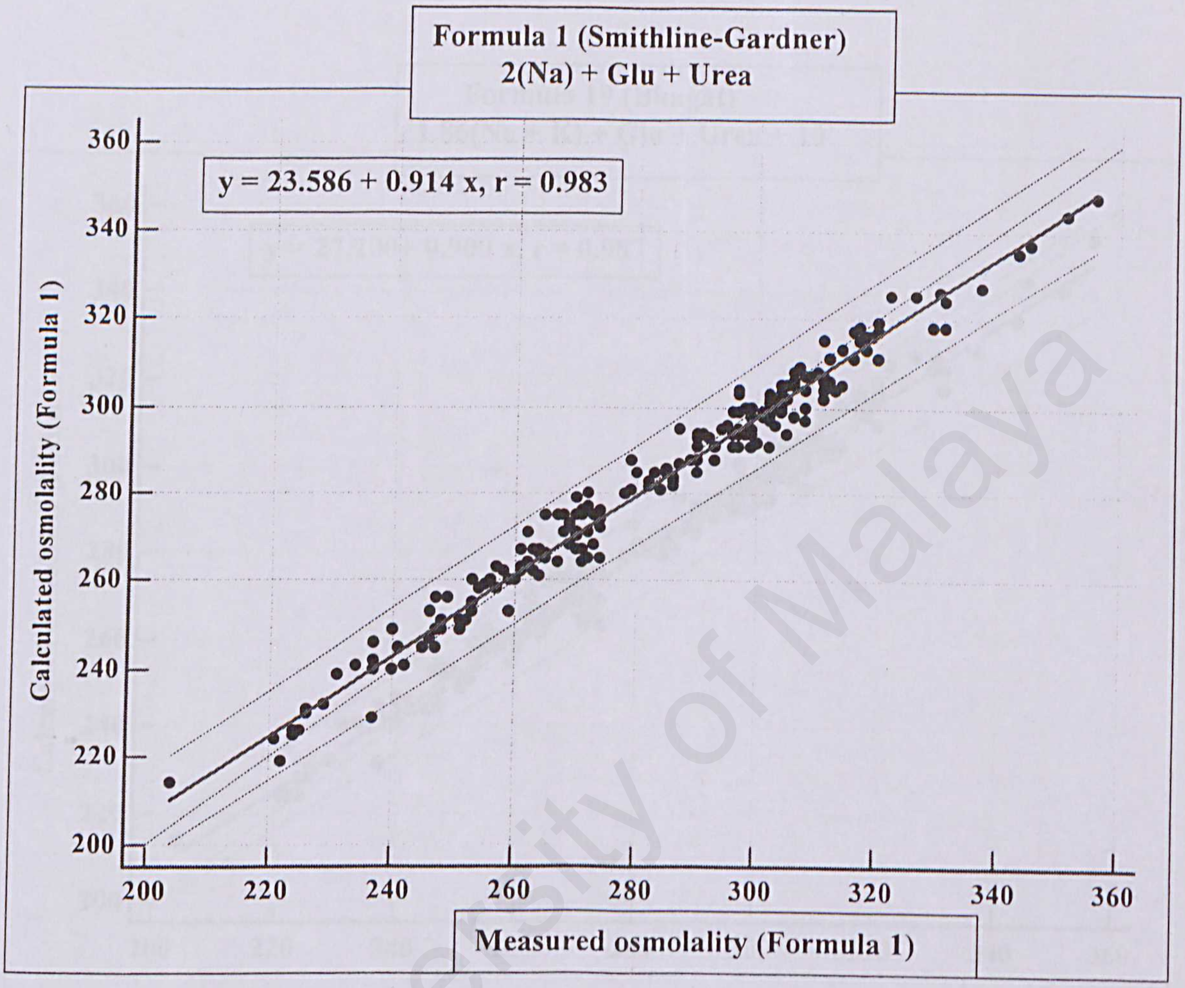

Figure 3A Passing-Bablok regression analysis between measured osmolality and calculated osmolality (Formula 1) for Group 2

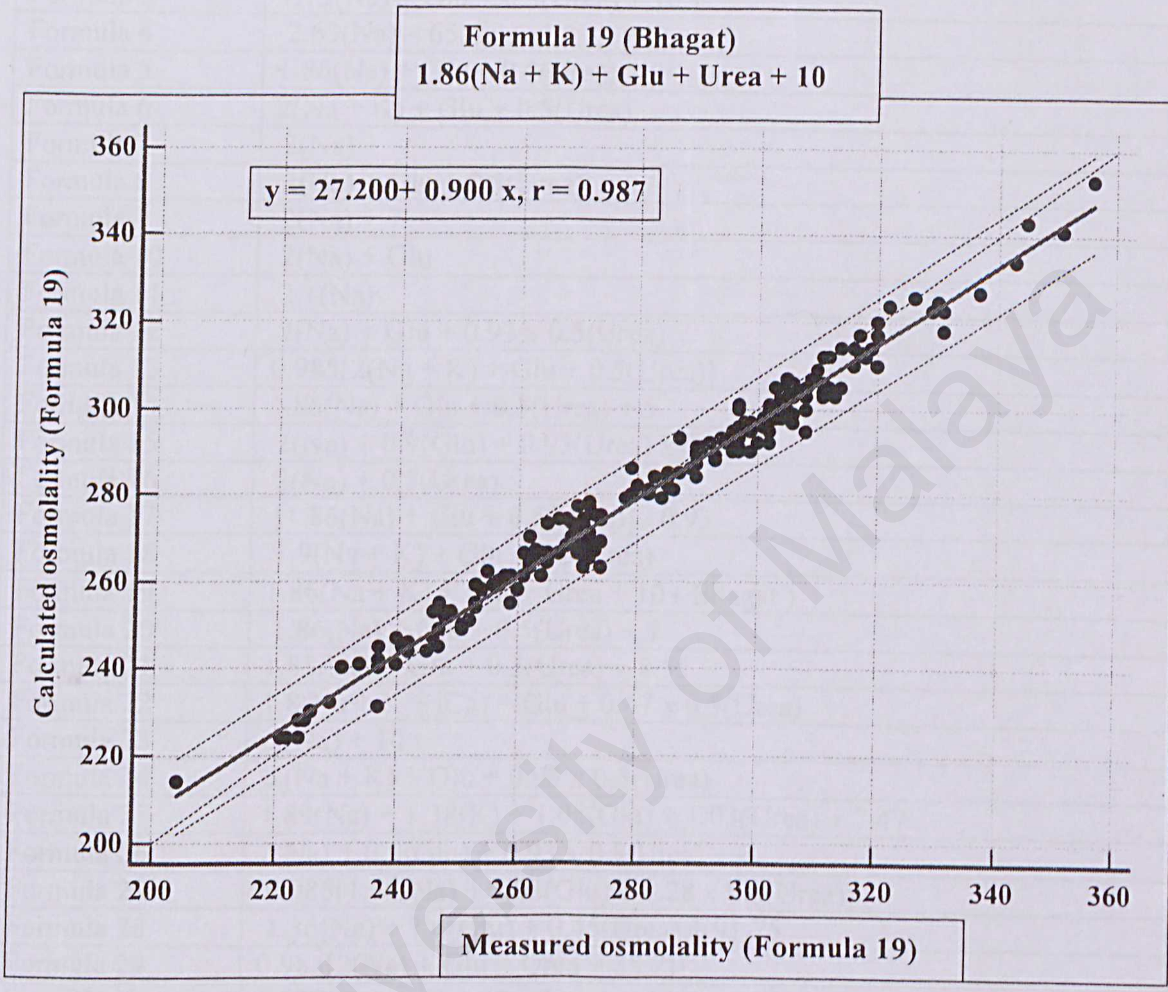

Figure 3B Passing-Bablok regression analysis between measured osmolality and calculated osmolality (Formula 19) for Group 2

Table 1 : The different formulae used for calculation of osmolality

	Formula
Formula 1	2(Na) + Glu + Urea (Smithline – Gardner)
Formula 2	1.86(Na) + Glu + Urea + 9 (Dowart's Chalmer)
Formula 3	1.75(Na) + Glu + 0.5(Urea) + 10.1
Formula 4	2.63(Na) – 65.4
Formula 5	1.86(Na) + Glu + 0.5(Urea)
Formula 6	2(Na + K) + Glu + 0.5(Urea)
Formula 7	2(Na)
Formula 8	2(Na) + Glu + 0.5(Urea)
Formula 9	2(Na) + 7
Formula 10	2(Na) + Glu
Formula 11	2.1(Na)
Formula 12	2(Na) + Glu + 0.93 x 0.5(Urea)
Formula 13	0.985[2(Na + K) + Glu + 0.5(Urea)]
Formula 14	1.86(Na) + Glu + 0.5(Urea) + 5
Formula 15	2(Na) + 0.9(Glu) + 0.93(Urea) x 0.5
Formula 16	2(Na) + 0.5(Urea)
Formula 17	[1.86(Na) + Glu + 0.5(Urea)] / 0.93
Formula 18	1.9(Na + K) + Glu + 0.5(Urea)
Formula 19	1.86(Na + K) + Glu + Urea + 10 (Bhagat)
Formula 20	1.86(Na) + Glu + 0.5(Urea) + 9
Formula 21	1.85(Na) + Glu + 0.5(Urea) + 8.55
Formula 22	1.8(Na + K + iCa) + Glu + 0.47 x 0.5(Urea)
Formula 23	2(Na) + 10
Formula 24	2(Na + K) + Glu + 0.93 x 0.5(Urea)
Formula 25	1.89(Na) + 1.38(K) + 1.08(Glu) + 1.03(Urea) + 7.47
Formula 26	2(Na) + 0.9(Glu) + 0.93 x 0.5(Urea) + 8
Formula 27	0.985[1.86(Na) + 1.03(Glu) + 1.28 x 0.5(Urea)]
Formula 28	1.36(Na) + 1.6(Glu) + 0.45(Urea) + 91.75
Formula 29	0.985[2(Na) + Glu + Urea + 35.2)]
Formula 30	1.897(Na) + Glu + 0.5(Urea) + 13.5
Formula 31	1.9(Na + K) + Glu + 0.5(Urea) + 5
Formula 32	1.86(Na + K) + Glu + Urea
Formula 33	2(Na) + 1.15(Glu) + Urea
Formula 34	1.86(Na + K) + 1.15(Glu) + Urea + 14
Formula 35	1.85(Na) + 1.84(K) + 1.15(iCa) + 1.17(Mg) + Glu + 0.5(Urea)
Formula 36	1.09 x 1.86(Na) + Glu + Urea
Formula 37	0.985(Na + K + Cl + HCO3 + Lactate + Glu +Urea + 6.5)

*Units for all analytes are in mmol/L

*Formula 1-37 adapted from Fazekas et al [12] and Choy et al [16]

