

The daily water, sodium and potassium excretion in urine of Ghanaian children aged 5 to 12 years

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Summary

Aim: The aim of the study was to determine the daily losses of water, sodium and potassium in the urine of Ghanaian children who presented to the paediatric surgery unit of the Korle-Bu teaching hospital.

Methods: The urine of 74 Ghanaian children (51 male, 23 female) who presented to the Paediatric surgery unit of the Korle-Bu teaching hospital between June 1997 and January 1999 was collected over a 24 hour period and analysed to determine the volume, sodium and potassium content.

Result: 74 children between the ages of 5 and 12 years with a mean age of 9 years were involved in the study. The mean daily urinary volume was 1136.8ml (95% confidence interval 1097.7 to 1176.0) with a range of 400 to 2400ml. The sodium excreted was 108.6mmol per day (confidence interval 105.3 to 111.9) with a range of 39.8 to 231.9mmol per day while the potassium excreted was 24.7mmol (confidence interval 23.7 to 25.7mmol) and a range of 6.25 to 69.9mmol per day.

Conclusion: This study showed that children between 5 and 12 years in a ward lose a mean of 1136.8ml of water per day, 4.6mmol per kilogram of sodium per day, and 1mmol per kg per day of potassium in their urine.

Key-words: Urinary water, Sodium and potassium, Children, 5 to 12 years.

Résumé

Le but: Le but de cette étude est de déterminer les niveaux des pertes quotidiens d'eau, de sodium et potassium dans l'urine des enfants Ghanéens qui se présentent à la Division de Chirurgie pédiatre au Centre hospitalier universitaire de Korle-Bu, Accra.

Méthode: L'information à propos de l'urine de soixante-quatorze (74) enfants Ghanéens, (50 garçons et 23 filles) se présentant à l'hôpital entre Juin 1997 et Janvier 1999 recueillie pendant une période de 24 heures a été analysé pour déterminer le volume, et le contenu de sodium et de potassium.

Resultats: 74 enfants âgées de 5 à 12 ans avec l'âge moyen de 9 ans ont été inclu dans l'étude. Le volume d'urine quotidien moyen était 1136,8ml (95% intervalle statistique 1097.7 à 1176.0) et une portée de 400 à 2,400 millilitres.

Le sodium excrété était 108,6 mmol (intervalle statistique de 109,3 à 111.9) avec une portée de 39.8 à 231,9 mmols par jour.

Le potassium excrété était 24,7 (intervalle statistique de 23, 7 à 25, 7mmol) avec une portée de 6,25 à 69,9 mmols par jour.

Conclusion: Cette étude démontre que les enfants entre l'âge de 5 à 12 ans pendant une période d'hospitalisation perdent au moyen 1136,8mls d'eau par jour, 4,6 mmol par Kg de sodium par jour et 1mmol par Kilogram de potassium par jour dans leur urine.

Introduction

Maintenance of normal fluid and electrolyte balance depends on a knowledge of the losses of water, sodium and potassium in urine, faeces and through the skin and lungs.

Studies done in temperate climates have been the basis for parenteral fluid and electrolyte therapy in our tropical environment in children.

Badoe¹, Badoe and Osafo² and Elebute³, have shown that there are differences in fluid and electrolyte requirements between adults in the tropics and those in temperate climates.

Da Rocha et al⁴ have also shown differences in fluid requirements between neonates in the tropics and those in temperate climates.

No study of fluid and electrolyte losses of children in our environment has to our knowledge been conducted.

The purpose of this study was to determine the daily urinary losses of water, sodium and potassium of Ghanaian children aged 5 to 12 years, who reported for operation to the paediatric surgical unit of Korle-Bu Teaching hospital, Accra. Studies done by Badoe¹ in Accra for a whole year, showed that while the temperature in the shade ranged from 18.3 to 34.4°C, that in Surgical Ward Three, Korle-Bu Teaching Hospital varied between 20°C and 31.1°C.

Patients and methods

Seventy four children, (51 male and 23 female) between the ages of 5 and 12 years, who presented to the Paediatric Surgical Unit of Korle-Bu Teaching Hospital, with surgical conditions that did not affect urine volume and electrolytes between June 1997 and January 1999, were included in the study.

Some of these children were admitted prior to surgery while others had recovered fully after surgery and were on a normal diet and fluid intake.

