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Effects of Acute and Chronic Eight Weeks Continuous and Intermittent Trainings on Salivary Levels of Cortisol, Dehydroepiandrosterone and Dehydroepiandrosterone to Cortisol Ratio of Active Young Women

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Mina Mehrafsar, Hassan Matinhomaee, Hamid Agha Alinejad, Mohammad Ali Kohanpour, Mohammad Hassan Boostani, Amir Hamzeh Zare: Effects of Acute and Chronic Eight Weeks Continuous and Intermittent Trainings on Salivary Levels of Cortisol, Dehydroepiandrosterone and Dehydroepiandrosterone to Cortisol Ratio of Active Young Women

ABSTRACT

In attention to shortage of researches in the fields of various kinds of resistance exercises, the purpose of the present study was comparison of acute and chronic influences of continuous and intermittent trainings on salivary levels of cortisol, dehydroepiandrosterone and dehydroepiandrosterone to cortisol ratio of active young women. Twenty one subjects, which have been investigated in this study, were randomly divided to continuous training (CT), intermittent training (IT) and control groups (3 groups). The two experimental groups participated in 8 weeks progressive trainings. Salivary samples were taken from the subjects, before, immediately then, 2 hr after first test (48 hr before trainings beginning) and 2h after final one (48 hr after trainings ending). The control group gave salivary samples only at the beginning and ending of the 8 weeks period. In order to investigate changes of under study variables in both CT and IT groups, variance analysis test with repeated measurements was used. Considering the presence of the control group, to compare between CT and IT groups, independent one-way variance analysis test and independent T test were used, at steps of before and after the activity, respectively. In order to investigate variations of under study variables in control group, T paired test was utilized. Salivary cortisol, dehydroepiandrosterone, dehydroepiandrosterone to cortisol ratio hadn't any significant changes in both CT and IT groups ($P>0.05$). Also, there wasn't any significant difference between 2 training groups, in all of the 3 under study variables ($P>0.05$). Because, these trainings haven't any destructive influence on hormonal consistencies of active young women, they could readily use continuous and/or intermittent trainings, in attention to their interesting. However, more study is required.

***Key words*:** Cortisol, Dehydroepiandrosterone, Resistance Exercise, Continuous and Intermittent trainings, Saliva.

Introduction

Notice to sport has been become to an unavoidable event. This attention exists in the whole classes of society and with various aims. Physical activity and exercise accompany with physiologic consistencies. Knowledge and study of these consistencies especially in hormonal system, which has an important role in body vital reactions, is very substantial and remarkable. Because, through performing activities and different sport exercises, hormones involved various changes and understanding of these variations is effective in interpretation of body physiologic mechanisms. In the other hand, resistance exercises (RE) have been interested by many people, and especially women, in the purposes of fitness. These exercises include several types, like concentric, eccentric, isometric and even continuous and intermittent training (CT and IT) and might lead to structural variations and physiologic consistencies. The most prominent aspect of structural variations and physiologic