Abbreviations: Na, sodium; Glu, glucose; K, potassium; Mg, magnesium; iCa, ionised calcium; Cl, chloride

Table 2: The Wilcoxon test for 2 paired samples between measured osmolarity and calculated osmolality for Group 1

Formula	Mean +SD	Mean Difference + SD	95% CI	OG + SD	p (2- tailed)
Formula 1	288+ 4.1	-0.3+2.9	-0.69 to 0.12	0.3 +2.9	0.1083
Formula 2	277+3.8	-10.7+2.9	-11.13 to -10.32	11+2.9	< 0.0001
Formula 3	261+3.5	-27.3+2.9	-27.68 to -26.86	27+3	< 0.0001
Formula 4	299+5.2	11.1+3.7	10.59 to 11.62	-11+3.8	< 0.0001
Formula 5	266+3.7	-22.1+2.9	-22.53 to -21.71	22+3	< 0.0001
Formula 6	294+4	5.5+2.9	5.10 to 5.90	-5+2.9	< 0.0001
Formula 7	277+4	-10.9+3.3	-11.34 to -10.43	11+3.3	< 0.0001
Formula 8	286+4	-2.7+2.9	-3.15 to -2.33	3+3	< 0.0001
Formula 9	284+4	-3.9+3.3	-4.34 to -3.43	4+3.3	< 0.0001
Formula 10	283+4	-5.1+3.2	-5.52 to -4.65	5+3.2	< 0.0001
Formula 11	291+4.2	3.1+3.3	2.65 to 3.57	-3+3.4	< 0.0001
Formula 12	285+4	-2.9+3.0	-3.32 to -2.48	3+3	< 0.0001
Formula 13	289+3.9	1.1+1.1	0.69 to 1.48	-1+2.9	< 0.0001
Formula 14	271+3.7	-17.1+-17.7	-17.53 to -16.71	17+3	< 0.0001
Formula 15	285+4	-3.5+-3.5	-3.93 to -3.09	3+3	< 0.0001
Formula 16	280+4	-8.5+-8.4	-8.90 to -8.04	8+3.1	< 0.0001
Formula 17	286+4	-2.0+-1.9	-2.50 to -1.67	2+3	< 0.0001
Formula 18	279+3.9	-8.9+3.1	-9.21 to -8.36	9+3.1	< 0.0001
Formula 19	286	-2.0 +2.7	-2.50 to -1.71	2+2.8	< 0.0001

Abbreviations: SD: standard Deviation, 95 % CI: 95% Confidence Interval, OG: Osmolar Gap, p: probability

Table 3: Passing-Bablok regression analysis between measured osmolality and calculated osmolality (Formula 1, 13, 17, 19) for Group 1

Formula	Regression equation	Correlation coefficient , r	CI for intercept	CI for slope
Formula 1	y = 31.67 + 0.889x	0.773	0.0 to 57.2	0.8 to 1.0
Formula 2	y = 46.60 + 0.800x	0.772	15.27 to 65.93	0.73 to 0.909
Formula 13	y = 49.00 + 0.833 x	0.787	1.0 to 73.0	0.75 to 1.0
Formula 17	y = 39.0 + 0.857 x	0.762	-2.0 to 69.75	0.75 to 1.0
Formula 19	y = 45.67 + 0.833x	0.786	-2.0 to 69.75	0.75 to 1.0

Table 4: Passing-Bablok regression analysis between measured osmolality and calculated osmolality (Formula 1 and 19) for Group 2

Formula	Regression equation	Correlation coefficient , r	CI for intercept	CI for slope
Formula 1	y = 23.59 + 0.914x	0.983	17.805 to 29.393	0.893 to 0.935
Formula 19	y = 27.20 + 0.90x	0.987	21.983 to 31.967	0.883 to 0.918

Abbreviations: 95 % CI: Confidence Interval

CHAPTER 4

DISCUSSION

Since 1958, there has been effort in the pursuit of the formula that will give the minimum osmolal gap. The best formula will produce a gap as close to zero and with a low standard deviation. The purpose of the study was to validate 19 formulae used to predict osmolality. Our goal was to identify the most efficacious formula and that can applied for the calculation of osmolality. Fazakes et al [12]suggested that a mean difference of ≤ 2 mOsm/kg between the calculated and measured osmolality would be desirable and a value above 5 mOsm/kg significantly compromise the usefulness of the formula. Hence, in order to evaluate the equation for calculating osmolality, we considered a mean difference of ≤ 2 mOsm/kg. Osmolal gap was $\pm$ 2 mOsm/kg seen only for four (Equation 1, 13, 17 and 19) out of the 19 formulae being studied. Choy et al [16] applied to 34 formulae to the data from Royal College of pathologists of Australasia Quality assurance Program (RCPA QAP) Liquid Serum Chemistry and noted that only 6 formulae gave mean OG within 2mOsm/ kg. The Smithline-Gardner formula (Formulae 1) gave the lowest osmolal gap. Similar to their findings, we also observed Smithline-Gardner equation showed the minimum osmolal gap when compared to all the other formulae. When comparing these four formulae, the Formula 1 (Smithline) showed lowest mean difference of -0.3 $\pm$ 2.9 (mean $\pm$ SD) with the 95% confidence interval of -0.69 to 0.12 compared to others. The Wilcoxon test for paired samples also showed that there is statistically no significant difference between the measured and calculated osmolality (p>0.05).

The Bland-Altman plot for these four formulae as shown in Figure 1(A-D), showed that 95% of the results were within the confidence interval. This means that there is an agreement between the osmolal gap and the average of calculated and measured osmolalities of the four selected formulae.

The Passing-Bablok regression analysis was performed for the four formulae which showed the least osmolal gap compared to other formulae . Of the four, only Formula 1, 17 and 19 showed the slope and intercept confidence intervals that included 1 and 0, respectively.

Formula 17 ([1.86(Na) + Glu + 0.5(Urea)] / 0.93) was more complicated compared to Smithline-Gardner Formula 1 (2(Na) + Glu + Urea) and Bhagat Formula 19 (1.86(Na + K) + Glu + Urea + 10). Hence we applied Smithline-Gardner and Bhagat formulae for the group 2 patient samples to study the relationship between the calculated and measured osmolality. The group 2 patient samples comprised of hyponatraemic, hypernatraemic and normonatraemic samples. Both formulae gave similar results as shown in Table 4. The Dorwarts-Chalmers formula (Formula 2) which is now widely used and has also has been incorporated widely in the inbuilt analyser software.[13] However, we observed that Dorwart's formula underestimates the osmolality compared to the measured osmolality as shown in Table 2, Similar findings has been reported by other studies also. [2 13 15]

The reporting of calculated parameters which derive from measured parameters, are a part of the post analytical phase of the testing process. Numerous different formulae may be used for calculations. However, the formula and the reference intervals used may not necessarily be appropriate for all the analytical methods used.[19] In an effort to harmonise the calculation of osmolal gap in Australasia (based on the data from RCPAQAP Chemical Pathology liquid Serum Chemistry program 2014),it was recommended the use of the Smithline-Gardner formula which produced osmolar gap close to zero with an SD of around 4.[16] It was also demonstrated that the Smithline-Gardner formula is also adequately robust for all major analysers in laboratories across Australasia.[16]

CHAPTER 5

CONCLUSION

Based on our data findings, we recommend Smithline-Gardner formula to be used by laboratories and also by clinician for the calculation of osmolal gap, on the basis that (i) OG gap is close to zero, (ii) it is simple, easy to calculate at bedside and (iii) can be easily automated into the Laboratory Information System(LIS). We do not recommend the use of the Dorwart-Chalmers formula since it underestimates the calculated osmolality.

CHAPTER 6

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APPENDIX A: ETHICS COMMITTEE APPROVAL

UNIVERSITY OF MALAYA MEDICAL CENTRE

MEDICAL RESEARCH ETHICS COMMITTEE
(Formerly known as Medical Ethics Committee)
UNIVERSITY OF MALAYA MEDICAL CENTRE
ADDRESS : LEMBAH PANTAI, 59100 KUALA LUMPUR, MALAYSIA
TELEPHONE : 03-79493209/2251 FAXIMILE : 03-79492030

ME OF ETHICS COMMITTEE/IRB cal Research Ethics Committee, University Malaya Medical Centre	**MREC ID NO**: 20161230-4721
RESS : LEMBAH PANTAI, 59100 KUALA LUMPUR, MALAYSIA	
TOCOL NO(if applicable) :	
LE: arison of various equations to calculate plasma osmolality	
NCIPAL INVESTIGATOR : DR SARASWATHY A/P APPAROW	**SPONSOR** -

ollowing item [✓] have been received and reviewed in connection with the above study to conducted by the above investigator.

] Application to Conduct Research Project(form)	Ver.No :	Ver.Date : 30-12-2016
] Study Protocol	Ver.No : 2016	Ver.Date : 07-01-2017
] Patient Information Sheet	Ver.No :	Ver.Date :
] Consent Form	Ver.No :	Ver.Date :
] Questionnaire	Ver.No :	Ver.Date :
] Investigator's CV / GCP (DR SARASWATHY A/P APPAROW,PAVAI STHANESHWAR,)	Ver.No :	Ver.Date :
] Insurance certificate	Ver.No :	Ver.Date :
Other documents		
1) Comparison of various equations to calculate plasma osmolality	Ver.No : 2017	Ver.Date : 09-01-2017

decision is [✓]

Approved (Full Board)
Approved (Expedited)
Rejected(reasons specified below or in accompanying letter)

nts:

nents made.

estigators are required to:

follow instructions, guidelines and requirements of the Medical Research Ethics Committee.
report any protocol deviations violations to Medical Research Ethics Committee.
provide annual and closure report to the Medical Research Ethics Committee.
comply with International Conference on Harmonization – Guidelines for Good Clinical Practice (ICH-GCP) and Declaration of Helsinki.
obtain a permission from the Director of UMMC to start research that involves recruitment of UMMC patient.
ensure that if the research is sponsored, the usage of consumable items and laboratory tests from UMMC services are not charged in the patient's hospital bills but are borne by research grant.
note that he she can appeal to the Chairman of Medical Research Ethics Committee for studies that are rejected.
note that Medical Research Ethics Committee may audit the approved study.
ensure that the study does not take precedence over the safety of subjects.

xpedited approval : 03-02-2017

computer generated letter. No signature required.

