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Research Article

THE EFFECTS OF THE TWO TYPES OF CONTINUOUS AND INTERMITTENT RESISTANCE EXERCISES ON URINARY EXCRETIONS OF SODIUM AND POTASSIUM AMONG ACTIVE YOUNG MEN

***Fateme Khodaie[1], Amir Hamzeh Zare[1] and Sirvan Adeli[2]**
[1]Education Organization of Fars Province, Shiraz, Iran
[2]Sport Organization Municipality of Tehran
**Author for Correspondence*

ABSTRACT
In regard of researches shortage about influences of various kinds of resistance exercises, the purpose of the present study was comparison of acute and chronic effects of two types of continuous and intermittent resistance exercises on urinary excretions of sodium and potassium among active young men. Twenty 24-30 years old young men were randomly divided to two groups of continuous and intermittent exercises. The both groups participated in 8 weeks progressive resistance exercises. Urinary samples were taken from the subjects, before, immediately then and two hrs after the first test (48 hrs before the trainings beginning) and the final one (48 hr after the trainings ending). In order to compare variations of variables in both continuous and intermittent groups, analysis of variance test with repeated measurements was implemented. Both urinary sodium and potassium significantly reduced in the two continuous and intermittent groups ($P<0.05$), though there was not observed any significant difference between variations patterns of the two groups ($P>0.05$). However, the decreases in urinary electrolytes could result from homeostasis consistencies and responses, but in order to draw a rather clear conclusion, we need more accurate and controlled investigations, in the future.

Keywords: *Sodium, Potassium, Continuous and Intermittent Exercises, Resistance Exercise*

INTRODUCTION
Sport and physical activity accompany with physiologic consistencies. The cognition and investigation of these consistencies, especially in equilibrium of water and electrolytes that have indispensable roles in vital reactions of the body, are very important and remarkable. Because, the amounts of absorption and excretion of water and electrolytes would expose different changes through doing various sport exercises and activities, which understanding of these changes is effective in the interpretation of physiologic mechanisms of the body.

In the other hand, many people, especially men, have recently noticed the resistance exercises for the purposes of the healthiness. These exercises contain various kinds like concentric, eccentric, isometric and even the continuous and intermittent types, and would cause the generation of physiologic consistencies that could appear in renal performance, too. Measurements of urinary excretions of the electrolytes following various resistance exercises schedules could aid the superior understanding of acute and chronic effects of the resistance exercises. The physical activity induced urinary levels of sodium and potassium electrolytes would affected by different intensities, spans and types of the physical exercises (Mooren *et al.*, 2001). Because, the athletes are severally exposed to the exercise induced muscle cramps, the researchers think the electrolytes and liquids disorders would cause the arising of this phenomenon (Stofan *et al.*, 2005). Therefore, the intense exercise preserves the liquid and most electrolytes, except the serum potassium (Zorbas *et al.*, 2001).

Besides exercise intensity, the type of exercise could play a contributive role in excretions of the electrolytes. During exercise execution, variation of body tonicity might origin from disequilibrium between absorptions and excretions of water and sodium and potassium serums, which depends to adrenal or renal mechanisms (Mallie *et al.*, 2002). The long-term excretions are hazardous to the electrolytes equilibrium and might lead to mild hyponatremia (Noakes *et al.*, 2005).

Several researches observed significant increases in sodium plasma levels among the subjects who were carrying out physical activities (Rocker *et al.*, 1989). Nevertheless, some scholars did not find any significant changes in sodium plasma (Jokinen *et al.*, 1991). In the other hand, most studies indicated reduction of urinary sodium concentration following sport activities. It seems, this matter have occurred because of increase in tubular sodium reabsorption to preserve liquids of the body, which appears its origin results from the reduction of plasma volume (Joborn *et al.*, 1985).

By investigation of effects of long-term exercises on potassium plasma and intracellular erythrocytes concentrations, the scholars have drawn a conclusion that the duration of sport exercise has direct and reverse relations versus amount of urinary potassium excretion and concentration of potassium plasma, respectively (Lijnen *et al.*, 1989).