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consistencies could appear in hormonal system. Measurement of exercise pressure indices following various resistance trainings schedules could aid in superior understanding of acute and chronic effects of RE. CT and IT are from the types of RE trainings, which unfortunately have been investigated, inadequately. So, their influences haven't been determined in comparison with each other, yet. The endocrine system helps body integrity and implementation control and provides stability or vital balance and in the other word homeostasis [9]. One of the most important methods to evaluate pressure and intensity of exercise and the amount of its influence on athletes is measurement of anabolic and catabolic hormones. In a manner, whether catabolic hormones increase following exercise, indicates high pressure of activity. And, if there's a balance between anabolic and catabolic hormones, then athlete has a good readiness situation [25]. In this relation, testosterone and cortisol as anabolic and catabolic hormones have been noticed rather than other hormones and the ratio of these hormones is a useful index to determine person's readiness situation and pressure of activity and exercise [25]. However, dehydroepiandrosterone to cortisol ratio is usually used, in studies which concern to girls [1]. In the other hand, using saliva increases progressively, in exercise physiology studies as a determining tool. Convenient samples collecting, ability of repetitive samples collecting, inoffensiveness, stress free and cheaper cost are some advantages of this method and it has determined that, salivary concentrations of theses hormones have significant relations with their serum amounts [5,21,23]. The relations of various kinds of exercises with dehydroepiandrosterone to cortisol ratio and generally exercise pressure index haven't been considered well, and it hasn't been cleared which RE is a stronger stimulant to stimulate growth elements and increment of power. Hence, attention to these substantial matters has an enormous importance. Also, there're few studies about investigation of hormonal responses and consistencies following various kinds of RE, especially continuous and intermittent ones. The continuous resistance exercises are from the types of exercises which are usually executed with a constant intensity (typically with a moderate intensity) and are performed continuously, during exercise. In contrast, intermittent resistance exercises are conducted with two different activity intensities (intense and low-pitched) and in an intermittent manner. Now, the question that arises is; whether intensities (in as much as possible) and span of these two types of RE are controlled uniformly, do these two types of trainings have the same effects on hormonal and physiologic responses in acute and/or chronic cases?

So, the purpose of the present study is determination of acute and chronic effects of the two types of CT and IT on salivary dehydroepiandrosterone, cortisol and dehydroepiandrosterone to cortisol ratio of active young women.

Material And Methods

The Subjects:

Thirty six 20-28 years old sport student girls of Tehran city declared their readiness to participate in the study after an announcement in universities of Tehran city. They were randomly divided to 2 experimental groups (each group consisted of 14 persons) and a control one (8 persons). Only 7 persons remained in each group, after ending of trainings period. The other subjects were eliminated, because of their personal reasons. According to examination and approval of physician, all of the subjects had perfect physical healthiness. The subjects are homogenized (except in hereditary objects) to reduce probability of impressionability of dependent variables by disturbing variants, as much as possible. The subjects' properties have been represented in Table 1.

Table 1: Personal Characteristics of the Participants (Average ± Standard Deviation)

Variable	Continuous Group	Intermittent Group	Control Group
Number	7	7	7
Age (years old)	22.28±2.13	22.14±2.47	25.14±2.34
Height (cm)	165.34±4.39	165.86±2.19	166.29±6.65
Weight (Kg)	56.52±13.63	59.6±8.08	67.34±9.59

Data Collecting Methods:

The subjects were become familiar with trainings protocol in justification meeting, one week before research execution. Beside introduction of the subjects with resistance movements, anthropometric properties, height, weight, body fat percentage and also 1 Repetition Maximum (1RM) were measured, in justification session. Then, the subjects attended in test session, 48 hr before trainings beginning and salivary samples were taken from training groups, before, immediately then and 2 hr after a continuous or intermittent resistance exercise session. This session was conducted with 20% of a maximal repetition. Then, the subject performed their trainings schedules in span of 8 weeks and with progressive manners. After ending of 8 weeks trainings and after a rest, which was proportional to the interval between the first samples collecting day and trainings beginning (48 hr), last session of resistance activities was conducted just like the first day and with the same 20% of a maximal repetition. Salivary samples

were taken from the subjects, before, immediately then and 2 hr after the last session. Control group gave salivary samples without any exercise.

Trainings Schedule:

