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Effect Of Physical Exercises On Serum Electrolyte

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Abstract:*The effect of physical exercise on serum electrolyte was estimated in this work with interest on the effect of short duration exercise(45 minutes) on serum sodium,potassium,chloride and bicarbonate.The samples for analysis were collected randomly from athletes,football players,volley ball players and handball players at two instatnts,pre-exercise and post-exrecise.Samples were also collected from individuals not active in these physical exercises as control.The mean values and standard error mean for pre and post-exercise samples were respectively 139.26± 0.18 and 137.36± 0.16,for* Na^+*,4.33± 0.003 and 4.04± 0.02,for* K^+*,101.25± 0.15 and 98.32± 0.14 for* Cl^- *and 27.94± 0.19 and 25.60± 0.23 for* HCO_3^-*.The values for the control correlated well with pre-exrecise values.The findings of this work showed that in short duration exercise,accompanied with sweating,the serum electrolytes are usually decreased but at variable rate.*

Keywords:*Physical exercise,Serum Electrolytes,Short duration exercises,*

I. Introduction

Electroytes are the positively and negatively charge molecules called ions that are found within the body's cells and intracellular fluid including blood plasma(Henry et al.,2001).Those electrolytes that are positively charged are called cations while negatively charged are called anions(Tom,2003;Philip,2005).The electrolyes mostly affected in exercise is serum/plasma electrolytes.The important electrolytes routinely requested for estimation in the laboratory are potasium,sodium,chloride,bicarbonate,calcium and phosphate(Tom,2003;Philip,2005).

Physical exercise had been shown to induce bone mass gain,especially in load bearing bone sites(Maimoum et al.,2005).This will invaraibly disturb the serum/plasma calcium ion concentration therefore distort serum/plasma electrolytes balance.Parathyroid hormone(PTH) which is the major regulator of bone metabolism,functions to maintain the calcium ion concentration of the extra celluar fluids within physiological limit.The activity of PTH and readily influenced by both exrecise duration and intensity(Maimoun et al.,2005).It had also been discovered that serum/plasma calcium and phosphorus concentration moves in opposite direction,and therefore usually discussed and analysed together.

It is not exaggeration saying that the concentration of plasma/serum sodium is affected during exercise.Research had shown that exercise during that hot and humid condition causes an increase in plasma/serum sodium concentration(Senay,1968).This implies that water replacement may be more than sodium replacement during exceptional heat stress.Hyponatraemia(reduced sodium level) had also been recognised in many athletes competing in long duration endurance exercise(Speedy et al.,1997;Noakes,1990;Irving et al.,1991) and they had been advised to drink as much water as possible during exercise to prevent dehydration(Convertino et al.,1996).However,sodium and chloride ions usually move in the same direction most often into the cell as sodium is extracellular(Philip,2005).Analyses of sodium ion concentration in the serum/plasma usually correlate with chloride ion concentration except in certain disease condition like chronic renal failure.

Potassium the main electrolytes found inside the body's intracellular fluid and stored in muscle fibers along with glycogen plays a key role by helping transport glucose into the muscle cells(Armstrong and Epstein,1999).Potassium also interacts with both sodium and chloride to control fluid and electrolyte balances and assists in the conduction of nereve impulse(Brouns,1992).When glycogen breaks down to supply energy for exercise,muscle cells are depleted of potassium.Replenishing potassium after loss during exrecise is important because hyperkalemia can cause electrical impulse disturbance and possibly death(Armstrong et al.,1985).However,individual should never take potassium supplement in large dose without the advice of a physician.

The effect of physical exercise on serum electrolytes is more pronounced when the exercise is prolonged(Maimoun et al.,2005).Heat and intensity of the exercise is also important factor that contributes to the variations of serum electrolytes during physical exercise.Extreme(Alert level) concentration of serum electrolytes should be avoided as it can lead to death(Armstrong et al.,1985)
This study is centered on studying the effect of several physical exercises on the electrolyte.

AIMS AND OBJECTIVES
To determine the effcet of physical exercises on serum electrolyte.

II. Materials And Methods

SUBJECTS
This study was conducted during the weekend physical exercise ususaly done by the students of Ebonyi State University,Abakaliki.Forty(40) subjects were recruited,randomly from footballers,athletes,volleyball players and handball players and control subjects not partaking.
INCLUSION CRITERIA
(I) Subjects were made up of males and females in the age range 18-35 years.
(II) Subjects must have participated in the physical exercise in not less than three months.
(III) Subjects must not have any history of medical illness.
(IV) Subjects must not have any history of chronic or recent medicinal drug use.

Questionaires were issued to the subjects to complete,followed by personal interview conducted with the subjects prior to the exercise during which the information provided in the questionaire about the history of medical illness,exercise and drugs use were confirmed.
ETHICS:Oral consents were made to the subjects prior to the sample collection.
SAMPLES
PRE-EXERCISE BLOOD SAMPLES
Pre-exercise blood samples were collected from all the subjects 15 minutes before the exercise from anticubital veins with the subjects in sitting position.All blood samples were clearly labelled and stored in well sealed tubes for later analysis.The blood samples were analysed for serum sodium,serum potassium,serum chloride,and serum bicarbonate.
POST-EXERCISE BLOOD SAMPLES
Post-exercise blood samples were collected after 45 minutes of the exercise just before the subject drinks water or any fluid.The blood samples were also analysed for serum total calcium,serum sodium,serum potassium,serum chlorides and serum bicarbonates.
METHODS
The processing of the samples commenced within 45 minutes of collection.The blood sapmles were centrifuged for 5 minutes at 2,500rmp and the serum separated.
ESTIMATION OF SERUM SODIUM
Sodium estimation was done using sodium reagent set by Teco Diagnostics.
ESTIMATION OF SERUM POTASSIUM
Potassium estimation was done using Turbidimetric test-TPB method of the test kit by Quimica Clinical Aplicada S.A.
DETERMINATION OF SERUM BICARBONATE(Modified Von-Slyke)