Increase in amount of potassium plasma has been also seen following intense sport activities among the athletes and untrained persons, and potassium plasma would increase proportional to intensity of the activity (Lindinger and Sjogaard, 1991).

However, the effects of the resistance exercises on excretions of the electrolytes have not been surveyed adequately, and these influences are still in ambiguity. They are few studies about investigation of responses and consistencies of urinary sodium and potassium after doing various kinds of resistance exercises, especially the continuous and intermittent types.

The aim of the present research was determination and investigation of effects of 8 weeks continuous and intermittent resistance exercises on relaxation and in response to exercise levels of urinary sodium and potassium among active young men.

MATERIALS AND METHODS

Subjects

The statistical society of this research consisted of entire active male students of Kermanshah city of Iran. Twenty 24-30 years announced their readiness to participate in the research, following an invitation throughout universities of the city. They purposefully chosen as the subjects and randomly divided to two groups of continuous and intermittent. According to physician's examinations and approval, the whole subjects had perfect physical healthiness.

The demographic properties of the subject have been represented in table 1.

Table 1: Demographic properties of the subjects

Variable	Continuous group	Intermittent group
Number	7	7
Age (year old)	27.33±3.11	26.78±2.9
Height (cm)	178.31±4.55	178.63±5.21
Weight (kg)	76.46±5.76	75.86±5.94

Data Collecting

The subjects became familiar with the exercises protocols in justification meeting, one week before the research execution. Besides orientation to the resistance movements, the properties of the subjects and a maximal repetition for each resistance movement were measured, in this meeting. Thereafter, the subjects attended in the test session, 48 hrs before the trainings beginning, and urinary samples were taken from the two exercise groups, before, immediately then and 1 hr after a continuous and an intermittent resistance activity session.

This session were held with a 20% of a maximal repetition. Then, the subjects performed their trainings schedules in progressive features, during 8 weeks. They performed three weekly sessions. The progressive implemented load was in a manner that the subjects carried out their exercises with 20, 25, 30, 35, 40, 45, 50 and 55 percentages of a maximal repetition for the first to the eighth week, respectively, during these 8 weeks. After ending of the eight weeks trainings and then the proportional rest to the interval between the first samples gathering day and the exercises beginning day (48 hrs), the last exercise

activity session was held just like the first day and with the same 20% of a maximal repetition. Urinary samples were taken from the subject, before, immediately then and 1 hr after this last session, too.

Resistance Exercises Schedule

The resistance exercise schedule consisted of three weekly sessions in duration of 8 weeks. Each session lasted 68 min, involving 10 min warm up, 52 min main exercise and 6 min cold down. In this schedule, a percentage of a maximal repetition and execution speed were considered as exercise intensity and mass. The exercise loads were the same among continuous and intermittent resistance exercises. The resistance exercises were designated in circular figures and two schemes of continuous and intermittent. Each circle has involved bench press, legs press, biceps, forelegs, triceps, rear-legs and side stretch or length, which the order of execution of the movements was as the same mentioned sequence. The span of each station has been assigned as three min that done with different speeds in continuous and intermittent resistance exercises. The rest intervals between each two stations and each two circles have been designated as 1 min and 2 min, respectively. Two circles have been assigned in each exercise session. The continuous exercise group has performed the 3 min of each station with speed of V (V has been designated as 75 BPM). The intermittent exercise group has carried out 10 sec with speed of 2V and next 20 sec with speed of ½V until finishing of the 3 min of each station. Since, the speed of each movement was controlled by metronome; the number of movements in each set was the same for the whole movements and versus the increment of exercise intensity.