Resistance trainings schedule consisted of 8 weeks (3 exercises days in each week) and span of each session was 63 min (including 10 min warm-up, 47 min main exercise and 6 min cool-down). In this schedule, a percentage of a maximal repetition and speed execution considered as intensity and mass of training. Exercises loads were the same for CT and IT. The progressive implemented load was in a manner that during these 8 weeks, the subject performed their training with 20%, 25%, 30%, 35%, 40%, 45%, 50% and 55% of a maximal repetition for the first week to the last one, respectively. The resistance trainings were designed in circular figures and 2 schemes of continuous and intermittent procedures. Each circle contained chest press, feet press, fore-arm, fore-feet, rear-arm, rear-feet and sidelong tension or length, which order of execution was the same as what mentioned. Duration of each station considered as 2 minutes (min) and 30 seconds (sec), which executed with different speeds in continuous and intermittent exercises. The continuous training group performed 2 min and 30 sec of each station with speed of V, continuously. And, the intermittent one carried out 10 sec with speed of 2V and 20 sec with speed of ½ V intermittently, to the ending of 2 min and 30 sec of each station. Speeds of movements were been controlling by metronome. Rest intervals between 2 successive stations and circles considered as 1 min and 2 min, respectively. Two circles were considered in each exercise session. Both of before and after the trainings period resistance activities, which counted as the test session and samples collecting one, respectively, were done in the same mentioned figures and with 20% of a maximal repetition. Each person started and finished her entire activity sessions in particular times. These times are the same for all of her exercise sessions. The subjects of control group didn't performed any sport and physical exercise and proceeded their daily and usual activities.

Salivary Samples Collecting and Hormonal Analysis:

Before, immediately then and 2 hr after the first test (48 hr before trainings beginning) and the final one (48 hr after trainings ending), salivary samples were collected in especial containers. The control group gave salivary samples only at the beginning and ending of the 8 weeks period (in company with the 2 experimental groups), and avoided performing any exercise and proceeded their ordinary and regular activities, during the trainings period. It should be noticed, in order to compensate lost liquids, enough drink was considered to drink by participants. The gathered samples preserved in frigid forms and at -20℃ until arriving to laboratory and there, lab examination started, immediately. It should be mentioned, the participants were wanted to avoid consuming cigarette, alcohol and caffeine at the last nights of samples collecting days and generally during the study stages. All of samples collecting steps are done in the same condition for the whole participants. Also, each participant started and finished her entire activity sessions in particular times, which are the same for all of her exercise sessions. Salivary cortisol was measured by Elisa method and using demeditec kit (made in Germany) with sensitivity level of 0.014 (ng/ml) and utilizing Elisa reader device (made in china), for each sample. Salivary dehydroepiandrosterone was measured by Elisa method and using IBL kit (made in Germany) with sensitivity level of less than 0.1 (ng/ml) and utilizing phomo device (made in china), for each sample. Salivary dehydroepiandrosterone to cortisol ratios were calculated by dividing values of salivary dehydroepiandrosterone (ng/ml) to values of salivary cortisol (ng/ml), in the present study.

Statistical Methods:

At first, values of whole under study variables were described using mean and standard deviation. Then, Kolmogorov–Smirnov test was utilized to investigate naturalness of distributions and usage of parametric or non-parametric tests. Because data have natural distributions, so variance analysis test with repeated measurements was applied, to investigate variation of under study variants in both CT and IT groups. Also, data sphericity was investigated, simultaneously with execution of variance analysis test, to implement Greenhouse-Giggs modification on degree of freedom, in necessary cases. Also, T paired test was utilized to investigate changes of the control group. Level of significance was considered as 0.05, for the whole statistical tests and SPSS v.16 was used for statistical calculations.

Results:

Statistical descriptions of salivary cortisol, dehydroepiandrosterone, dehydroepiandrosterone to cortisol ratio have been presented in table 2. The values have been reported as mean and standard deviation. Table 3 shows statistical results of independent one-way variance analysis test, which has compared relaxation levels of under study variables between the three groups (CT and IT groups and control group), after the trainings period. Table 4 indicates results of independent T test, which has compared after exercise values of the under study variants, between the two training groups (CT and IT groups), before and after the trainings period. Table 5

represents results of variance analysis test with repeated measurements, which has investigated changes of the under study variables in the 2 training groups. Table 6 shows results of dependent T test, which has investigated variations of the control group, during 8 weeks.