III. Result

Table 1 shows values of electrolytes of the subjects before exercise(pre-exercise) and after exercise(post-exercise).Comparing the sodium concentration pre-exercise 139.2±0.18,and post-exercise 137.36±0.16 shows a little difference in their mean values.The decrease in the sodium concentration was about 1.84±0.02.The potassium concentration also showed a mean difference between the pre-exercise and post-exercise sample 4.33±0.003 and 4.04±0.02 respectively.The mean concentration of chloride of pre-exercise was higher than the post-exercise sample,101.24±0.19 and 98.32±0.14 respectively.

However,the pre-exercise bicarbonate was 27.94± 0.19 while the post-exercise bicarbonate is 25.60± 0.23.Results showed that the mean differences observed in the electrolyte values were not statistically significant for all analyses measured($P>0.05$).

In table 2,the electrolyte values of the subjects in pre-exercise electrolyte values and the control were 139.26±0.18 and 139.28±0.15.The potassium concentration in pre-exercise and control values was 4.33±0.03 and 4.33±0.02.The chloride value of pre-exercise and control value was 101.25±0.15 and 100.83±0.23 while the bicarbonate values for pre-exercise and control was 27.94±0.19 and 26.70±0.11.The result revealed that the mean difference obsereved were not significant($P>0.05$).

When the electrolyte values in post-exercise sample and the control subjects werecompared,the post-exercise electrolyte mean value and control mean values were 137.36±0.15 for sodium,4.04±0.02 and 4.33±0.02 for potassium,98.32±0.14 and 100.83± 0.22 for chloride and,25.60±0.23 and 26.70±0.11 for bicarbonate values respectively for post-exercise and control values.The result also revealed no significant(P>0.05).This is showed in table 3.

Table 1:Comparism Of Electrolyte Values In Pre-Exercise Samples And Post-Exercise Sample

Electrolytes(mmol/L)	Pre-exercise	Post-exercise	Level of significance
Na^+	139.26± 0.18	137.36± 0.16	P>0.05
K^+	4.33± 0.03	4.04± 0.02	P>0.05
Cl^-	101.25± 0.19	98.32± 0.14	P>0.05
HCO_3^-	27,94± 0.19	25.60± 0.23	P>0.05

Table 2:Comparism Of Electrolyte Values In Pre-Exercise Samples Of The Subjects And The Control Subject Of Comparable Age

Electrolytes(mmol/L)	Pre-exercise	Post-exercise	Level of significance
Na^+	139.26± 0.18	139.28± 0.15	P>0.05
K^+	4.33± 0.03	4.33± 0.02	P>0.05
Cl^-	101.25± 0.19	100.83± 0.23	P>0.05
HCO_3^-	27,94± 0.19	26.70± 0.11	P>0.05

Table 3:Comparism Of Electrolyte Values In Post-Exercise Samples Of The Subjects And The Control Subject Of Comparable Age

Electrolytes(mmol/L)	Pre-exercise	Post-exercise	Level of significance
Na^+	137.36± 0.16	139.28± 0.15	P>0.05
K^+	4.04± 0.02	4.33± 0.02	P>0.05
Cl^-	98.32± 0.14	100.83± 0.23	P>0.05
HCO_3^-	25.60± 0.23	26.70± 0.11	P>0.05

IV. Discussion

The findings in this work revealed that during exercise individual is very likely to experience a reduction in serum sodium concentration.A low in serum sodium concentration(<130mmol/L) is called hyponatramia (Tom,2003).The reduction in serum sodium level during exercise can be attributed to the loss of sodium in sweat during exercise.This is in accordance with the finding of Sanders et al.(2001).However,it is expected that if the exercise duration and intensity is extended,and sweating increased,there will be increase in serum sodium level because of hydration and decrease blood volumes.Since the subjects were not taking any fluid during the exercise duration.

Several authours have described cases of hyponatraemia during endurance exercise in heat such authors includes Speedy et al.(2001) and Noakes (2002).Ri(2006) in his review of the role of sodium in fluid homeostatis advised that persons engaging in long distance exercise should drink as much fluid as possible to revent dehydration and hyponatraemia.

The findings of this work also showed that a reduction in serum chloride is expereinced during the exercise period.This can be explained by the fact that during exercise hyponatraemia is accompanied by a reduction in serum chloride as both sodium and chloride is the main contituent of sweat in form of salt.Since sodium and chloride are more extracellular,changes in their serum concentration usually correlate.

Similarly serum bicarbonate concentration changes in our resaerch showed a little decrease.This is not far from the fact that during the exercise period,There may be exercise induced tachycardia.This is also in consonance with Rojas et al.(2006).

Serum potassium is not left out in the alteration in serum electrolyte changes associated with exercise.Potassium which is mostly intracellular also interacts with sodium and chloride in the control of fluid and electrolyte balance and assist in the conduction of nerve impulses.However,the slight reduction in serum potassium might be due to the fact that the exercise duration was associated with sweating and lasted for forty five minutes.It is also expected that if the exercise is prolonged without taking any fluid with incereased breakdown of glycogen to supply energy for the body the muscle cells will be depleted of potassium resulting in increase in serum potassium concentration.

V. Conclusion

Alteration in serum electrolyte is always a seriously problem when their concentration is either too high or low and can cause sudden death.It is therefore very important that those embarking in serious physical exercise especially prolonged one should take as much fluid as possible especially water and electrolyte alteration.

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