Reference Values for Urea, Creatinine and Electrolytes in Zimbabwean Females

by

HILDA T. MARIMA-MATARIRA

Department of Chemical Pathology
Godfrey Huggins School of Medicine
P.O. Box A178, Avondale, Harare

SUMMARY

The reference values for urea, creatinine and electrolytes were determined in sera of 460 African and 200 Caucasian females. All except creatinine levels are significantly different statistically.

African females have lower limits for sodium, chloride while their upper limits are higher than those of Caucasian females. Reference values for potassium and anion gap are higher while those of urea and bicarbonate are lower in African than Caucasian females.

The analytes reported here are closer to gaussian distribution than the liver function tests described earlier (Matarira 1984b).

INTRODUCTION

Significant differences of urea, creatinine and electrolyte levels were observed in a study carried out on Zimababwean males (Matarira 1985). It was logical to carry out the same study on Zimbabwean females for the reason that these analytes are routinely determined in our laboratories to assist in the metabolic disorders of water and salt balance.

MATERIALS AND METHODS

Sera was prepared from 660 Zimbabwean females as described in the male study (Matarira 1985). The methods used to analyse urea, creatinine and electrolytes are those employed in Public Health Laboratories in Harare (Matarira 1985).

Quality Control

The day-to-day co-efficients of variation for the analytes were calculated and found to be the following: Urea 6.8%; creatinine 9.3%; potassium 4.3%; sodium 2.8%; chloride 3.1% and bicarbonate 7.9%. The analyses of samples from both males and females were run at the same time. The quality control values are within the permitted variations except for bicarbonate which is expected to be up to 5% (Benenson *et al.* 1955).

Statistical Method

A non-parametric assumption of distribution was made and reference values determined as previously described (Matarira 1984). The 't' value was calculated for each analyte using a standard statistical equation (Suedecor and Cochran 1978); where 't' value above 1.96 for reference populations above 120 individuals means that significant differences exist.

The reference values were determined by a non-parametric method from 460 African (no brackets) and 200 Caucasian (within brackets) females. Skewness and kurtosis were calculated on a Perkin-Elmer 3220 Computer Model at Research and Specialist Service, Harare, using a frequency programme. 't' Values were determined as above.

DISCUSSION

The acid-base equilibrium disorders can be caused by failure in the pulmonary and renal regulation of electrolytes, pH and body fluids. Electrolyte concentrations are controlled within narrow limits in healthy individuals. Variations in both serum and urine concentrations are often a result of diet and state of hydration.

A look at the results in Table I show that the reference ranges of analytes assayed except creatinine are significantly different between the African and Caucasian females. Caucasian females had higher urea levels than African females as was the case of males (Materira 1985). Poor protein intake in the African population may explain this observation since urea is an end production of protein and amino acid metabolisms.

Creatinine levels which are less affected by protein intake (Stateland and Winkel 1979) but more by muscular mass showed no differences. This implies that muscular masses between the two population groups are not significantly different. African females, however, show a mixture of both lower and higher sodium and chloride levels than Caucasian females. Changes in chloride concentrations often accompany sodium concentration changes.

The hormones, aldosterone renin, angiotensin and anti-diuretic hormone are involved in the regulation of plasma salts. It would appear that there are differences in the levels or activities of these hormones in the two populations (Matarira 1985). Salt intake and water loss may also contribute to the differences observed.

Increased serum potassium observed in African females which was also seen in the case of African males, implicates aldosterone again.

TABLE 1

Reference Values for Urea, Creatinine and Electrolytes in Zimbabwean Females, Skewness, Kurtosis and "Student" t-Value.

Analytes	Units	Reference Value	Skewness	Kurtosis	t-Value
1. Sodium	mmol/l	125–150 (130–146)	0.5 (0.0)	0.1 (2.0)	8.8
2. Potassium	mmol/l	3.0–5.6 (2.9–4.9)	-0.3 (0.7)	0.3 (0.3)	3.9
3. Chloride	mmol/l	94–114 (97–113)	0.8 (-0.1)	0.5 (1.3)	13.0
4. Bicarbonate	mmol/l	18–24 (20–25)	0.1 (-0.1)	−0.3 (−0.3)	-7.4
5. Urea	mmol/l	1.1 -6.7 (1.9–6.9)	0.1 (0.0)	0.8 (-0.4)	-3.5
6. Creatinine	μmol/l	34–121 (39–113)	0.5 (0.1)	1.3 (0.1)	1.9
7. Average Anion Gap	meq/l	19 (15)	—	—	8.8

The reference values were determined by a non-parametric method from 460 African (no brackets) an 200 Caucasian (within brackets) females. Skewness and kurtosis were calculated on a Perkin-Elme 3220 Computer Model at Research and Specialist Service, Harare, using a frequency programme. ' Values were determined as above.

Aldosterone promotes sodium and potassium exchange, and, a low activity would mean less exchange, resulting in higher serum potassium and low sodium levels.

The difference in the reference range for serum bicarbonate seen here, i.e. lower values in African females, was reported also in a male study (Matarira 1985). It is difficult to explain the possible responsible factors for the difference apart from variations in physiological disturbances at the time of blood collection and in preparation and storage of specimens.

The anion gap gives the sum difference in the acid-base status of the two populations. Higher values were observed in the African females. It remains to be seen whether the chemical diagnosis and interpretation of disease in the two populations would show significant differences as well.

ACKNOWLEDGEMENTS

I wish to thank most sincerely Mrs O. Gudza for technical assistance, staff of Public Health Laboratories, Red Cross and Blood Transfusion Service in Harare. Many thanks are due to M Kangai, a Biometrician at Research a Specialist Service in the Ministry of Agricultur for statistical analysis and the departmental se retary, Mrs Madyambudzi for typing. Finally wish to thank the University of Zimbabwe for t research grant.

REFERENCES

Benenson, A.S., Thompson, H.L. and Klugerman, M. (1955) *Amer. J. Clin. Pathol.* **25**, 575.
Matarira, H.T.M. (1984) *Cent. Afr. J. Med.* **30**, 211.
Matarira, H.T.M. (1984b) *Cent. Afr. J. Med.* **31**, 98.
Matarira, H.T.M. (1985) *Cent. Afr. J. Med.* **31**, 235.
Statland, B.E. and Winkel, P. (1979) In: Henry, J.B. (E *Clinical Diagnosis and Management by Laborat Methods*, 6th edit., Philadephia, W.B. Saunders C p. 6.
Suedecor, G.W. and Cochran, W.G. (1978) *Statisti Methods*, 6th edit., Iowa, Iowa State Univ. Pre p. 549.