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Research Article

THE EFFECT OF DELORME AND OXFORD RESISTANCE TRAINING ON URINARY EXCRETION OF SODIUM AND POTASSIUM IN YOUNG MEN

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ABSTRACT
Due to the lack of research about of the impact of resistance Training, the aim of the present research, comparison of acute and chronic effect on two types of Delorme and Oxford resistance training, were on urinary excretion of sodium and potassium in active young men. 20 young men aged 24 to 30 years old, they divided randomly in two Training groups, resistance training Delorme and Oxford. Two groups participated in eight weeks of resistance training increased. Before and immediately after, and one hour later the first test (48 hours before the start of training) and the final test (48 hours after the end of training), urine samples were collected from the participants. To compare variables changes, both Delorme and Oxford resistance training, factorial ANOVA with repeated measures was used. The urinary sodium and potassium in both groups significantly decreased ($P<0.05$) but there was no significant difference between the pattern of changes ($P>0.05$). Although, reducing urinary electrolytes could be due to response and adjustment of homeostasis to be training, but for clearer conclusions, requires more analysis and research in the future.

Keywords: *Sodium, Potassium, Delorme and Oxford Training, Resistance Training, Electrolytes*

INTRODUCTION
Physical activity and exercise is associated with physiological adaptations. identify and assess this compatibility, especially, in water and electrolyte balance that has important role in body's vital reactions, is very noticeable, because of the variety of sports activities and exercise, amount of absorption and excretion of water and electrolytes would be in different changes that understanding these changes is helpful in interpreting the physiological mechanisms.

On the other side, resistance training has recently attracted the attention of many people, especially men, who have health goals. The Training of various types such as concentric, eccentric, isometric, and even Delorme and Oxford are formed caused by physiological adaptations that can be found in kidney function. By measurement of urinary electrolytes of different resistance training programs can help to better understand the acute and chronic effects of resistance training. Electrolytes like sodium and potassium are electrolytes in the urine under the influence of physical activity intensity, duration and may be different (Mooren *et al.,* 2001).

But since many athletes are exposed to exercise-induced muscle cramps, researchers think that these phenomena are caused by fluid and electrolyte disturbances (Stofan *et al.,* 2005). Heavy exercise preserves more fluid and electrolyte except serum potassium (Zorbas *et al.,* 2001). In addition, with the intensity of exercise, type of exercise can also play an important role in the excretion of electrolytes. Tonicity changes in the body during exercise can cause an imbalance between intake and excretion of water and sodium and potassium levels, which is dependent mechanisms of renal or adrenal (Mallie *et al.,* 2002). Long-term disposal is critical for electrolyte balance and may lead to mild hyponatremia (Noakes *et al.,* 2005).

Many researches were observed significant increases in plasma sodium of the subjects that paid to physical activity (Rocker *et al.,* 1989). Although some researchers have found no significant changes in

plasma sodium (Jokinen *et al.,* 1991), On the other hand most studies showed that after exercise decreases the concentration of sodium in the urine that this stage due increased tubular reabsorption of sodium in order to maintain body fluids and seems to be due to a decrease in plasma volume (Joborn *et al.,* 1985). Researchers studying the effects of long-term exercise training on intracellular concentrations of erythrocytes and plasma potassium concluded that changes in plasma potassium concentration during exercise is inversely and related to urinary potassium excretion in directly (Lijnen *et al.,* 1989).
Plasma levels increased of potassium been observed in athletes and non- athletes after intense exercise, and plasma potassium level is proportional to the intensity of exercise increases (Lindinger *et al.,* 1991). However, resistance training on electrolyte excretion has been studied less and its effects are still obscure. Also about the survey responses and adaptations of urinary sodium and potassium after a variety of resistance training in particular, there is little research Delorme and Oxford training. The purpose of present study, determine and compare the effect of eight weeks of resistance training Delorme and Oxford training on the resting level and urinary sodium and potassium levels in response to exercise in active men.

MATERIALS AND METHODS

Subjects

20 healthy men 20 to 30 years and active in various student scholarships at Tehran Azad University, that declared their readiness to participate in the study and qualified to participate in this study (non-surgical disease, no drug use, non-smoking and having physical health and one session a week physical activity). Purposeful, accessible, selected and randomly were divided into two groups Delorme and Oxford (each group, n=10). Examined and approved by a physician, all subjects had a complete physical health. Demographic characteristics of the subjects are presented in Table 1.