APPENDIX B: RAW DATA OF THE STUDY

Request #	Osm	Na	K	Urea	Glu	Form 1
5010659159	290	141	3.9	5.2	6.6	294
5010660336	284	136	4	3.3	5.4	281
5010667557	283	137	4.4	6	5.3	285
5010667213	282	137	4.1	3.2	5.6	283
5010669123	290	137	4.3	3.9	7.3	285
5010687732	286	136	4.3	3.8	6.4	282
5010691836	285	139	3.8	3.5	4.8	286
5010705106	294	142	4.1	4.5	6.3	295
5010711969	279	135	4.4	4.7	6.1	281
5020713810	285	137	3.5	5.2	5.4	285
5020719626	287	142	4.5	3.7	7.1	295
5020720581	279	139	4.2	4	5.7	288
5020723573	285	139	4.4	3.8	4.5	286
5020725610	280	137	3.7	4.9	5.8	285
5020730395	290	140	3.8	6.1	6.7	293
5020737587	293	139	4.1	6.8	6.5	291
5020741364	278	135	4.4	3.4	6.1	280
5020746837	293	139	4.7	4.1	6.2	288
5020751459	289	139	4.4	3.3	6.4	288
5020759944	282	135	3.6	6.5	5.8	282
5020759594	295	142	3.5	4.4	7.2	296
5020760967	286	136	4.1	5	5.8	283
5020761234	286	137	3.6	3.7	6.1	284
5091085482	287	138	4.4	6.4	4.2	287
5091085847	291	141	3.8	4.6	6.9	294
5091091716	292	141	4.6	5.6	5.8	293
5091096888	290	139	4.7	4.6	5.2	288
5091100391	293	140	3.5	3.7	7	291
5091109364	290	140	4	4.2	6.6	291
5091113862	291	139	4.5	5	7.3	290
5091114289	287	141	4.4	4.8	4	291
5091118791	293	139	3.8	6.7	6.8	292
5091119683	289	137	3.7	4.2	7.1	285
5091119752	287	138	3.5	3.9	5.5	285
5091119751	286	137	4.7	4.4	5.8	284
5091124144	290	139	3.8	4.1	5.6	288
5091124103	291	140	4	3.5	5.9	289
5091126644	277	135	4.3	4.3	7.6	282
5101136251	287	139	4.3	3.3	5.3	287
5101139628	284	137	4	4.5	5.7	284
5101140075	283	135	3.8	4.2	7.5	282
5101141874	290	139	4.6	3.4	5.6	287
5101144715	286	137	4	4.2	6.1	284
5101149255	292	140	4.4	3.6	6.7	290
5101149898	290	141	4	4.4	5.9	292
5101151127	283	137	4.2	4.8	6.8	286

Request #	Osm	Na	K	Urea	Glu	Form 1
5101151922	291	142	4	3.6	4.3	292
5101153070	288	138	4.1	6.2	3.8	286
5101157517	295	139	4.7	5.2	6	289
5101157408	283	135	4.1	7.5	7.6	285
5101158170	285	139	3.8	5	7.7	291
5101162917	287	138	4	3.6	6.2	286
5101163555	293	139	3.7	6.7	5	290
5108009408	295	145	3.9	5.1	6.3	301
5101163496	275	135	4.2	3.7	5.2	279
5101164210	286	138	3.6	3.2	5.4	285
5101164369	289	140	4	4.9	4.2	289
5101164523	291	139	3.7	4.6	5.4	288
5101176282	290	141	4.4	4.9	4.5	291
5101178542	291	139	3.9	5.5	5.7	289
5101182829	288	139	3.5	4.1	7.3	289
5101184972	285	137	4.2	4	6.2	284
5101187651	284	138	4.3	4.2	6.8	287
5101187741	286	137	4.2	5.6	7.1	287
5101187711	288	139	4.5	4.2	4.6	287
5111188239	292	139	4.2	3.8	7.6	289
5111192035	282	138	3.6	3.5	5.7	285
5111196306	284	138	4.7	3.3	6.2	286
5111198115	289	140	4.3	3.4	5.3	289
5111198853	286	138	4.1	4.4	4.6	285
5111199336	288	140	4	5.5	5.2	291
5111201414	286	136	3.5	6.9	5.1	284
5111206837	294	139	4.2	7.4	5.6	291
5111206865	284	139	3.8	3.5	3.6	285
5111209018	293	139	4.1	5.7	5.2	289
5111208794	295	141	3.8	4.8	6.2	293
5111209652	293	139	4.4	5.9	5.7	290
5111209656	294	142	4.1	5.1	5.9	295
5111220218	294	140	3.8	5.2	6.6	292
5111221099	295	142	3.6	4.7	5.2	294
5111220981	294	136	4.8	7.4	7.6	287
5111221608	286	138	4.2	4.5	4.7	285
5111223094	293	141	4.2	3.7	5.1	291
5111224037	276	136	3.7	4.9	4.8	282
5111223041	284	138	4.2	4.2	5.3	286
5111227084	289	140	4.2	3.3	5.2	289
5111229506	280	135	4	5.9	5.8	282
5111231525	293	139	3.9	6.1	6.3	290
5111233662	290	138	4.5	4.9	5.8	287
5121235869	289	138	4.1	3.4	3.9	283
5121235833	287	138	3.9	3.5	5	285
5121245166	289	138	4.7	5.9	5	287

Request #	Osm	Na	K	Urea	Glu	Form 1
5121246091	291	141	3.8	3.3	5.9	291
5121249772	279	136	3.9	4.5	5.9	282
5121254789	284	139	4.1	3.6	6.1	288
5121257303	284	138	4.1	6.1	6.2	288
5121264634	294	137	5	4.7	7.2	286
5121264793	289	139	3.9	5.2	5.6	289
5121266292	286	137	4.4	7.9	7.4	289
5121269892	289	138	3.8	5.8	7.3	289
5121269738	282	136	3.5	5.4	6.2	284
5121269959	292	137	4.9	7.8	5.3	287
5121272147	288	139	4.7	4.3	4.8	287
5121272079	290	139	4.1	4.4	7.2	290
5121270035	289	140	3.8	3.3	6.9	290
5121274019	292	136	4.3	7.7	6.6	286
5121277883	283	138	3.6	3.3	7.1	286
5121281924	281	135	3.8	4.1	5.9	280
5121281992	289	137	4.1	5.8	7.3	287
5121282180	282	136	3.6	5.7	7.7	285
5121287912	281	136	4.6	6.1	4.8	283
6101746324	284	138	3.8	4.3	4.7	285
6011322833	292	138	4.3	4.7	4.7	285
6021346826	292	140	4.5	4.7	4.8	290
6061559916	295	141	3.8	4.7	5.1	292
6071588516	286	138	3.5	3.6	6.5	286
6061548465	286	140	4.3	3.8	3.9	288
6011315424	287	137	3.9	3.9	5	283
6011306371	280	136	3.6	4.6	5.9	283
6081645254	285	139	3.8	3.8	4	286
6051525236	289	141	3.8	3.2	4.5	290
6061576412	279	135	3.8	4.7	5.1	280
6071613586	292	141	3.9	4.1	5.4	292
6051525084	291	139	4.5	4.5	4.3	287
6091707546	287	137	4.6	5.5	6.4	286
6011320613	287	138	4.2	4.7	5.3	286
6091718346	291	140	5	4	5.7	290
6061563075	283	137	4	3.5	5.4	283
6071589645	285	137	4.2	4.4	5.2	284
6011324641	285	137	4.1	7.1	5	286
6061560731	288	142	3.8	4.1	4.4	293
6011320607	287	139	4.2	5.7	6.4	290
6081663196	291	139	4.4	6	5.6	290
6041486758	292	140	4.5	3.9	4	288
6091683211	287	139	4.5	3.2	4.6	286
6081644365	291	138	3.8	5.1	5	286
6081677010	292	140	4.1	5.2	5.6	291
6021364427	289	138	4.2	4.4	4.8	285

Request #	Osm	Na	K	Urea	Glu	Form 1
6041466302	288	139	3.9	4.8	4.4	287
6101743468	281	135	3.7	4.6	5.1	280
6031425751	280	136	3.9	4.1	6.3	282
6011289553	293	138	4.6	5.1	7.6	289
6011324262	295	142	3.6	3.6	5	293
6011297148	282	137	3.6	3.3	5.6	283
6011314347	292	139	5	6.9	5.9	291
6011289442	292	141	4.2	4.7	5.9	293
6102015522	286	138	4.4	3.7	5.6	285
6041444360	282	138	3.7	6.1	7.1	289
6021371497	293	139	4.2	3.2	6.4	288
6011318170	291	141	3.8	4.2	6.7	293
6041455671	287	135	4.3	4	7.7	282
6071589163	292	141	3.8	4.5	5.4	292
6011327290	294	143	3.6	5.3	5.8	297
6081641452	295	140	4.4	4.2	7.1	291
6011291971	294	140	3.8	5.1	6	291
6081641195	291	141	4.9	3.7	5.3	291
6011323665	289	138	4.2	6.4	4.3	287
6092008069	293	139	4.8	6	7.3	291
6011289670	295	141	4.7	7.4	5.2	295
6088978981	289	139	4.6	6.6	7.4	292
6051513082	289	141	4	4.9	5.4	292
6021370695	292	139	4.4	3.8	7.1	289
6051491981	288	137	4.5	7.7	6.1	288
6011338930	283	138	4.1	3.3	4.5	284
6021348601	294	139	3.7	4.4	7.6	290
6031399855	294	142	4.1	5.2	5.5	295
6081636388	291	140	4.9	4.9	7.7	293
6031435415	290	141	4.2	6.6	4.9	294
6061541755	295	140	3.6	7.2	5.7	293
6031435285	291	140	3.8	4.4	4.9	289
6011303949	292	140	4.7	4.6	3.7	288
6011309924	294	142	4.1	4.7	6.5	295
6031429503	289	141	3.5	4.6	6.1	293
6041481798	289	137	4.7	7.2	4.2	285
6041443029	285	139	3.8	3.8	6.3	288
6081631411	294	140	4.4	6.4	7.5	294
6061557600	295	141	4.1	6.8	5.1	294
6051490952	290	141	4.2	4.1	4.4	291
6071625595	293	140	4.2	7.1	5.7	293
6011313937	281	137	3.7	5.9	4.3	284
6011332217	287	138	4.5	3.3	4.8	284
6011307004	294	139	4.3	5.1	5.4	289
6011311946	285	138	3.9	8.2	6.9	291
6011303119	291	140	4	3.5	5.3	289

Request #	Osm	Na	K	Urea	Glu	Form 1
6041455296	295	142	3.6	4.4	5.9	294
6102019896	285	138	4.2	4.1	5	285
6051536060	278	135	4	3.9	4.5	278
6021353571	293	139	3.9	3.9	6.5	288
6031405711	292	140	3.7	6.8	5.7	293
6011307597	283	135	4.1	5.7	6.5	282
6051511429	277	137	4.2	4	5.3	283
6021350208	291	139	4.6	4.7	5.8	289
6071623631	290	139	3.9	3.6	7	289
6021355484	284	135	4.4	3.5	5.3	279
6011303723	291	144	4.1	4.2	4	296
6021379215	292	141	3.8	4.8	5.2	292
6051530787	290	140	4.2	4.2	5.4	290
6071614962	290	139	4.3	5.3	5.1	288
6031432108	295	140	4.1	5.1	7.3	292
6021368980	292	142	4.3	4.9	4.5	293
6051498356	292	140	4.3	4.8	5.1	290
6031435859	287	135	3.8	6	6.6	283
6061570889	281	136	4.8	4.4	5.8	282
6021344203	289	140	4	5	5	290
6021387030	286	138	4.1	4.1	6.2	286
			4	5	6	**288**
mean	**288**	**139**	**0.4**	**1.2**	**1.0**	**4.1**
SD	**4.6**	**2.0**				

