Original Research Article

Serum sodium, potassium and Proteins Levels in Protein Energy Malnutrition disorder

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Abstract: Protein-energy malnutrition (PEM) is a major public health problem in the tropical and subtropical regions of the world. The aim of this study was to estimate the concentration of serum sodium, potassium, total proteins, albumin and globulin in protein energy malnutrition patient. This study was case control study carried out in Omdurman pediatric hospital during the period January - May 2015. Blood sample were collected from 100 patients (50 kwashiorkor and 50 Marasmus) with age ranged between 1-3 years, and 50 from normal child as control with matching age and sex. Sodium and potassium were estimated by ion selective electrode (ISE) method (easylyte Na\K). Total protein and albumin were estimated by using Mindray chemistry analyser. In results the mean±SD of serum sodium, potassium, total protein, albumin and globulin in kwashiorkor respectively were (127.3±-3.2), (2.7±0.5), (3.7±1), (2.2±0.9), (1.5±1). The mean±SD of serum sodium, potassium, total protein, albumin and globulin in Marasmus respectively were (150.2±159.4), (2.7±0.4), (3.9±0.7), (2.6±0.5), (1.3±0.8).While the mean±SD of serum sodium, potassium, total protein, albumin and globulin in control study respectively were (140.7±4.39, (3.9±0.7), (7.2±0.8), (3.8±0.4), (3.4±0.7).The biochemical parameter, sodium, total protein, albumin and globulin in PEM respectively was significantly decrease (P.values 0.00) than in control population. While serum potassium was insignificantly decreased (P.values 0.7). in conclusion This study concluded that significant decrease in serum sodium, total protein, albumin and globulin (P.values 0.00) when compared with normal, While serum potassium had insignificant decreased (P.values 0.7).
Keywords: Protein energy malnutrition, serum electrolytes, sodium, potassium, total protein, albumin

INTRODUCTION

Protein-energy malnutrition (PEM) is a major public health problem in the tropical and subtropical regions of the world. Protein Energy Malnutrition (PEM) is a very common problem in children under five years of age . It is the most common nutritional disorder affecting children in developing countries and the most common disease of childhood in such countries [1]. There are a number of biochemical parameters which become altered during protein energy malnutrition. In addition, abnormal serum electrolyte and protein concentration are common in PEM and appear to be related to the prognosis [2]. Protein Energy Malnutrition in early childhood is the predisposing factor that leads much of the morbidity and mortality in children under five year [3]. The term protein energy malnutrition applies to a group of related disorders that include marasmus, kwashiorkor. Marasmus involves inadequate intake of protein and calories and is termed "the sickness of the weaning" with no oedema [3]. Kwashiorkor is characterized by massive oedema of the hands and feet, hair discolouration and a large fatty liver [3]. Hypoalbuminaemia and electrolyte imbalances have been put forward as possible causes of the oedema [3]. There are many ways to evaluate PEM; however biochemical parameters provide the valuable information for the over-all management and act as sensitive indicators [4]. Total body potassium and sodium is reduced in PEM due to decreased muscle proteins and loss of intracellular potassium, decreased amounts of ATP, due to decreased energy substrates, probably alters cellular exchange of sodium and potassium. Na-K-ATP pump actively pumps potassium into and sodium out of cells , when this is not working, results in potassium loss and increased intracellular sodium, Water goes with sodium, so there may be intracellular over hydration, May explain, the increased fatigability and reduced strength of skeletal muscle [5]. Total serum protein and albumin is reduced than normal value in PEM. The reductions of total serum protein and albumin are more marked in kwashiorkor with oedema than in marasmus. Lowering of these serum total protein and albumin values in PEM could be explained on the basis of generalized protein deficiency leading to

impaired synthesis [2]. The objective of this study to estimate the alteration of concentration of serum sodium, potassium, total protein, albumin and globulin in PEM patient and compare within normal.

MATERIAL AND METHOD:
Study population:
This is hospital-based case control study was conducted at the Omdurman paediatrics hospital. This study carried in Omdurman during the period of January - May 2015. 100 patient of case (Kwashiorkor and Marasmus) with age range between 12-48 months (in Kwashiorkor 28 male and 22 female) while (in Marasmus 27 male and 23 female).50 children as control with age range between 12-48 months, 29 male and 21 female. After obtaining ethical clearance from an ethical review board and appropriate informed consent from the subjects as well as their parents/guardian.

Including criteria: Children about 1-3year who attempted in to hospital during study period.

Excluding criteria: children with jaundice, Hepatomegaly, Cushing syndrome, Patients with chronic infectious diseases like nephrotic syndrome, chronic glomerulonephritis, acute renal failure [5].

Healthy children (Control) a total of 50 children who attended the clinic for routine checkups with normal weight were used as controls.