Table 2: Statistical descriptions of salivary cortisol, dehydroepiandrosterone, dehydroepiandrosterone to cortisol ratio

Control Groups	Intermittent Groups	Continuous Groups	Sampling Times	Variables
27.73±12.65	16.99±9.77	19.28±8.28	Pre	Cortisol (ng/ml)
	37.33±36.81	21.93±24,51	Post 1	
	48.07±25.41	29.73±30.03	Post 2	
30.91±16.07	29.75±29.01	25.83±28.86	Post 3	
	53.04±32.48	50.94±28.25	Post 4	
	27.96±16.34	28.08±18.45	Post 5	
97.75±17.06	90.24±26.50	96.97±21.77	Pre	DHEA (ng/ml)
	89.51±23.09	110.94±22.87	Post 1	
	87.37±21.05	103.01±16.30	Post 2	
99.08±20.15	98.58±18.31	108.81±11.38	Post 3	
	82.98±29.71	92.38±11.09	Post 4	
	98.25±16.38	96.54±21.23	Post 5	
5.16±5.07	7.31±5.29	6.09±3.77	Pre	DHEA to Cortisol Ratio (nmol/l)
	4.99±3.80	13.03±10.16	Post 1	
	4.52±7.31	9.87±11.17	Post 2	
3.96±2.01	8.65±8.81	10.96±8.98	Post 3	
	2.41±1.75	3.53±5.04	Post 4	
	4.54±2.45	6.98±7.43	Post 5	

DHEA: Dehydroepiandrosterone

Table 3: Statistical results of independent one-way variance analysis test to compare relaxation levels between the 3 groups

P	F	Mean Square	df	Sum of Squares		Time of Sampling	Variables
0.15	2.07	224.18	2	448.37	Between Groups	Before Training	Cortisol
		108.05	18	1945.005	Within Groups		
			20	2393.38	Total		
0.92	0.07	49.61	2	99.22	Between Groups	After Training	
		644.64	18	11603.59	Within Groups		
			20	11702.81	Total		
0.78	0.24	119.41	2	238.83	Between Groups	Before Training	DHEA
		489.42	18	8809.60	Within Groups		
			20	9048.43	Total		
0.46	0.80	232.77	2	465.54	Between Groups	After Training	
		290.43	18	5227.74	Within Groups		
			20	5693.29	Total		
0.70	0.35	8.14	2	16.29	Between Groups	Before Training	DHEA to Cortisol Ratio
		22.68	18	408.28	Within Groups		
			20	424.57	Total		
0.22	1.64	89.14	2	178.29	Between Groups	After Training	
		54.16	18	974.96	Within Groups		
			20	1153.25	Total		

DHEA: Dehydroepiandrosterone

Table 4: Statistical results of independent T test to compare after exercise values of the under study variables between the 2 training groups

P	df	T	Time of Exercise	Time of Training	Variables
0.37	12	0.92	Immediately After Exercise	Before Training	Cortisol
0.24	12	1.23	One Hours After Exercise		
0.89	12	0.12	Immediately After Exercise	After Training	
0.98	12	0.01	One Hours After Exercise		
0.10	12	1.74	Immediately After Exercise	Before Training	DHEA
0.14	12	1.55	One Hours After Exercise		
0.44	12	0.78	Immediately After Exercise	After Training	
0.86	12	0.16	One Hours After Exercise		
0.07	12	1.95	Immediately After Exercise	Before Training	DHEA to Cortisol Ratio
0.31	12	1.06	One Hours After Exercise		
0.59	12	0.55	Immediately After Exercise	After Training	
0.42	12	0.82	One Hours After Exercise		

P: P values
T: T-test
DHEA: Dehydroepiandrosterone

Table 5: Statistical results of variance analysis test with repeated measurements to investigate variations of the under study variables between the 2 training groups

P	F	Mean Squares	df	Sum of Squares	Variables	Group
0.14	1.77	891.46	5	4457.31	Cortisol	Continuous Groups
0.40	1.06	382.23	5	1911.65	DHEA	
0.28	1.32	85.70	5	428.53	DHEA to Cortisol Ratio	
0.13	1.84	12.6255	5	6312.79	Cortisol	Intermittent Groups
0.71	0.58	266.32	5	1331.62	DHEA	
0.36	1.13	66.92	2.59	173.52	DHEA to Cortisol Ratio	