Form 2	Form 3	Form 4	Form 5	Form 6	Form 7	Form 8	Form 9
283	266	305	271	299	282	291	289
271	255	292	260	287	272	279	279
275	258	295	263	291	274	282	281
273	257	295	262	289	274	281	281
275	259	295	264	292	274	283	281
272	256	292	261	289	272	280	279
276	260	300	265	292	278	285	285
284	267	308	273	301	284	293	291
271	255	290	260	287	270	278	277
274	258	295	263	289	274	282	281
284	268	308	273	302	284	293	291
277	261	300	266	294	278	286	285
276	260	300	265	293	278	284	285
275	258	295	263	290	274	282	281
282	265	303	270	297	280	290	287
281	263	300	268	296	278	288	285
270	254	290	259	287	270	278	277
278	262	300	267	296	278	286	285
277	261	300	267	295	278	286	285
272	255	290	260	286	270	279	277
285	268	308	274	300	284	293	291
273	256	292	261	289	272	280	279
274	258	295	263	289	274	282	281
276	259	298	264	292	276	283	283
283	266	305	271	299	282	291	289
283	265	305	271	300	282	291	289
277	261	300	266	295	278	286	285
280	264	303	269	296	280	289	287
280	264	303	269	297	280	289	287
280	263	300	268	297	278	288	285
280	263	305	269	297	282	288	289
281	264	300	269	296	278	288	285
275	259	295	264	291	274	283	281
275	259	298	264	290	276	283	283
274	258	295	263	291	274	282	281
277	261	300	266	293	278	286	285
279	263	303	268	296	280	288	287
272	256	290	261	288	270	280	277
276	260	300	265	294	278	285	285
274	258	295	263	290	274	282	281
272	256	290	261	287	270	280	277
277	261	300	266	295	278	285	285
274	258	295	263	290	274	282	281
280	264	303	269	297	280	289	287
282	265	305	270	298	282	290	289
275	259	295	264	292	274	283	281

Form 2	Form 3	Form 4	Form 5	Form 6	Form 7	Form 8	Form 9
281	265	308	270	298	284	290	291
276	259	298	264	291	276	283	283
279	262	300	267	296	278	287	285
275	258	290	262	290	270	281	277
280	264	300	269	296	278	288	285
275	260	298	265	292	276	284	283
279	262	300	267	294	278	286	285
290	273	316	279	307	290	299	297
269	253	290	258	285	270	277	277
274	259	298	264	290	276	283	283
279	262	303	267	295	280	287	287
278	261	300	266	293	278	286	285
281	264	305	269	298	282	289	289
279	262	300	267	294	278	286	285
279	263	300	268	294	278	287	285
274	258	295	263	291	274	282	281
277	261	298	266	294	276	285	283
277	260	295	265	292	274	284	281
276	260	300	265	294	278	285	285
279	263	300	268	296	278	288	285
275	259	298	264	291	276	283	283
275	259	298	265	293	276	284	283
278	262	303	267	296	280	287	287
275	258	298	263	291	276	283	283
280	263	303	268	296	280	288	287
274	257	292	262	288	272	281	279
281	263	300	268	296	278	287	285
275	259	300	264	291	278	283	285
278	261	300	267	294	278	286	285
282	265	305	271	298	282	291	289
279	262	300	267	295	278	287	285
284	267	308	273	301	284	292	291
281	264	303	270	297	280	289	287
283	266	308	272	299	284	292	291
277	259	292	264	293	272	283	279
275	259	298	264	291	276	283	283
280	264	305	269	297	282	289	289
272	255	292	260	287	272	279	279
275	259	298	264	292	276	283	283
278	262	303	267	295	280	287	287
272	255	290	260	287	270	279	277
280	263	300	268	295	278	287	285
276	260	298	265	293	276	284	283
273	257	298	262	290	276	282	283
274	258	298	263	291	276	283	283
277	260	298	265	293	276	284	283

Form 2	Form 3	Form 4	Form 5	Form 6	Form 7	Form 8	Form 9
280	264	305	270	297	282	290	289
272	256	292	261	288	272	280	279
277	261	300	266	294	278	286	285
278	261	298	266	293	276	285	283
276	259	295	264	294	274	284	281
278	262	300	267	294	278	286	285
279	261	295	266	294	274	285	281
279	262	298	267	294	276	286	283
274	257	292	262	288	272	281	279
277	259	295	264	293	274	283	281
277	260	300	265	294	278	285	285
279	263	300	268	296	278	287	285
280	264	303	269	296	280	289	287
276	259	292	263	291	272	282	279
276	260	298	265	292	276	285	283
270	254	290	259	286	270	278	277
277	260	295	265	292	274	284	281
275	259	292	264	290	272	283	279
273	256	292	261	289	272	280	279
275	258	298	264	290	276	283	283
275	259	298	264	292	276	283	283
279	262	303	268	296	280	287	287
281	264	305	270	297	282	289	289
276	260	298	265	291	276	284	283
277	261	303	266	294	280	286	287
273	257	295	262	289	274	281	281
272	256	292	261	287	272	280	279
275	259	300	264	292	278	284	285
279	263	305	268	296	282	288	289
270	254	290	259	285	270	277	277
281	264	305	270	297	282	289	289
276	260	300	265	294	278	285	285
276	259	295	264	292	274	283	281
276	259	298	264	292	276	284	283
279	263	303	268	298	280	288	287
273	257	295	262	289	274	281	281
273	257	295	262	290	274	281	281
276	258	295	263	291	274	283	281
282	265	308	271	298	284	290	291
280	263	300	268	296	278	287	285
279	262	300	267	295	278	287	285
277	261	303	266	295	280	286	287
275	260	300	265	293	278	284	285
276	259	298	264	291	276	284	283
280	263	303	269	296	280	288	287
275	259	298	264	291	276	283	283

Form 2	Form 3	Form 4	Form 5	Form 6	Form 7	Form 8	Form 9
277	260	300	265	293	278	285	285
270	254	290	259	285	270	277	277
272	256	292	261	288	272	280	279
278	262	298	267	295	276	286	283
282	265	308	271	298	284	291	291
273	257	295	262	288	274	281	281
280	263	300	268	297	278	287	285
282	265	305	271	299	282	290	289
275	259	298	264	292	276	283	283
279	262	298	267	294	276	286	283
277	261	300	267	294	278	286	285
282	266	305	271	298	282	291	289
272	256	290	261	288	270	280	277
281	265	305	270	297	282	290	289
286	269	311	274	302	286	294	293
281	264	303	270	298	280	289	287
281	264	303	269	296	280	289	287
280	264	305	269	299	282	289	289
276	259	298	264	292	276	284	283
281	264	300	269	298	278	288	285
284	266	305	271	300	282	291	289
282	264	300	269	298	278	289	285
282	265	305	270	298	282	290	289
278	262	300	268	296	278	287	285
278	260	295	265	293	274	284	281
273	258	298	263	290	276	282	283
280	263	300	268	295	278	288	285
284	267	308	272	300	284	292	291
282	265	303	271	300	280	290	287
283	265	305	270	299	282	290	289
282	264	303	270	297	280	289	287
279	262	303	268	295	280	287	287
278	261	303	266	295	280	286	287
284	267	308	273	301	284	293	291
282	265	305	271	297	282	290	289
275	258	295	263	291	274	282	281
278	262	300	267	294	278	286	285
283	266	303	271	300	280	291	287
283	265	305	271	299	282	291	289
280	263	305	269	297	282	288	289
282	264	303	270	298	280	289	287
274	257	295	262	289	274	281	281
274	258	298	263	291	276	282	283
278	261	300	266	295	278	286	285
281	263	298	268	295	276	287	283
278	262	303	267	295	280	287	287

Form 2	Form 3	Form 4	Form 5	Form 6	Form 7	Form 8	Form 9
283	267	308	272	299	284	292	291
275	259	298	264	291	276	283	283
269	253	290	258	284	270	276	277
278	262	300	267	294	278	286	285
282	264	303	270	297	280	289	287
272	256	290	260	288	270	279	277
273	257	295	262	290	274	281	281
278	262	300	267	295	278	286	285
278	262	300	267	295	278	287	285
269	253	290	258	286	270	277	277
285	268	313	274	302	288	294	295
281	264	305	270	297	282	290	289
279	263	303	268	296	280	288	287
278	261	300	266	294	278	286	285
282	265	303	270	298	280	290	287
283	266	308	271	300	284	291	291
279	263	303	268	296	280	288	287
273	256	290	261	287	270	280	277
272	256	292	261	290	272	280	279
279	263	303	268	296	280	288	287
276	260	298	265	292	276	284	283
277	**261**	**299**	**266**	**294**	**277**	**286**	**284**
3.8	**3.5**	**5.2**	**3.7**	**4.0**	**4.0**	**4.0**	**4.0**

Form 10	Form 11	Form 12	Form 13	Form 14	Form 15	Form 16	Form17
289	296	291	295	276	290	285	292
277	286	279	283	265	278	274	280
279	288	282	287	268	282	277	283
280	288	281	285	267	281	276	282
281	288	283	287	269	282	276	284
278	286	280	285	266	280	274	281
283	292	284	288	270	284	280	285
290	298	292	296	278	292	286	293
276	284	278	283	265	278	272	279
279	288	282	285	268	281	277	283
291	298	293	297	278	292	286	294
284	292	286	290	271	285	280	286
283	292	284	289	270	284	280	285
280	288	282	285	268	281	276	283
287	294	290	293	275	289	283	290
285	292	288	292	273	287	281	289
276	284	278	282	264	277	272	278
284	292	286	291	272	285	280	287
284	292	286	290	272	285	280	287
276	284	279	282	265	278	273	280
291	298	293	296	279	293	286	294
278	286	280	284	266	280	275	281
280	288	282	285	268	281	276	283
280	290	283	288	269	283	279	284
289	296	291	294	276	290	284	292
288	296	290	295	276	290	285	291
283	292	285	290	271	285	280	286
287	294	289	291	274	288	282	290
287	294	289	292	274	288	282	289
285	292	288	292	273	287	281	289
286	296	288	293	274	288	284	289
285	292	288	291	274	287	281	289
281	288	283	286	269	282	276	284
282	290	283	286	269	283	278	284
280	288	282	287	268	281	276	283
284	292	286	289	271	285	280	286
286	294	288	291	273	287	282	288
278	284	280	284	266	279	272	280
283	292	285	289	270	284	280	285
280	288	282	286	268	281	276	283
278	284	279	283	266	279	272	280
284	292	285	290	271	285	280	286
280	288	282	286	268	281	276	283
287	294	288	293	274	288	282	289
288	296	290	294	275	289	284	291
281	288	283	287	269	282	276	284

