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Urinary Sodium and Potassium Excretion Following Karate Competitions

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Original Paper

Introduction. Exercise induces renal hemodynamic alterations and stimulates electrolytes excretion. The purpose of this study was to assess urinary excretion of sodium and potassium in karate practitioners, following competitions.

Materials and Methods. The study population composed of 18 healthy men, aged 18 to 21 years, with similar physical characteristics. They were professional karatekas with a history of at least 7 years of karate training. The participants competed in 3 rounds of about 3 minutes in duration with 10 minutes resting intervals between them. The 24-hour urine samples were collected before (while trainings were stopped) and after the match and their sodium and potassium concentrations were measured. Also, blood samples were obtained before and after the match for measurement of these electrolytes in the participants' sera.

Results. Before the match, the mean values of urinary sodium and potassium were 200.3 ± 89.3 mEq/L/d and 68.5 ± 12.9 mEq/L/d, respectively. After the match, they changed into 206.9 ± 74.7 mEq/L/d and 67.1 ± 14.4 mEq/L/d, respectively. No significant alterations were observed in urinary sodium and potassium excretion following karate match (P = .94 and P = .96, respectively). Serum sodium levels were 136.7 ± 3.1 mEq/L and 136.3 ± 2.9 mEq/L, before and after the match, respectively (P = .11), serum potassium levels were 4.2 ± 0.3 mEq/L and 4.1 ± 0.2 mEq/L, respectively (P = .16).

Conclusions. With regard to short duration and anaerobic nature of karate, it seems that a Karate match does not contribute to excessive urinary electrolytes excretion.

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INTRODUCTION

Exercise can induce hemodynamic alterations that change the glomerular basement membrane permeability in the kidneys, leading to proteinuria and excretion of electrolytes. The sympathetic overactivity and secretion of antidiuretic hormone and aldosterone, proportionate to exercise intensity, result in reduction in renal blood flow and glomerular filtration. Therefore, heavy exercise retains fluids and most electrolytes except for serum potassium.[1-3] In addition to exercise intensity, exercise duration can play a contributory role in the excretion of electrolytes and even it may be more important than the intensity.[4,5] During exercise, a change in body tonicity can result from an imbalance between intake and loss of serum sodium, serum potassium and water, due to renal or extrarenal mechanisms.[6] Long-lasting exertion

is harmless for electrolyte balance and may result in slight hyponatremia.[7-9]

Karate training is usually divided into 3 parts: *kihon* (basics), *kata* (forms or patterns of moves), and *kumite* (sparring). Techniques in kihon and kata are characterized by deep long stances that provide stability, enable powerful movements, and strengthen the legs. Karate is often regarded as a "hard" and "external" martial art. Kumite or sparring is the practical application of kata to real opponents.[10] Thus, we can anticipate that during kumite, a significant alteration in the concentration of serum electrolytes and body fluid volume may happen. However, such changes in sort-duration exercises have been rarely addressed in the scientific literature. In order to assess the urinary sodium and potassium excretion following kumite, we conducted a cross-sectional study on 18 healthy karate practitioners. This study can help us to know more about renal physiology and potential hazards following short-duration sports and to prevent undesirable events in martial arts.

MATERIALS AND METHODS

Eighteen young male karatekas with a history of at least 7 years of karate training volunteered for enrollment in this study. The study population were healthy (based on their medical history) and nonsmokers. They were informed about the study's aims and design and signed a consent form. All of the practitioners competed in 3 rounds, each lasted about 3 minutes. There were 10-minute resting intervals between the rounds. All matches were performed 24 hours after the latest training session.

After the training session, 24-hour urine collection was done. Then, the practitioners emptied their bladders 1 hour before the match. The competitors were asked to collect their urine for another 24 hours after the match, as well, in order to measure concentrations of sodium and potassium in urine and compare values before and after the match. The participants conformed to a similar water intake protocol of about 200 mL, 1 hour before and 5 minutes after the match, and a regular diet was administered. Water intake during the rest of the day was liberal based on their feeling of thirst, but excessive water intake was discouraged. In addition, blood samples were obtained before and after the match for measurement of serum levels of sodium and potassium and their alterations.