P: P values
DHEA: Dehydroepiandrosterone

Table 6: Statistical results of dependent T test concern to variations of the control group during 8 weeks

P	df	T	Variables
0.67	6	0.43	Cortisol
0.77	6	0.29	DHEA
0.48	6	0.74	DHEA to Cortisol Ratio

T: T-test
DHEA: Dehydroepiandrosterone

As has been indicated in table 3, there wasn't any significant difference in salivary relaxation levels of the 3 groups, before the trainings period (P=0.15). Also, there wasn't any significant difference in salivary relaxation levels of the 3 group, after the trainings period (P=0.92). Besides, as has been shown in table 4, there wasn't observed any significant difference in values of salivary cortisol between the 2 training groups, before and after the trainings period (P>0.05). In addition, as have been indicated in tables 5 and 6, variations of salivary cortisol weren't significant in any of the three CT, IT and control groups, during 8 weeks (P>0.05).

Also, as has been shown in table 4, there wasn't observed any significant difference in values of salivary dehydroepiandrosterone between the 2 CT and IT groups, in response to exercise, before and after the trainings period (P>0.05). In addition, as has been presented in tables 5 and 6, changes of salivary dehydroepiandrosterone weren't significant in any of the 3 CT, IT and control groups, during 8 weeks (P>0.05).

Also, as has been indicated in table 4, there wasn't observed any significant difference in values of salivary dehydroepiandrosterone to cortisol ratio between the 2 CT and IT groups, in response to exercise, before and after the trainings period (P>0.05). In addition, as has been shown in tables 5 and 6, variations of salivary dehydroepiandrosterone to cortisol ratio weren't significant in any of the 3 CT, IT and control groups, during 8 weeks (P>0.05).

Discussion:

According to founds of the present study, there wasn't observed any significant difference in relaxation levels of salivary cortisol between the 3 groups, before and after the training period. Also, there wasn't seen any significant difference between responses to the 2 types of CT and IT resistance activities, before and after a resistance trainings period. Hackney *et al*, (1995) compared hormones responses between CT and IT affords of bicycling activity with the same weeks and working loads, and reported a greater significant cortisol response in intermittent activity than continuous one, which was similar with other results. Although, they only used endurance trained subject [10]. Also, Hackney *et al*, (1995) declared training situations could affect hormonal responses of activities. Perhaps, difference in training protocols is a reason of different results [10]. So, related previous founds are negligible, and all of them concern to studies that have investigated various types of trainings, separately. Therefore, different results are expectable, and obviously an accurate conclusion couldn't be achieved, before performance of rather researches. Also, most of these studies have investigated serum levels of cortisol hormone.

As has been determined, intensity of activity is the most important variable of exercise, in response to cortisol, and perhaps the reason of resemblance between influences of CT and IT on salivary cortisol levels is sameness in intensities of trainings. Span of training is another important influencing parameter, after intensity of training. Indeed, intensities and spans of both resistance trainings were the same and they were different in CT and IT execution of similar trainings for both training groups. Based on the understandings of the present study, there wasn't any significant change in salivary cortisol levels of the 2 CT and IT groups. Though, Willoughby *et al*, (2003) reported decrease in cortisol following resistance trainings [30]. They assumed decrease in cortisol response of resistance activity following a resistance trainings period, to low regulation of Glucocorticoids grabbers, partly. Chatard *et al*, (2002) reported that, cortisol concentrations of non-athletes had been less than athletes' ones, during rest [4]. The recent issue shows, trainings cause decrease in relaxation levels of cortisol and also reduce cortisol response to activity. So, trainings might probably lead to decrease in body stress and pressure, consequent on activities, and also during rest. However, this conclusion wasn't observed in the present study. Maybe, intensities and spans of trainings have