Form 10	Form 11	Form 12	Form 13	Form 14	Form 15	Form 16	Form17
288	298	290	294	275	290	286	291
280	290	283	287	269	282	279	283
284	292	286	292	272	286	281	287
278	284	281	285	267	280	274	282
286	292	288	291	274	287	281	289
282	290	284	288	270	283	278	285
283	292	286	289	272	286	281	287
296	305	299	302	284	298	293	300
275	284	277	281	263	276	272	278
281	290	283	286	269	282	278	284
284	294	286	290	272	286	282	287
283	292	286	289	271	285	280	286
287	296	289	293	274	288	284	289
284	292	286	290	272	286	281	287
285	292	287	290	273	286	280	288
280	288	282	286	268	281	276	283
283	290	285	289	271	284	278	286
281	288	284	288	270	283	277	285
283	292	285	289	270	284	280	285
286	292	287	291	273	287	280	288
282	290	283	286	269	283	278	284
282	290	284	289	270	283	278	284
285	294	287	291	272	286	282	288
281	290	283	287	268	282	278	283
285	294	288	292	273	287	283	289
277	286	280	283	267	280	275	281
284	292	287	291	273	286	282	288
282	292	283	287	269	283	280	284
283	292	286	290	272	285	281	287
288	296	290	294	276	290	284	291
284	292	286	291	272	286	281	287
290	298	292	296	278	292	287	293
287	294	289	292	275	288	283	290
289	298	291	294	277	291	286	292
280	286	283	289	269	282	276	284
281	290	283	287	269	282	278	283
287	296	289	293	274	288	284	289
277	286	279	282	265	279	274	280
281	290	283	287	269	283	278	284
285	294	287	291	272	286	282	287
276	284	279	282	265	278	273	279
284	292	287	291	273	287	281	288
282	290	284	289	270	283	278	285
280	290	281	285	267	281	278	282
281	290	283	286	268	282	278	283
281	290	284	289	270	283	279	285

Form 10	Form 11	Form 12	Form 13	Form 14	Form 15	Form 16	Form17
288	296	289	293	275	289	284	290
278	286	280	284	266	279	274	281
284	292	286	290	271	285	280	286
282	290	285	289	271	284	279	286
281	288	283	289	269	283	276	284
284	292	286	290	272	285	281	287
281	288	285	290	271	284	278	286
283	290	286	289	272	285	279	287
278	286	281	284	267	280	275	282
279	288	283	289	269	282	278	284
283	292	285	290	270	284	280	285
285	292	287	291	273	287	280	288
287	294	288	292	274	288	282	289
279	286	282	287	268	282	276	283
283	290	285	288	270	284	278	285
276	284	278	281	264	277	272	279
281	288	284	288	270	283	277	285
280	286	282	285	269	282	275	283
277	286	280	285	266	279	275	280
281	290	283	286	269	282	278	283
281	290	283	287	269	282	278	284
285	294	287	292	273	287	282	288
287	296	289	293	275	289	284	290
283	290	284	287	270	284	278	285
284	294	286	290	271	285	282	286
279	288	281	284	267	280	276	281
278	286	280	283	266	279	274	281
282	292	284	287	269	283	280	284
287	296	288	291	273	288	284	289
275	284	277	281	264	277	272	278
287	296	289	293	275	289	284	290
282	292	284	289	270	284	280	285
280	288	283	288	269	282	277	284
281	290	283	288	269	283	278	284
286	294	288	293	273	287	282	288
279	288	281	285	267	280	276	282
279	288	281	285	267	281	276	282
279	288	282	286	268	282	278	283
288	298	290	294	276	290	286	291
284	292	287	291	273	286	281	288
284	292	286	291	272	286	281	287
284	294	286	291	271	285	282	286
283	292	284	289	270	284	280	285
281	290	283	287	269	283	279	284
286	294	288	292	274	287	283	289
281	290	283	287	269	282	278	284

Form 10	Form 11	Form 12	Form 13	Form 14	Form 15	Form 16	Form17
282	292	285	288	270	284	280	285
275	284	277	281	264	277	272	278
278	286	280	284	266	280	274	281
284	290	286	291	272	285	279	287
289	298	291	294	276	290	286	291
280	288	281	284	267	281	276	282
284	292	287	293	273	287	281	288
288	296	290	294	276	289	284	291
282	290	283	288	269	283	278	284
283	290	286	289	272	285	279	287
284	292	286	290	272	285	280	287
289	296	291	294	276	290	284	291
278	284	280	284	266	279	272	280
287	296	289	293	275	289	284	290
292	300	294	297	279	294	289	295
287	294	289	294	275	288	282	290
286	294	288	292	274	288	283	289
287	296	289	294	274	288	284	290
280	290	283	288	269	283	279	284
285	292	288	293	274	287	281	289
287	296	291	296	276	290	286	292
285	292	288	293	274	288	281	290
287	296	290	293	275	289	284	290
285	292	287	291	273	286	280	288
280	288	284	289	270	283	278	285
281	290	282	286	268	282	278	283
286	292	288	291	273	287	280	289
290	298	292	296	277	291	287	293
288	294	290	295	276	289	282	291
287	296	290	294	275	289	285	291
286	294	289	292	275	288	284	290
285	294	287	290	273	286	282	288
284	294	286	291	271	285	282	286
291	298	293	297	278	292	286	294
288	296	290	293	276	290	284	291
278	288	282	287	268	281	278	282
284	292	286	289	272	285	280	287
288	294	290	295	276	290	283	292
287	296	290	294	276	290	285	291
286	296	288	292	274	288	284	289
286	294	289	293	275	288	284	290
278	288	281	284	267	281	277	282
281	290	282	287	268	282	278	283
283	292	286	290	271	285	281	287
283	290	287	290	273	286	280	288
285	294	287	291	272	286	282	288

Form 10	Form 11	Form 12	Form 13	Form 14	Form 15	Form 16	Form17
290	298	292	295	277	291	286	293
281	290	283	287	269	282	278	284
275	284	276	280	263	276	272	277
285	292	286	290	272	286	280	287
286	294	289	292	275	288	283	290
277	284	279	283	265	279	273	280
279	288	281	285	267	281	276	282
284	292	286	291	272	285	280	287
285	292	287	290	272	286	280	287
275	284	277	282	263	276	272	278
292	302	294	298	279	294	290	295
287	296	289	293	275	289	284	290
285	294	287	291	273	287	282	288
283	292	286	290	271	285	281	286
287	294	290	294	275	289	283	291
289	298	291	295	276	290	286	291
285	294	287	292	273	287	282	288
277	284	279	283	266	279	273	280
278	286	280	285	266	279	274	281
285	294	287	291	273	287	283	288
282	290	284	288	270	283	278	285
283	**291**	**285**	**289**	**271**	**285**	**280**	**286**
4.0	**4.2**	**4.0**	**3.9**	**3.7**	**4.0**	**4.0**	**4.0**

Form 18	Form 19	OG1	OG2	OG3	OG4	OG5	OG6
284	291	-4	7	24	-15	19	-9
274	279	3	13	29	-8	24	-3
276	284	-2	8	25	-12	20	-8
276	281	-1	9	25	-13	20	-7
278	284	5	15	31	-5	26	-2
275	281	4	14	30	-6	25	-3
278	284	-1	9	25	-15	20	-7
286	293	-1	10	27	-14	21	-7
274	280	-2	8	24	-11	19	-8
274	282	0	11	27	-10	22	-4
287	293	-8	3	19	-21	14	-15
280	286	-9	2	18	-21	13	-15
279	285	-1	9	25	-15	20	-8
276	282	-5	5	22	-15	17	-10
283	290	-3	8	25	-13	20	-7
280	289	2	12	30	-7	25	-3
273	279	-2	8	24	-12	19	-9
281	288	5	15	31	-7	26	-3
282	286	1	12	28	-11	22	-6
271	280	0	10	27	-8	22	-4
286	292	-1	10	27	-13	21	-5
274	281	3	13	30	-6	25	-3
276	281	2	12	28	-9	23	-3
277	285	0	11	28	-11	23	-5
285	291	-3	8	25	-14	20	-8
285	292	-1	9	27	-13	21	-8
280	287	2	13	29	-10	24	-5
282	288	2	13	29	-10	24	-3
283	289	-1	10	26	-13	21	-7
282	289	1	11	28	-9	23	-6
284	289	-4	7	24	-18	18	-10
280	289	2	12	30	-7	24	-3
276	283	4	14	30	-6	25	-2
277	283	2	12	28	-11	23	-3
277	284	2	12	28	-9	23	-5
279	285	2	13	29	-10	24	-3
282	287	2	12	28	-12	23	-5
274	281	-5	5	21	-13	16	-11
280	285	0	11	27	-13	22	-7
276	282	0	10	26	-11	21	-6
273	280	1	11	27	-7	22	-4
281	286	3	13	29	-10	24	-5
276	283	2	12	28	-9	23	-4
283	289	2	12	28	-11	23	-5
284	290	-2	8	25	-15	20	-8
277	284	-3	8	24	-12	19	-9

Form 18	Form 19	OG1	OG2	OG3	OG4	OG5	OG6
285	289	-1	10	26	-17	21	-7
276	284	2	12	30	-10	24	-3
283	288	6	16	33	-5	28	-1
274	284	-2	8	25	-7	21	-7
281	288	-6	5	21	-15	16	-11
279	284	1	12	27	-11	22	-5
279	287	3	14	31	-7	26	-1
291	298	-6	5	22	-21	16	-12
271	278	-4	6	22	-15	17	-10
277	282	1	12	27	-12	22	-4
280	287	0	11	27	-14	22	-6
279	285	3	13	30	-9	25	-2
284	290	-1	9	26	-15	21	-8
279	287	2	12	29	-9	24	-3
280	286	-1	9	25	-12	20	-6
277	283	1	11	27	-10	22	-6
280	286	-3	7	24	-14	18	-10
277	285	-1	9	26	-9	21	-6
279	286	1	12	28	-12	23	-6
281	288	3	13	29	-8	24	-4
276	283	-3	7	23	-16	18	-9
279	285	-2	9	25	-14	19	-9
282	287	0	11	27	-14	22	-7
277	283	1	11	28	-12	23	-5
282	289	-3	8	25	-15	20	-8
274	281	2	12	29	-6	24	-2
279	289	3	13	31	-6	26	-2
278	283	-1	9	25	-16	20	-7
279	287	4	15	32	-7	26	-1
284	290	2	13	30	-10	24	-3
281	288	3	14	31	-7	26	-2
286	293	-1	10	27	-14	21	-7
282	289	2	13	30	-9	24	-3
286	291	1	12	29	-13	23	-4
277	287	7	17	35	2	30	1
277	284	1	11	27	-12	22	-5
283	289	2	13	29	-12	24	-4
272	280	-6	4	21	-16	16	-11
277	284	-2	9	25	-14	20	-8
282	287	1	11	27	-14	22	-6
273	280	-2	8	25	-10	20	-7
280	288	3	13	30	-7	25	-2
278	286	3	14	30	-8	25	-3
276	282	6	16	32	-9	27	-1
278	282	3	13	29	-11	24	-4
278	286	2	12	29	-9	24	-4