Blood samples:
Blood samples were collected from all the children who fulfilled the inclusion criteria. Simple random sampling was used to select both the malnourished and healthy children for the study. Aseptically 5ml of venous blood was collected from patients and controls. As soon as the blood was collected from the patients, it was carried to the lab. The blood was allowed to clot and serum was separated by centrifugation at 5000 rpm for 5 minutes. It was used to estimate the main parameters.

Analytical procedure: Serum sodium and potassium were estimated by spectrophotometric method(easylyte Na\K).Total protein and albumin were estimated by using Mindray for chemistry analyser.

Statistical analysis:
SPSS for windows Version-16 (2007) was employed for statistical analysis. The Independent-Sample's't' test procedure was used to compare the mean of the cases and controls. Results were presented as mean±SD.

RESULT AND DISCUSSION:
This prospective study included 150 children, among them 100 were malnourished (50 as Kwashiorkor 28male, 22femal) (50 as Marasmus 27male, 23female) and 50 were well normal children. Among the PEM group 56 % were males and 44 % were females. The mean age of the children with PEM was 22.9 month compared to23.6 month for the controls. In PEM cases, the mean weight was 5.6 (kgs) and, in the control group, the mean weight was 5 (kgs). The difference was statistically insignificant. Significant decrease in serum sodium, total protein, albumin and globulin in kwashiorkor (p value= 0.00) and in Marasmus (P.values=0.00) in PEM compared to control. While insignificant decrease in serum potassium (P.values= 0.7) as showing in table (2).

Table-1:- The (mean±SD) of demographic data in the study population

Parameter	Patient N=100 (Kwashiorkor + Marasmus)	Control N=50	P.values
Age	22.9±1	23.6±1	0.7
Weight	5.6±1.2	5±1.5	0.01
Odema	20%		

Table-2:- The (mean±SD) of serum biochemical parameter in study population

Parameter	Patient N=100		Control N=50	P.values
	Kwashiorkor=50	Marasmus=50		
Total protein	3.7±1	3.9±0.7	7.2±0.8	0.00
Albumin	2.2±0.9	2.6±0.5	3.8±0.4	0.00
Globulin	1.5±1	1.3±0.8	3.4±0.7	0.00
Na+	127.3±3.2	150.2±159.4	140.7±4.3	0.00
K+	2.7±0.5	2.7±0.4	3.9±0.7	0.7

Table(2) presents the values of mean ± SD of serum sodium (Na+), potassium (K+), total protein, albumin and globulin in mg/dL respectively in both cases and controls. As represented in the Table 2 there

was a statistically significant decrease in the mean of Na+ values in PEM patient when compared to the control group (p<0.05). Similarly, there was a insignificant decrease in the mean of K+ values in PEM patients when compared to the control group (p>0.05). There was a significant decrease in the mean of total protein value in PEM patient when compared to the control group (p<0.05). There was a significant decrease in the mean of albumin value in PEM patient when compared to the control group (p<0.05). There was a significant decrease in the mean of globulin value in PEM patient when compared to the control group (p<0.05).Protein energy malnutrition (PEM) continues to be a major public health problem throughout the developing world. Malnutrition increases one's susceptibility to and severity of infections, and is the major component of illness and death from diseases. The risk of death is directly correlated with the degree of malnutrition [6].This study showed strong association of hyponatremia and protein energy malnutrition. There was significant correlation of either hyponatremia or hypokalemia with nutritional status'P' value for hyponatremia and hypokalemia are<0.05 and 0.0001 respectively. Because of increase in intracellular water, the total sodium may be increased but the actual serum level may be relatively decreased as a result of excessive increase in water in comparison to increase in sodium [7, 8].

There was insignificant difference in mean potassium concentration in both groups (p>0.0001). This showed strong association of hypokalemia and protein energy malnutrition. Insignificant difference in serum potassium concentration was noted in PEM and control groups. Occurrence of hypokalaemia could be falsely be decreased if samples taken were haemolysed as a result of improper sampling technique. In the present study all the haemolysed samples were excluded from the study. This study showed strong association of hypoproteinaemia and Hypoalbuminaemia with protein energy malnutrition. There was significant correlation of either hypoproteinaemia or Hypoalbuminaemia with nutritional status'P' value for hypoproteinaemia and hypoproteinaemia are 0.00 and 0.00 respectively. Hypoalbuminaemia and hypoproteinaemia have been put forward as possible causes of the odema.

The difference in mean sodium in PEM and control groups was significant in the present study, while in potassium was insignificant. Similar results with low serum potassium were obtained from studies conducted by Rao A *et al.;* [9] and Kalra K *et al.;* [10] in India.

CONCLUSION
This study concluded that significant decrease in serum sodium, total protein, albumin and globulin. A significant proportion of children with protein energy

malnutrition had altered biochemical parameters which were related to food intake and biochemical metabolism during growth and development of children less than five years of age.

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