Urinary Samples Gathering and Analysis

The urinary samples were gathered in specific containers, before, immediately then and 1 hr after the first test (48 hrs before the trainings beginning) and the final one (48 hrs after the trainings ending). The whole gathered urinary samples were preserved in frigid forms and at temperature of -20℃, until arriving to the laboratory, and used at the lab examination moment. It should be mentioned, the subjects were asked to avoid smoking and consumption of caffeine and alcohol, at the night before samples collecting and generally during the entire stages of the research. The entire steps of samples collecting were executed in the same conditions, for the whole subjects. The urinary and serum amounts of sodium and potassium were measured by the method of *flain photometry* upon the unit of (*mEq/L*), for each sample.

Statistical Approaches

At first, the values of each under study variable were described by using mean and standard deviation. The Smirnov-Kolmogorov test was applied, to survey the naturalness of data distribution and determine the usage of whether parametric or non-parametric test. Since, the data had natural distribution; the test of factor analysis of variance with repeated measurements was implemented, to investigate variations of under study variables in both continuous and intermittent groups. The significance level has been assigned as 0.05, for entire statistical tests. In addition, the statistical software SPSS v.16 was utilized for statistical calculations.

RESULTS AND DISCUSSION

The statistical descriptions of urinary sodium and potassium have been presented in table 2. The values have been reported as mean and standard deviation. In addition, to compare variations of under study variables between the two continuous and intermittent groups, the results of factor analysis of variance test with repeated measurements have been given in tables 3 and 4. Time operation was significant (P=0.000) but group operation and time and group co-operations were insignificant (P=0.731 and P=0.588, respectively), about urinary sodium. Generally, the amounts of urinary sodium of the subjects of both exercise groups decreased, significantly (P=0.000), though there was not observed any significant difference between the two continuous and intermittent groups (P=0.588). Time and group operations were significant (P=0.000 and P=0.043, respectively) but time and group co-operations were insignificant, about urinary potassium (P=0.561). Overall, the amounts of urinary potassium of both exercise group reduced, significantly (P=0.000), and nevertheless the both groups are distinct from each other (P=0.043) but there was not observed any significant difference between those of the two continuous and intermittent groups (P=0.561).

Table 2: Statistical descriptions of urinary sodium and potassium

Variables	Sampling Times	Continuous group	Intermittent group
Sodium	Pre	132.60±34.030	125.40±31.997
(*mEq/L)*	Post 1	118±23.295	116.90±27.086
	Post 2	114.20±23.394	108.30±19.026
	Post 3	106.60±22.202	106.70±21.654
	Post 4	100.90±19.784	98.100±19.649
	Post 5	96.900±17.246	93±17.211
Potassium	Pre	78.90±5.486	89.330±16.228
(*mEq/L)*	Post 1	73.690±4.358	83.130±11.592
	Post 2	70.340±5.129	79.390±12.213
	Post 3	68.50±4.819	76.280±4.819
	Post 4	64.871±5.204	72.530±11.667
	Post 5	61.250±5.207	69.870±11.862

Table 3: Statistical results of factor analysis of variance test with repeated measurements to compare changes of urinary sodium in the two groups

Factor	Sum of Square	df	Mean Square	F	P	Effect Size	Observed Power
Time	15316	1.660	9226.829	38.016	0.000 *	0.679	1
Group	360.533	1	360.533	0.122	0.731	0.007	0.063
Time*Group	194.067	1.660	116.912	0.482	0.588	0.026	0.116

**The mean difference is significant at the 0.05 level*

Table 3: Statistical results of factor analysis of variance test with repeated measurements to compare changes of urinary potassium in the two groups

Factor	Sum of Square	df	Mean Square	F	P	Effect Size	Observed Power
Time	4488.394	1.815	2472.278	91.067	0.000 *	0.835	1
Group	2338.979	1	2338.979	4.720	0.043 *	0.208	0.538
Time*Group	27.492	1.815	15.143	0.558	0.561	0.030	0.131

**The mean difference is significant at the 0.05 level*

Discussion

According to the results of the present study, there was not observed any significant difference in excretion of urinary sodium between the effects of 8 weeks continuous and intermittent resistance exercises.