Form 18	Form 19	OG1	OG2	OG3	OG4	OG5	OG6
283	289	0	11	27	-14	21	-6
274	281	-3	7	23	-13	18	-9
281	286	-4	7	23	-16	18	-10
279	287	-4	6	23	-14	18	-9
280	286	8	18	35	-1	30	0
281	287	0	11	27	-11	22	-5
279	288	-3	7	25	-9	20	-8
279	287	0	10	27	-9	22	-5
275	281	-2	8	25	-10	20	-6
277	287	5	15	33	-3	28	-1
280	286	1	11	28	-12	23	-6
281	288	0	11	27	-10	22	-6
284	288	-1	9	25	-14	20	-7
275	285	6	16	33	0	29	1
278	284	-3	7	23	-15	18	-9
273	278	1	11	27	-9	22	-5
278	286	2	12	29	-6	24	-3
276	283	-3	7	23	-10	18	-8
274	282	-2	8	25	-11	20	-8
276	283	-1	9	26	-14	20	-6
277	284	7	17	33	-6	28	0
282	288	3	13	30	-11	24	-4
282	289	3	14	31	-10	25	-2
277	283	0	10	26	-12	21	-5
280	286	-2	9	25	-17	20	-8
275	281	4	14	30	-8	25	-2
273	280	-3	8	24	-12	19	-7
277	283	-1	10	26	-15	21	-7
282	287	-1	10	26	-16	21	-7
271	278	-1	9	25	-11	20	-6
283	289	1	11	28	-13	22	-5
280	286	4	15	31	-9	26	-3
278	285	1	11	28	-8	23	-5
277	284	1	11	28	-11	23	-5
283	289	1	12	28	-12	23	-7
276	281	0	10	26	-12	21	-6
277	282	1	12	28	-10	23	-5
275	285	-1	9	27	-10	22	-6
284	290	-5	6	23	-20	17	-10
281	288	-3	7	24	-13	19	-9
280	288	1	12	29	-9	24	-4
280	287	4	15	31	-11	26	-3
280	285	1	12	27	-13	22	-6
277	284	5	15	32	-7	27	0
282	289	1	12	29	-11	23	-4
277	284	4	14	30	-9	25	-2

Form 18	Form 19	OG1	OG2	OG3	OG4	OG5	OG6
278	285	1	11	28	-12	23	-5
271	278	1	11	27	-9	22	-4
275	281	-2	8	24	-12	19	-8
280	288	4	15	31	-5	26	-2
283	289	2	13	30	-13	24	-3
276	280	-1	9	25	-13	20	-6
282	291	1	12	29	-8	24	-5
284	291	-1	10	27	-13	21	-7
279	284	1	11	27	-12	22	-6
278	287	-7	3	20	-16	15	-12
281	286	5	16	32	-7	26	-1
284	290	-2	9	25	-14	20	-7
275	281	5	15	31	-3	26	-1
283	289	0	11	28	-13	22	-5
286	294	-3	8	25	-17	20	-8
284	290	4	14	31	-8	25	-3
281	289	3	13	30	-9	25	-2
286	290	0	11	27	-14	22	-8
277	285	2	13	30	-9	25	-3
284	291	2	12	29	-7	24	-5
285	294	0	11	29	-10	24	-5
283	291	-3	7	25	-11	20	-9
283	290	-3	7	24	-16	19	-9
283	288	3	14	30	-8	24	-4
277	287	0	10	28	-7	23	-5
277	282	-1	10	25	-15	20	-7
281	287	4	14	31	-6	26	-1
286	292	-1	10	27	-14	22	-6
286	292	-2	9	26	-12	20	-9
284	292	-4	7	25	-15	20	-9
281	290	2	13	31	-8	25	-2
280	287	2	12	29	-12	24	-4
281	287	4	14	31	-11	26	-3
286	293	-1	10	27	-14	21	-7
284	289	-4	7	24	-16	18	-8
275	285	4	14	31	-6	26	-2
281	286	-3	7	23	-15	18	-9
285	292	0	11	28	-9	23	-6
283	292	1	12	30	-10	24	-4
284	289	-1	10	27	-15	21	-7
283	291	0	11	29	-10	23	-5
273	282	-3	7	24	-14	19	-8
278	283	3	13	29	-11	24	-4
282	287	6	16	33	-6	28	-1
278	289	-6	4	22	-13	17	-10
281	287	2	13	29	-12	24	-4

Form 18	Form 19	OG1	OG2	OG3	OG4	OG5	OG6
285	291	1	12	28	-13	23	-4
277	284	0	10	26	-13	21	-6
271	277	0	10	25	-12	20	-6
281	286	5	15	31	-7	26	-1
282	290	-1	10	28	-11	23	-4
273	281	1	11	27	-7	23	-5
276	282	-6	4	20	-18	15	-13
280	288	3	13	30	-9	24	-4
280	286	1	12	28	-10	23	-5
272	278	5	15	31	-6	26	-2
288	294	-5	6	23	-22	17	-11
282	289	0	11	28	-13	22	-5
282	288	0	11	27	-13	22	-6
280	287	2	12	29	-10	24	-4
284	290	3	13	30	-8	25	-3
285	292	-1	9	26	-16	21	-8
282	288	2	13	29	-11	24	-4
273	281	4	14	31	-3	26	0
276	282	-1	9	25	-11	20	-9
281	288	-1	10	26	-14	21	-7
279	285	0	10	26	-12	21	-6
279	**286**	**0**	**11**	**27**	**-11**	**22**	-5
3.9	**3.9**	**2.9**	**2.9**	**3.0**	**3.8**	**3.0**	**2.9**

OG7	OG8	OG9	OG10	OG11	OG12	OG13	OG14
8	-1	1	1	-6	-1	-5	14
12	5	5	7	-2	5	1	19
9	1	2	4	-5	1	-4	15
8	1	1	2	-6	1	-3	15
16	7	9	9	2	7	3	21
14	6	7	8	0	6	1	20
7	0	0	2	-7	1	-3	15
10	1	3	4	-4	2	-2	16
9	1	2	3	-5	1	-4	14
11	3	4	6	-3	3	0	17
3	-6	-4	-4	-11	-6	-10	9
1	-7	-6	-5	-13	-7	-11	8
7	1	0	3	-7	1	-4	15
6	-2	-1	0	-8	-2	-5	12
10	0	3	3	-4	0	-3	15
15	5	8	9	1	5	1	20
8	0	1	2	-6	0	-4	14
15	7	8	9	1	7	2	21
11	3	4	5	-3	3	-1	17
12	3	5	6	-2	3	0	17
11	2	4	4	-3	2	-1	16
14	6	7	8	0	6	2	20
12	4	5	6	-2	4	1	18
11	4	4	7	-3	4	-1	18
9	0	2	2	-5	0	-3	15
10	1	3	4	-4	2	-3	16
12	5	5	7	-2	5	0	19
13	4	6	6	-1	4	2	19
10	1	3	3	-4	1	-2	16
13	3	6	6	-1	3	-1	18
5	-1	-2	1	-9	-1	-6	13
15	5	8	8	1	5	2	19
15	6	8	8	1	6	3	20
11	4	4	6	-3	4	1	18
12	4	5	6	-2	4	-1	18
12	4	5	6	-2	4	1	19
11	3	4	5	-3	3	0	18
7	-3	0	-1	-7	-3	-7	11
9	2	2	4	-5	2	-2	17
10	2	3	4	-4	2	-2	16
13	3	6	6	-1	4	0	17
12	5	5	6	-2	5	0	19
12	4	5	6	-2	4	0	18
12	4	5	5	-2	4	-1	18
8	0	1	2	-6	0	-4	15
9	0	2	2	-5	0	-4	14

OG7	OG8	OG9	OG10	OG11	OG12	OG13	OG14
7	1	0	3	-7	1	-3	16
12	5	5	8	-2	5	1	19
17	8	10	11	3	9	3	23
13	2	6	5	-1	2	-2	16
7	-3	0	-1	-7	-3	-6	11
11	3	4	5	-3	3	-1	17
15	7	8	10	1	7	4	21
5	-4	-2	-1	-10	-4	-7	11
5	-2	-2	0	-9	-2	-6	12
10	3	3	5	-4	3	0	17
9	2	2	5	-5	3	-1	17
13	5	6	8	-1	5	2	20
8	1	1	4	-6	1	-3	16
13	5	6	7	-1	5	1	19
10	1	3	3	-4	1	-2	15
11	3	4	5	-3	3	-1	17
8	-1	1	1	-6	-1	-5	13
12	2	5	5	-2	2	-2	16
10	3	3	5	-4	3	-1	18
14	5	7	6	0	5	1	19
6	-1	-1	0	-8	-1	-4	13
8	0	1	2	-6	0	-5	14
9	2	2	4	-5	2	-2	17
10	3	3	5	-4	3	-1	18
8	0	1	3	-6	0	-4	15
14	5	7	9	0	6	3	19
16	7	9	10	2	7	3	21
6	1	-1	2	-8	1	-3	15
15	7	8	10	1	7	3	21
13	4	6	7	-1	5	1	19
15	6	8	9	1	7	2	21
10	2	3	4	-4	2	-2	16
14	5	7	7	0	5	2	19
11	3	4	6	-3	4	1	18
22	11	15	14	8	11	5	25
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11	4	4	6	-3	4	0	19
4	-3	-3	-1	-10	-3	-6	11
8	1	1	3	-6	1	-3	15
9	2	2	4	-5	2	-2	17
10	1	3	4	-4	1	-2	15
15	6	8	9	1	6	2	20
14	6	7	8	0	6	1	20
13	7	6	9	-1	8	4	22
11	4	4	6	-3	4	1	19
13	5	6	8	-1	5	0	19