Those who were studied pre-operatively presented with herniae, hydroceles, undescended testes, hypospadias and some tumours. They were admitted 24hr before surgery during which period their urine was collected. Post-operative patients numbering 39, mostly had surgery for Acute Appendicitis, had fully recovered and were on a normal diet. They were ready for discharge but were detained further for their urine to be collected.

All of these patients were examined to ensure that they had no oedema, ascites, or systemic illness likely to affect the urinary parameters being studied. Their urine samples were tested for sugar, protein and pus cells.

Diet and fluid intake was not restricted in any way during the study.

Informed consent was obtained from the parents. Urine was collected in a Winchester jar over a 24-hour period. The volume of urine was determined with standard calibrated kidney dish, recorded and a sample sent to the laboratory for

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analysis of the sodium and potassium content.

The sodium and potassium ion concentrations were initially measured with a Jenway (Clinical PFP 7) Flame Photometer, (manufactured by Jenway Ltd. Felsted Dunmow Essex CM63LB England), by the method of Flame Emission Spectrophotometry. Later an ACE Clinical chemistry analyser (manufactured by Schiaparelli Biosystems Inc., New Jersey, USA) using ion selective electrodes was used for these measurements, when this became available. The results were, however, comparable after some of the urine samples were tested using both methods.

Children in the 5 to 12 year age group were chosen in order to make collection of urine practicable.

The ages, heights and weights of the children were recorded.

The 95% confidence interval was used to analyse the results.

Result

Table 1

In all, 74 children (51 male and 23 female) between the ages of 5 and 12 years with a mean age of 9 years were involved in the study.

The mean weight was 23.6kg with a 95% confidence interval of 23.1 to 24.1kg and a range of 14 to 40kg.

The volume of urine obtained was a mean of 1136.8ml with a 95% confidence interval of 1097.7 to 1176.0ml and a range of 400 to 2400ml. This was equivalent to about 2.0ml per kg. per hour.

The sodium excreted was a mean of 108.6mmol per day with a confidence interval of 105.3 to 111.9mmol and a range

The sodium loss was 108.6mmol (39.8 to 231.9mmol) daily. This was a mean of 4.6mmol per kg per day. The normal urinary loss of sodium of children in the temperate climate has been reported as 2 to 3mmol per kg per day.⁵ It seems, therefore, that the sodium requirement in the age group studied may be higher than that in temperate regions. This is based on the fact that the children studied lost more sodium in their urine than those in temperate regions.

The potassium excreted, 24.7mmol (6.25 to 69.9mmol) per day was equivalent to a mean of 1.0mmol per kg per day. The reported daily loss of potassium in children is about 1 to 2mmol per kg. per day.⁵ This is similar to the results obtained in this study.

Possible effects of surgery on electrolytes include sodium and water retention. However, by waiting till the children were 4 to 5 days post-op., and were on a normal diet and fluid intake this effect if any was made insignificant. The results in fact showed an increased loss of sodium rather than retention.

Conclusion

The urinary water and potassium excretion of children between 5 and 12 years in our environment is similar to those in the temperate climates but more sodium is excreted in the urine of our children.

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Table 1 Average daily urinary losses

Age (Years)	Volume of Urine/Total Daily loss (Ml)	Volume of Urine/ Loss/Kg hour (Ml /kg/hr.)	Sodium Total Daily loss (mmol)	Sodium Loss/Kg/ day (Mmol/ kg/day)	Potassium Total Daily loss (Mmol)	Potassium Loss/Kg/ day (Mmol/ kg/day)
5 - 12	1136.8 (400 to 2400)	2	108.6 (39.8 to 231.9)	4.6	24.7 (6.25 to 69.9)	1.0

of 39.8 to 231.9mmol. This mean was equivalent to 4.6mmol per kg. per day.

The mean potassium excreted was 24.7mmol per day with a confidence interval of 23.7 to 25.7 mmol and a range of 6.25 to 69.9mmol. This was equivalent to 1.0mmol per kg. per day.

Discussion

Normal fluid and electrolyte therapy is based on a knowledge of the daily losses in urine, skin, lungs and faeces.

In this study, the daily losses of water, sodium and potassium in the urine of 74 Ghanaian children aged 5 to 12 years in the Paediatric Surgery unit of Korle-Bu Teaching Hospital were determined.

The mean volume of urine was 1136.8ml (400 to 2400ml), an average of 2,0ml per kg per hour. This volume is the same as in temperate climates.⁵

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