All electrolyte measurements were done by flame photometry method. The reference ranges for 24-hour urine sodium and potassium values were 15 mEq/L/d to 250 mEq/L/d and 25 mEq/L/d to 100 mEq/L/d, respectively. All data analyses were carried out using the SPSS software (Statistical Package for the Social Sciences, version 11.5, SPSS Inc, Chicago, Ill, USA). Values of quantitative variables were expressed as mean ± standard deviation. The paired *t* test was used for comparison of variables before and after the match. A *P* value less than .05 was considered significant.

RESULTS

The participants were between 18 and 21 years old, and they had approximately similar physical characteristics; their mean age, weight, and height were 18.9 ± 0.87 years, 67.2 ± 14.3 kg, and 173.1 ± 28.9 cm, respectively. They reported a mean training time of 9.0 ± 0.6 hours per week.

Before the match, the mean values of urinary sodium and potassium were 200.3 ± 89.3 mEq/L/d and 68.5 ± 12.9 mEq/L/d, respectively. After the match, these values changed into 206.9 ± 74.7 mEq/L/d and 67.1 ± 14.4 mEq/L/d, respectively. No significant alterations were observed in urinary sodium and potassium excretion following karate match (P = .94 and P = .96, respectively). Also, there were no significant differences between serum electrolytes concentrations before and after match; serum sodium levels were 136.7 ± 3.1 mEq/L and 136.3 ± 2.9 mEq/L, before and after the match, respectively (P = .11). Serum potassium levels were 4.2 ± 0.3 mEq/L and 4.1 ± 0.2 mEq/L, respectively (P = .16). The Table shows the additional laboratory data of the competitors.

Laboratory Data of Karate Competitors

Laboratory Values	Before Match	After Match
Urine		
Creatinine, mg/dL	110 to 160	185 to 250
Volume, mL	1500 to 2000	1000 to 1600
Sodium, mEq/L	110 to 287	137 to 300
Potassium, mEq/L	22 to 92	49 to 110
Serum		
Sodium, mEq/L	131 to 142	130 to 142
Potassium, mEq/L	3.9 to 4.5	3.7 to 4.5

DISCUSSION

During prolonged and heavy physical exercises such as marathon running, hyponatremia as a result of dehydration and large sodium loss may ensue. On the other hand, dehydration-related excessive fluid intake dilutes the total body sodium due to volume expansion.[11] If exercise-induced hyponatremia is left untreated, it can lead to encephalopathy which may be fatal.[12] Although, karate is not considered as long lasting or heavy exertion, the working load in kumite subdivision is high and dependent on competitors' physical capabilities and activities. This indicates the predominant role of glomerular filtration changing factors, such as sympathetic overactivity and competition stress which also have influence on urinary electrolyte excretion via renin-angiotensin-aldosterone system.[1,13] In this study, however, we found no significant differences in sodium and potassium concentrations between urine samples taken before and after kumite competition. This finding was in contrast to those of some studies on prolonged heavy exercises.[3,4] This may be attributed to the short duration and anaerobic nature of kumite competitions.[14]

Our study showed that karate does not contribute to excessive excretion of urinary electrolytes. We speculate that exercise duration is more important than exercise intensity or the physical stress which stimulates renin-angiotensin-aldosterone system.[4,5] In addition, avoiding excessive fluid intake, as mentioned in other studies too,[9] may be another reason for the stability in concentration of serum electrolytes (particularly sodium and potassium) in our study. Therefore, it is important to consider a reasonable fluid intake in athletes before and after their exercises. Some researchers have reported similar results [9,15]; however, studies on short-duration exercises are few, and concerning the specific issue of martial arts, we could not find any similar reports.

CONCLUSIONS

Karate, as a short-duration exercise, may have no influence on urinary excretion of electrolytes. Further researches with larger sample sizes are recommended to confirm this finding.

CONFLICT OF INTEREST

None declared.

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