OG7	OG8	OG9	OG10	OG11	OG12	OG13	OG14
9	1	2	3	-5	2	-2	16
7	-1	0	1	-7	-1	-5	13
6	-2	-1	0	-8	-2	-6	13
8	-1	1	2	-6	-1	-5	13
20	10	13	13	6	11	5	25
11	3	4	5	-3	3	-1	17
12	1	5	5	-2	1	-4	15
13	3	6	6	-1	3	0	17
10	1	3	4	-4	1	-2	15
18	9	11	13	4	9	3	23
10	3	3	5	-4	3	-2	18
12	3	5	5	-2	3	-1	17
9	0	2	2	-5	1	-3	15
20	10	13	13	6	10	5	24
7	-2	0	0	-7	-2	-5	13
11	3	4	5	-3	3	0	17
15	5	8	8	1	5	1	19
10	-1	3	2	-4	0	-3	13
9	1	2	4	-5	1	-4	15
8	1	1	3	-6	1	-2	15
16	9	9	11	2	9	5	23
12	5	5	7	-2	5	0	19
13	6	6	8	-1	6	2	20
10	2	3	4	-4	2	-1	16
6	0	-1	2	-8	0	-4	15
13	6	6	8	-1	6	3	20
8	0	1	2	-6	0	-3	14
7	1	0	3	-7	1	-2	16
7	1	0	3	-7	1	-2	16
9	2	2	4	-5	2	-2	15
10	3	3	5	-4	3	-1	17
13	6	6	9	-1	7	2	21
13	4	6	7	-1	4	-1	18
11	3	4	6	-3	4	-1	18
11	3	4	5	-3	3	-2	18
9	2	2	4	-5	2	-2	16
11	4	4	6	-3	4	0	18
11	2	4	6	-3	3	-1	17
4	-2	-3	0	-10	-2	-6	12
9	0	2	3	-5	0	-4	14
13	4	6	7	-1	5	0	19
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9	3	2	4	-5	3	-2	17
15	7	8	10	1	8	4	22
12	4	5	6	-2	4	0	18
13	6	6	8	-1	6	2	20

OG7	OG8	OG9	OG10	OG11	OG12	OG13	OG14
10	3	3	6	-4	3	0	18
11	4	4	6	-3	4	0	17
8	0	1	2	-6	0	-4	14
17	7	10	9	3	7	2	21
11	4	4	6	-3	4	1	19
8	1	1	2	-6	1	-2	15
14	5	7	8	0	5	-1	19
10	2	3	4	-4	2	-2	16
10	3	3	4	-4	3	-2	17
6	-4	-1	-1	-8	-4	-7	10
15	7	8	9	1	7	3	21
9	0	2	2	-5	0	-3	15
17	7	10	9	4	7	3	21
10	2	3	5	-4	3	-1	17
8	0	1	2	-6	0	-3	15
15	6	8	8	1	6	1	20
14	5	7	8	0	6	2	20
9	2	2	4	-5	2	-3	17
13	6	6	9	-1	6	1	20
15	5	8	8	1	5	0	19
13	4	6	8	-1	4	-1	19
11	0	4	4	-3	1	-4	15
7	-1	0	2	-7	-1	-4	14
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14	4	7	8	0	4	-1	18
7	1	0	3	-7	1	-3	15
16	6	9	8	2	6	3	21
10	2	3	5	-4	2	-2	17
11	1	4	3	-3	1	-4	15
8	0	1	3	-6	0	-4	15
15	6	8	9	1	6	3	20
11	4	4	6	-3	4	1	19
12	6	5	8	-2	6	1	21
10	1	3	4	-4	1	-3	16
7	-1	0	1	-7	-1	-4	13
15	7	8	11	1	7	2	21
7	-1	0	1	-7	-1	-4	13
14	3	7	7	0	4	-1	18
13	5	6	8	-1	5	1	19
8	2	1	4	-6	2	-2	16
13	4	6	7	-1	4	0	18
7	0	0	3	-7	0	-3	14
11	5	4	6	-3	5	0	19
16	8	9	11	2	8	4	23
9	-2	2	2	-5	-2	-5	12
11	4	4	6	-3	4	0	19

OG7	OG8	OG9	OG10	OG11	OG12	OG13	OG14
11	3	4	5	-3	3	0	18
9	2	2	4	-5	2	-2	16
8	2	1	4	-6	2	-2	15
15	7	8	9	1	7	3	21
12	3	5	6	-2	3	0	18
13	4	6	7	-1	4	0	18
3	-4	-4	-2	-11	-4	-8	10
13	5	6	7	-1	5	0	19
12	3	5	5	-2	3	0	18
14	7	7	9	1	7	2	21
3	-3	-4	-1	-11	-3	-7	12
10	2	3	5	-4	3	-1	17
10	3	3	5	-4	3	-1	17
12	4	5	7	-2	4	0	19
15	5	8	8	1	5	1	20
8	1	1	4	-6	1	-3	16
12	5	5	7	-2	5	0	19
17	7	10	10	4	8	4	21
9	1	2	3	-5	1	-4	15
9	2	2	4	-5	2	-2	16
10	2	3	4	-4	2	-2	16
11	**3**	**4**	**5**	**-3**	**3**	**-1**	**17**
3.3	**3.0**	**3.3**	**3.2**	**3.4**	**3.0**	**2.9**	**3.0**

OG15	OG16	OG17	OG18	OG19
0	5	-2	6	-1
6	10	4	10	5
1	6	0	7	-1
1	6	0	6	1
8	14	6	12	6
6	12	5	11	5
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2	8	1	8	1
1	7	0	5	-1
4	8	2	11	3
-5	1	-7	0	-6
-6	-1	-7	-1	-7
1	5	0	6	0
-1	4	-3	4	-2
1	7	0	7	0
6	12	4	13	4
1	6	0	5	-1
8	13	6	12	5
4	9	2	7	3
4	9	2	11	2
2	9	1	9	3
6	12	5	12	5
5	10	3	10	5
4	8	3	10	2
1	7	-1	6	0
2	7	1	7	0
5	10	4	10	3
5	11	3	11	5
2	8	1	7	1
4	11	2	9	2
-1	3	-2	3	-2
6	12	4	13	4
7	13	5	13	6
4	9	3	10	4
5	10	3	9	2
5	10	4	11	5
4	9	3	9	4
-2	5	-3	3	-4
3	7	2	7	2
3	8	1	8	2
4	11	3	10	3
5	10	4	9	4
5	10	3	10	3
4	10	3	9	3
1	6	-1	6	0
1	7	-1	6	-1

OG15	OG16	OG17	OG18	OG19
1	5	0	6	2
6	9	5	12	4
9	14	8	12	7
3	9	1	9	-1
-2	5	-4	4	-3
4	9	2	8	3
7	12	6	14	6
-3	2	-5	4	-3
-1	3	-3	4	-3
4	8	2	9	4
3	7	2	9	2
6	11	5	12	6
2	6	1	6	0
5	10	4	12	4
2	8	0	8	2
4	9	2	8	2
0	6	-2	4	-2
3	9	1	9	1
4	8	3	9	2
5	12	4	11	4
-1	4	-2	6	-1
1	6	0	5	-1
3	7	1	7	2
4	8	3	9	3
1	5	-1	6	-1
6	11	5	12	5
8	12	6	15	5
1	4	0	6	1
8	12	6	14	6
5	11	4	11	5
7	12	6	12	5
2	7	1	8	1
6	11	4	12	5
4	9	3	9	4
12	18	10	17	7
4	8	3	9	2
5	9	4	10	4
-3	2	-4	4	-4
1	6	0	7	0
3	7	2	7	2
2	7	1	7	0
6	12	5	13	5
7	12	5	12	4
8	11	7	13	7
5	9	4	9	5
6	10	4	11	3

OG15	OG16	OG17	OG18	OG19
2	7	1	8	2
0	5	-2	5	-2
-1	4	-2	3	-2
0	5	-2	5	-3
11	18	10	14	8
4	8	2	8	2
2	8	0	7	-2
4	10	2	10	2
2	7	0	7	1
10	14	8	15	5
4	8	3	8	2
3	10	2	9	2
1	7	0	5	1
10	16	9	17	7
-1	5	-2	5	-1
4	9	2	8	3
6	12	4	11	3
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2	6	1	7	-1
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10	14	8	15	8
5	10	4	10	4
6	11	5	13	6
2	8	1	9	3
1	4	0	6	0
7	11	6	12	6
1	6	-1	7	0
2	5	1	8	2
1	5	0	7	2
2	7	1	8	1
3	8	2	9	3
7	11	6	11	5
5	10	3	9	2
4	9	3	10	3
4	9	3	8	2
3	7	1	8	2
4	9	3	8	3
3	7	2	10	0
-2	2	-3	4	-2
1	6	-1	6	-1
5	10	4	11	3
7	10	6	12	5
3	7	2	7	2
8	12	7	14	7
5	9	3	10	3
7	11	5	12	5

OG15	OG16	OG17	OG18	OG19
4	8	3	10	3
4	9	3	10	3
0	6	-1	5	-1
8	14	6	13	5
5	9	4	12	6
1	6	0	6	2
5	11	4	10	1
3	8	1	8	1
3	8	2	7	2
-3	3	-5	4	-5
8	13	6	12	7
1	7	0	7	1
8	15	7	12	6
3	8	2	9	3
0	5	-1	8	0
7	13	5	11	5
6	11	5	13	5
3	7	1	5	1
6	10	5	12	4
6	12	4	9	2
5	9	3	10	1
1	8	-1	6	-2
0	5	-1	6	-1
6	12	4	9	4
5	10	3	11	1
1	5	0	6	1
7	14	5	13	7
3	7	1	8	2
2	9	0	5	-1
1	5	-1	6	-2
7	11	5	14	5
5	9	3	11	4
7	10	6	11	5
2	8	0	8	1
-1	5	-2	5	0
8	11	7	14	4
0	5	-2	4	-1
4	11	2	9	2
5	10	4	12	3
2	6	1	6	1
5	9	3	10	2
0	4	-1	8	-1
5	9	4	9	4
9	13	7	12	7
-1	5	-3	7	-4
5	9	3	10	4

OG15	OG16	OG17	OG18	OG19
4	9	2	10	4
3	7	1	8	1
2	6	1	7	1
7	13	6	12	7
4	9	2	10	2
4	10	3	10	2
-4	1	-5	1	-5
6	11	4	11	3
4	10	3	10	4
8	12	6	12	6
-3	1	-4	3	-3
3	8	2	10	3
3	8	2	8	2
5	9	4	10	3
6	12	4	11	5
2	6	1	7	0
5	10	4	10	4
8	14	7	14	6
2	7	0	5	-1
2	7	1	8	1
3	8	1	7	1
3	**8**	**2**	**9**	**2**
3.0	**3.1**	**3.0**	**3.1**	**2.8**