Actually, both exercise groups would cause significant decreases in urinary sodium among active young men, though the difference between the two groups was insignificant. Generally, the present founds indicated that the groups did not follow any different pattern of variations, which was statistically significant, over time. Most studies indicated reduction of urinary sodium concentration following sport activities. It appears, this matter have occurred because of increase in tubular sodium reabsorption to preserve liquids of the body, which appears its origin results from the reduction of plasma volume (Joborn *et al.*, 1985).

In the other hand, Freund *et al.*, (1991) reported the intense exercises would lead to increases in urinary electrolytes excretions. Ahmadi *et al.*, (2009) declared one aerobic activity session would cause significant increase in urinary sodium concentration. Nevertheless, Zambraski *et al.*, (1990) reported the sport exercise would naturally cause reduction of sodium excretion. Poortmans (1984) stated the reduction of sodium excretion by means of sport exercise should be mainly resulting from the production of aldosterone during the exercise. By surveying electrolytes excretions in two days and during long-term

exercises among healthy men, Lijnen *et al.*, (1984) drew a conclusion that the level of excreted sodium through urine was low during exercises days, but the level of urinary aldosterone had an increment.

According to the understandings of the present research, there was not observed any significant difference in excretion of urinary potassium between the effects of continuous and intermittent resistance exercises, among active young men. Indeed, both exercise groups would lead to significant reductions of urinary potassium among active young men, though the difference in the amounts of variations was not significant between the two groups. Overall, the present understandings showed that the groups did not follow any different pattern of variations, which was statistically significant, over time. By investigation of effects of long-term sport exercises on concentration of potassium plasma, some researchers drew a conclusion that the span of sport exercise has reverse and direct correlations versus the variations of potassium plasma concentration and the level of urinary potassium excretion, respectively (Lijnen *et al.*, 1989; Yalfani, 1992). Ahmadi *et al.*, (2009) reported one aerobic activity session did not generate any significant change in concentration of urinary potassium. By surveying electrolytes excretions in duration of two days long-term exercises among healthy men, Lijnen *et al.*, (1984) concluded that the excretion amount of urinary potassium was low during exercises days.

Perhaps, the incongruity of the understandings between various researches relates to the differences in sample collecting moments, exercise protocols, under study societies and exercise situations of the subjects. In addition, most previous researches investigated the influences of one activity session rather than a period of exercises. Moreover, a research that has investigated and compared the two types of continuous and intermittent exercises has seldom surveyed, yet. Hence, it is not appropriate to draw a conclusion, before accomplishment of further studies. In the present study, both continuous and intermittent resistance exercises, which were executed in duration of 8 weeks (3 weekly sessions), would cause decreases in sodium and potassium excretions, and there was not observed any difference between the two types of resistance exercises, about the recent issue. As has been distinguished, intensity of activity is the most substantial exercise variable of physiologic responses, and maybe the reason of nonbeing differences between effects of continuous and intermittent resistance exercises on urinary excretions of both sodium and potassium is the sameness in intensities of exercises. After the exercise intensity, span of exercise is another important effective parameter, too. Actually, both intensities and spans of the two continuous and intermittent resistance exercises were the same, in the present study, and the distinction arose from the continuous or intermittent execution of a similar exercise between the two groups of the subjects. Further studies should still be accomplished to could draw an unfailing conclusion in various research conditions. Enough information does not exist about urinary excretions of sodium and potassium in consistency and response to resistance exercises, yet.

Conclusion

According to the results of the present study, it is concluded that there does not exist any significant difference between the two types of continuous and intermittent resistance exercises in relaxation levels and those of in response to resistance activity sport of urinary sodium and potassium, before and after the eight weeks resistance exercises. In addition, both levels of sodium and potassium significantly decreased, in the two continuous and intermittent resistance exercise groups, during the trainings period. It appears there was not any difference about this matter between the two types of continuous and intermittent exercises. However, accomplishments of further researches are required. In order to achieve a rather accurate conclusion, the only solution is completion of more accurate and controlled investigations and studies, in the future.

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