Table 1: Demographic characteristics of subjects

Variables	Delorme groups	Oxford groups	Total
Number	10	10	20
Age (Years)	26.50±2.27	25.10±2.68	25.80±2.52
Height (Cm)	175±4.37	175.70±6.09	175.35±5.17
Weight (Kg)	75±3.82	71.70±5.77	73.35±5.06
BMI (Kg/m^2)	24.04±1.39	23.90±1.3	23.97±1.35

Methods of Data Collection

One week before the study, in the briefing, subjects were familiarized with the study protocol, in this session, in addition to familiarize participants with resistance movements demographic characteristics were measured including height, weight, BMI and the 1RM and 10RM. then, 48 hours before the start of the exercise test sessions were present and previous training groups, were collected before, immediately after and one hour after a single session of resistance exercise Delorme and Oxford urine samples. Then, the subjects for eight weeks, their training programs conducted, after eight weeks of training and after the proportional rest with the distance from the first day of sampling and start of last session training (48 Hours) resistance exercise, just like the first day was done. Before, immediately after and one hour after the meeting urine samples were collected.

Training Program

The program consists of eight weeks of resistance training three days a week and each session was 50 minutes and 10 minutes to warm up, 35 minutes to main training and had a 5 minute cool-down, exercise were similar in resistance training pyramid and reverse pyramid. Resistance training in a circle was designed in two ways Delorme and Oxford. Exercises for both groups, were in seven stations, bench press, leg press, biceps, knee extension, triceps, knee flexion, lateral Stretch. Each move consists of three sets of 10 reps per set, one minute rest between each set, tow minute rest between each movement. Each session will also include a circular. In the Delorme group (light to heavy System) three sets of each move

performed, respectively 50%, 75% and 100% of 10 repetition maximum tests. In the Oxford Group (heavy to Light System) three sets of each move, performed respectively, with 100%, 75% and 50% of 10 repetitions maximum.

Collection and Analysis of Urine Samples

Before, immediately after and one hour after the first test (48 hours before the start of training) and final exam (48 hours after the end of training), urine samples were collected in special containers. The urine samples frozen at 20 ° C, and was used in vitro evaluation. It should be noted, after each activity session, were considered to drink enough fluids for participants to replace lost fluids and the subjects were told that the night before the study, sampling and generally refrain from alcohol and caffeine. Sodium and potassium were measured in urine samples Flame Photometry for each based on a single mEq/L.

Statistical Methods

The first, values for each variable studied, described for using the mean and standard deviation. to investigate the normal distribution and parametric or non-parametric tests, were used from Smirnov – Kolmogorov test, Since the data had normal distribution, to compare and evaluate the variables studied in both Delorme and Oxford, was used factorial ANOVA with repeated measures. For all statistical tests, was considered the level of significance equal to 0.05, the statistical software SPSS version 16 was used for statistical calculations.

RESULTS AND DISCUSSION

Statistical characterization of urinary sodium and potassium are presented in Table 2. Values are reported as mean and standard deviation. Also, factorial repeated measures analysis of variance to compare variables between the two groups Delorme and Oxford is presented in Tables 3 and 4. About the urinary sodium, the time factor is significant (P = 0.000), but the group and interaction between time and group non-significant was (respectively P = 0.710 and P = 0.955). Overall urinary Sodium subjects training groups significantly decreased (P = 0.000), but there was no difference between a Delorme and Oxford (P = 0. 955). About the urinary potassium the time factor is significant (P = 0.000), but the group and interaction between time and group non-significant (respectively P = 0.674 and P = 0.130), In general, urinary potassium subjects training groups significantly decreased (P = 0.000), but there was no difference between a Delorme and Oxford (P = 0. 130).

Table 2: Statistical characterization of urinary sodium and potassium

Variables	Sampling Times	Delorme group	Oxford group
Sodium (*mEq/L)*	Pre	130.60±24.541	133±37.324
	Post 1	122.40±23.505	128.60±35.650
	Post 2	119.10±23.558	123.80±35.009
	Post 3	114.80±25.001	121±34.240
	Post 4	111.40±24.010	116.90±33.804
	Post 5	109.90±25.653	114.70±32.510
Potassium (*mEq/L)*	Pre	89.400±13.833	92.50±26.974
	Post 1	87.622±13.757	90.10±26.425
	Post 2	85.220±12.938	88.90±27.874
	Post 3	83.870±12.836	87.050±26.721
	Post 4	81.570±12.995	86.690±27.070
	Post 5	79.310±13.683	85.980±26.171

Table 3: Results of factor analysis of variance (ANOVA) with repeated measures to compare the two groups in changes in urinary sodium