GROUP 2 DATA

No	Osm	Na	K	Urea	Glu	Form 1 Smith	Form 19 Bhag
1	204	102	2.1	1.9	8	214	214
2	221	107	2.7	3.2	6.9	224	224
3	222	103	5.2	6.3	6.8	219	224
4	224	107	3.5	4.8	7.5	226	228
5	224	110	2.1	2.6	2.8	225	224
6	225	108	3.8	2.9	7.4	226	228
7	226	107	2.6	6.3	10.2	231	230
8	226	109	2.7	4.2	8	230	230
9	229	110	3	5.8	6.2	232	232
10	231	116	3.9	2.5	4.8	239	240
11	234	114	3	3.7	9.2	241	241
12	237	115	3	3.4	7	240	240
13	237	117	2.8	6.4	6	246	245
14	237	117	3.6	1.9	5.7	242	242
15	237	107	3.6	6.3	8.6	229	231
16	240	119	2.5	1.6	9	249	247
17	240	108	3.5	15.5	8.3	240	241
18	241	116	3.6	4.9	7.7	245	245
19	242	114	5	4.5	8.2	241	244
20	242	115	5.6	4.5	6.8	241	246
21	245	116	3.2	6.6	6.1	245	244
22	246	119	3.6	1.2	7.8	247	247
23	246	121	3.9	5.6	5	253	253
24	247	118	3.9	5.9	6.8	249	249
25	247	124	3.1	3.2	5.1	256	255
26	247	119	3.5	4	3.2	245	245
27	248	118	4.7	4.7	8.6	249	252
28	248	116	4.6	6.8	12.1	251	253
29	249	124	2.2	3.1	5	256	253
30	251	118	3.2	2.3	12.3	251	250
31	251	117	3.7	6.7	7.9	249	249
32	252	120	3.5	3.7	7.5	251	251
33	253	121	3.6	4.1	9.2	255	255
34	249	124	2.2	3.1	5	256	253
35	253	125	3.4	2.7	7	260	259
36	254	124	4.2	4.6	5	258	258
37	255	119	4.9	3.9	17.3	259	262
38	256	124	3.4	3.7	8.3	260	259
39	257	114	4.1	15.6	14	258	259
40	257	124	2.4	2.2	12.6	263	260
41	258	125	3.3	2.8	9.3	262	261
42	259	118	4.6	11.5	5.8	253	255
43	259	121	4.3	13.6	4	260	261
44	260	127	3.3	4.3	1.8	260	258
45	261	126	3.5	4.5	5.8	262	261
46	261	127	3.5	5.6	7.3	267	266
47	261	127	3.2	2	6.7	263	261

GROUP 2 DATA

No	Osm	Na	K	Urea	Glu	Form 1 Smith	Form 19 Bhag
48	262	130	3.8	9.4	1.5	271	270
49	262	124	4.1	2.8	12.6	263	264
50	262	128	3.7	4.5	3.9	264	263
51	263	126	5.6	3.2	6.8	262	265
52	263	125	4.1	5.5	11.5	267	267
53	264	129	4.2	2.6	5.4	266	266
54	264	128	3.8	4.2	7	267	266
55	264	123	3.7	3.9	11.2	261	261
56	264	123	3.7	3.9	11.2	261	261
57	265	129	4.1	1.9	5	265	264
58	265	128	4.3	6	4.1	266	266
59	267	129	4.1	8.1	8.6	275	274
60	267	123	5	6.1	11.5	264	266
61	268	129	2.6	3	10.3	271	268
62	268	131	4.2	8.1	4.9	275	274
63	269	129	4.1	5.9	9.2	273	273
64	269	130	3.4	4.2	7.4	272	270
65	269	123	4.7	5.7	16.7	268	270
66	270	132	2.9	4	6.8	275	272
67	270	136	4	2.1	4.7	279	277
68	270	131	4	3.6	5.3	271	270
69	270	127	3.8	3.8	8.9	267	266
70	270	128	4.2	2.7	11.3	270	270
71	270	127	4.2	7.1	5.7	267	267
72	271	124	3.6	12.9	2.9	264	263
73	271	119	4.1	22.3	6.8	267	268
74	271	132	3.8	4.4	7.1	276	274
75	271	124	3.3	3.4	23.3	275	273
76	272	133	4.7	2.6	8.3	277	277
77	272	125	4	13.9	7.1	271	271
78	272	137	3.7	4	2.4	280	278
79	272	128	6.9	3.3	5.9	265	270
80	272	126	4.1	7.5	5.1	265	265
81	273	124	3.6	8.3	11.6	268	267
82	273	132	4.3	4.9	6.1	275	275
83	274	131	3.8	4.7	9.3	276	275
84	274	125	5.4	10.3	11.5	272	274
85	274	129	3.2	4.1	9.5	272	269
86	274	123	3	8.6	10	265	263
87	274	132	4.3	5.6	4.6	274	274
88	248	116	4.6	6.8	12.1	251	253
89	249	124	2.2	3.1	5	256	253
90	249	124	2.2	3.1	5	256	253
91	296	132	4.2	8.3	18.5	291	290
92	297	142	4.1	2.2	7.3	294	291
93	297	141	3.7	11	11	304	301

GROUP 2 DATA

No	Osm	Na	K	Urea	Glu	Form 1 Smith	Form 19 Bhag
94	297	141	4.2	5.3	7.3	295	293
95	297	134	4.2	11.4	11.3	291	290
96	297	136	3.4	13	17.7	303	300
97	297	138	3.4	5.4	17.7	299	296
98	298	143	3.8	6.8	6.8	300	297
99	298	133	5.8	25.6	2.3	294	296
100	299	139	4	4.4	17.1	300	297
101	299	143	3.6	3.5	8.8	298	295
102	299	139	5.2	11.7	5.2	295	295
103	299	138	4.7	6.6	7.9	291	290
104	299	125	4.6	18.8	24.7	294	295
105	300	132	4.3	3.9	24.1	292	292
106	301	142	5.3	8.4	5.2	298	298
107	301	140	3.6	15.7	3.3	299	296
108	302	144	4.3	7.2	5.5	301	299
109	302	137	4.9	12.8	13.6	300	300
110	302	141	4.2	8.4	12.3	303	301
111	302	133	5.1	4.6	27.3	298	299
112	302	124	4.5	4.4	38.5	291	292
113	302	131	3.1	21.8	18.3	302	300
114	302	132	4.5	6	28.6	299	298
115	302	138	4	4	16.8	297	295
116	303	130	9.4	15.9	20.3	296	305
117	303	143	3.6	9.4	6.2	302	298
118	303	133	4.8	4.3	30.3	301	301
119	304	138	5.1	6.8	20.1	303	303
120	304	127	4	6.1	44.4	305	304
121	304	138	4.6	6.2	18	300	299
122	304	128	3.6	14	29.4	299	298
123	304	134	5.5	13.3	19.3	301	302
124	305	140	4.1	16	5.9	302	300
125	305	135	5.8	14.4	20.6	305	307
126	305	128	7.3	16.9	20.8	294	299
127	306	133	3.4	18.5	23.9	308	306
128	306	136	4	7.9	25.2	305	304
129	306	140	3.9	19.6	6.4	306	304
130	306	140	3.6	15.7	9.8	306	303
131	306	129	4	4.1	35.6	298	297
132	306	130	4.7	5.8	32.4	298	299
133	307	131	2	8.5	38.2	309	304
134	308	140	3.9	7.8	9.1	297	295
135	308	135	4.5	4.7	25.4	300	300
136	308	137	4.7	6	23.5	304	303
137	308	140	3.9	5	22	307	305
138	309	141	5.4	17.3	7.8	307	307
139	310	133	4.9	39	3.4	308	309

GROUP 2 DATA

No	Osm	Na	K	Urea	Glu	Form 1 Smith	Form 19 Bhag
140	311	133	4.9	7.5	32.4	306	306
141	311	134	4.1	14.1	22	304	303
142	311	137	4.6	25.7	6.8	307	306
143	311	130	5.2	4.8	37.4	302	304
144	311	142	4.8	11.3	9.1	304	303
145	311	137	3.6	21.3	19.3	315	312
146	312	138	4.1	11.3	18.9	306	305
147	312	137	5.2	28.8	8.6	311	312
148	313	134	4.4	8.1	27.5	304	303
149	314	128	5.2	9.3	47.2	313	314
150	314	131	4.5	20.7	22.1	305	305
151	316	131	3.6	12.4	36.8	311	310
152	316	141	3.4	28.6	6.6	317	314
153	317	140	4.5	32.8	5.3	318	317
154	317	130	3.4	18.4	36.4	315	313
155	318	139	4.5	16.3	18.3	313	312
156	318	142	3.6	10.1	21.6	316	313
157	319	140	4.1	10.9	25.4	316	314
158	320	129	6.1	39.5	19.6	317	320
159	320	137	4.6	11.4	25.7	311	310
160	320	135	4	23.6	24.9	319	317
161	322	146	5	26.4	6.3	325	324
162	326	138	5.5	40.3	8.8	325	326
163	329	127	6.7	26.5	37.6	318	323
164	330	147	5.3	26.4	5.2	326	325
165	331	129	4.3	28.2	31.9	318	318
166	331	142	4.7	10.2	29.5	324	323
167	337	128	4.7	6.2	64.4	327	327
168	343	147	5.1	34.5	6.2	335	334
169	345	121	6.7	55.8	39.5	337	343
170	351	146	4.2	44.5	7.2	344	341
171	293	139	3.7	6.7	10.3	295	292
172	290	141	3.9	5.2	6.6	294	291
173	284	136	4	3.3	5.4	281	279
174	283	137	4.4	6	5.3	285	284
175	282	137	4.1	3.2	5.6	283	281
176	290	137	4.3	3.9	7.3	285	284
177	286	136	4.3	3.8	6.4	282	281
178	285	139	3.8	3.5	4.8	286	284
179	294	142	4.1	4.5	6.3	295	293
180	279	135	4.4	4.7	6.1	281	280
181	285	137	3.5	5.2	5.4	285	282
182	287	142	4.5	3.7	7.1	295	293
183	279	139	4.2	4	5.7	288	286
184	285	139	4.4	3.8	4.5	286	285
185	280	137	3.7	4.9	5.8	285	282

GROUP 2 DATA

No	Osm	Na	K	Urea	Glu	Form 1 Smith	Form 19 Bhag
186	290	140	3.8	6.1	6.7	293	290
187	293	139	4.1	6.8	6.5	291	289
188	278	135	4.4	3.4	6.1	280	279
189	293	139	4.7	4.1	6.2	288	288
190	289	139	4.4	3.3	6.4	288	286
191	282	135	3.6	6.5	5.8	282	280
192	295	142	3.5	4.4	7.2	296	292
193	286	136	4.1	5	5.8	283	281
194	286	137	3.6	3.7	6.1	284	281
195	287	138	4.4	6.4	4.2	287	285
196	291	141	3.8	4.6	6.9	294	291
197	292	141	4.6	5.6	5.8	293	292
198	290	139	4.7	4.6	5.2	288	287
199	293	140	3.5	3.7	7	291	288
200	290	140	4	4.2	6.6	291	289