Factor	Sum of Square	df	Mean Square	F	P	Effect Size	Observed Power
Time	5358.267	5	1071.653	22.988	0.000 *	0.561	1
Group	740.033	1	740.033	0.143	0.710	0.008	0.065
Time*Group	50.067	5	50.067	0.215	0.955	0.012	0.099

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

Table 4: Results of factor analysis of variance (ANOVA) with repeated measures to compare the two groups in changes in urinary potassium

Factor	Sum of Square	df	Mean Square	F	P	Effect Size	Observed Power
Time	944.961	1.877	503.470	33.705	0.000 *	0.652	1
Group	489.163	1	489.163	0.183	0.674	0.010	0.069
Time*Group	61.380	1.877	32.703	2.189	0.130	0.108	0.403

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

Discussion

According to present research findings, between of the effect of eight weeks of resistance training Oxford on urinary sodium excretion in young men, a significant difference was not observed. In fact, both training groups were significantly reduced urinary sodium in young men, but the difference between the two groups was not significant. Overall, the present findings indicate that research groups, over time, from the different changes model that was statistically significant did not follow.

Most studies indicate that, after exercise decreases the concentration of sodium in the urine that increased tubular sodium reabsorption due to fluid retention in the body and seems to be due to a decrease in plasma volume (Joborn *et al.,* 1985). Also Portman (1984) reported that severe exercise increases urinary excretion of electrolytes. Ahmadi *et al.,* (2009) reported that aerobic activity led to a significant increase in urinary sodium concentration. But Zambraski *et al.,* (1990) reported that exercise is normally reduced sodium excretion. Portman (1984) stated that sodium excretion decreased by exercise training, Seems to be largely due to aldosterone production during exercise. Lijnen *et al.,* (1984) in the study of electrolyte excretion during the two-day long training exercise in healthy men concluded that The amount of sodium excreted in the urine during the training days are low, but urinary aldosterone levels are increased.

Based on research findings, the effect of eight weeks of resistance training Delorme and Oxford on urinary potassium excretion was no significant difference between the young men. In fact, both training groups significantly were reduced urinary potassium young men. But the difference between the two groups was not significant changes. Overall, the findings showed that research groups, over time, from the different changes model that was statistically significant did not follow. Researchers studying the effects of long-term exercise training on plasma potassium concentration reached the conclusion that changes in plasma potassium concentration during exercise and the relationship is directly related to urinary potassium excretion (Lijnen *et al.,* 1989; Yalfani, 1992). Ahmadi *et al.,* (2009), after his study reported that such aerobic activity does not induce significant changes in urinary potassium concentration. Lijnen *et al.,* (1984) in the study of electrolyte excretion during the two-day long training exercise in healthy men reached the conclusion that the amount of potassium excreted in the urine during the training days were low.

Perhaps the lack of consistent findings in researches various, is due to differences in sampling time, training protocols, the study population and training status of the subjects. Most previous research activities as well as the impact of a single session, and fewer have examined the impact of training, most important, research two types of resistance training compared to the Delorme and Oxford is placed, not performed. So before definitive conclusions, must do more research. However, in this study, both types of

resistance training Delorme and Oxford which were for eight weeks and three sessions per week were decreased urinary sodium and potassium excretion. In this case, no difference was observed between the two different types of resistance training.

As is clear, activity intensity is the most important physiological response to exercise and perhaps due to differences between the effects of resistance training Delorme and Oxford on the urinary excretion of sodium, potassium, is no difference in exercise intensity. After intense exercise, duration of training is another important factor for the variable. the intensity and duration of exercise in the present study were similar for both types of resistance training and the difference in performance of Delorme (from light to heavy) and Oxford (from heavy to light) exercise was similar for both groups of subjects. Still more research should be done to a conclusion based on the research to be presented in a variety of conditions and there is no much information about sodium and potassium excretion in response and adaptation to resistance training.

Conclusion

According to recent research findings it is concluded that between the sodium and potassium urinary levels in resting and at response to resistance exercise, before and after eight weeks of resistance training, there is no significant difference between the two types of Delorme and Oxford resistance training. Also, the levels of urinary sodium and potassium - both - in both resistance training Delorme and Oxford, during the training period, significantly decreased.

It seems that in this respect between the two different types of resistance training, there is no difference between Delorme and Oxford.

Although more research is needed, although urinary electrolyte reduction could be due to response and compatibility of homeostasis to be exercise training, in order to achieve a more accurate conclusions the only solution more accurate and controlled research studies in the future.

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