affected in these results and rather investigations are required. In opposition to founds of Agha-Alinejad *et al*, (2013) and in authentication with understandings of the present study [1], Hakkinen *et al*, (2000) reported constancy of cortisol response to a resistance trainings period [13]. However, with approval at founds of Agha-Alinejad *et al*, (2013) and in contrary to understanding of the present study [1], Kraemer *et al*, (1999) showed decrease in cortisol response to resistance activity, following a resistance trainings period [19]. McCall *et al*, (1999) observed decrease in cortisol, following resistance trainings, after performing their research [24]. Also, in contrast of the present study, Staron *et al*, (1994) reported that the acute response of cortisol serum to resistance activity reduces after a resistance trainings period [27]. By a distinct study and in agreement with founds of the present study, Fry *et al*, (1994) showed constancy of cortisol response to resistance activity, after a resistance trainings period [8]. Hakkinen *et al*, (1990) reported that a resistance trainings period hasn't any influence on cortisol response to a resistance activity [14]. And, Kraemer *et al*, (1998) reported cortisol concentrations decrease after resistance trainings [21]. The lack of conformity in these founds maybe covert in various training protocols or spans of trainings periods. Also, the difference in under study societies shouldn't be ignored. Also, sample volume might be one of the influencing parameters. Perhaps, it's necessary to execute the same research (with the present research) with more subjects, in future studies. Eventually, it shouldn't be forgotten that most of previous founds have investigated cortisol serum levels not salivary cortisol ones. Although, significant correlations between serum and salivary levels of this hormone have been reported [5,21,23], but rather cautions should be paid to interpret understandings.

According to understandings of the present study, there wasn't any significant difference in relaxation levels of salivary dehydroepiandrosterone between the three groups, before and after the trainings period. Also, there wasn't observed in values of salivary dehydroepiandrosterone between responses to the 2 types of CT and IT activities, before and after a resistance trainings period. Hackney *et al*, (1995) compared hormones responses of CT and IT bicycling activity efforts, with the same weeks and working loads, and stated exercise situation could affect on hormonal response to activity [10]. They didn't find any difference in responses of testosterone and other sexual hormones between exercise sessions. However, they only plied endurance trained subjects. Hakkinen *et al*, (2005) observed increases in amounts of salivary dehydroepiandrosterone in inactive women, after 12 and 21 weeks strength and endurance trainings, respectively [11].

Also, level of dehydroepiandrosterone sulfate increased after activity, though its amount following resistance exercise was larger than its amount after running. In contrary to these founds, Arce *et al*, (1993) reported that subjects of resistance and endurance trainings had lower testosterone levels than control group [3]. Jensen *et al*, (1991) reported testosterone increased significantly after both resistance and endurance trainings in men, and returned to basic levels, after 2 hr [15]. Amounts and patterns of testosterone variations between resistance and endurance trainings were almost similar. In contrast. Though, Jensen *et al*, (1991) didn't find any difference in responses of sexual hormones [15]. Also, Keizer *et al*, (1989) reported dehydroepiandrosterone sulfate increased in response to endurance exercises [17]. Diamond *et al*, (1989) showed that dehydroepiandrosterone sulfate level increased, following resistance activity and remained at high level after that [6]. However, more studies should be done to determine results, more suitably. Based on founds of the present study, salivary dehydroepiandrosterone levels hadn't any significant change neither in continuous resistance training group nor in intermittent one, during the research period. In contrast, Kvorning *et al*, (2006) show significant increases in testosterone following resistance trainings and strength development generation exercises [22]. Kraemer and Ratamess, (2005) reported that heavy strength exercises for several weeks or months create some periodic variations, but not chronic, in concentrations of total and free testosterone and bonded protein to testosterone [20]. Also, Tremblay *et al*, (2004) indicated increase in acute response of testosterone to exercise following a resistance trainings period, to changes of relaxation concentrations, in men. Also, Willoughby and Taylor, (2004) reported increment of Androgen expression receptors in trained muscle cell through intense resistance exercise. In contrast and in other founds [29], Chatard *et al*, (2002) stated that non-athletes' dehydroepiandrosterone sulfate concentrations was larger than athletes' ones, at the moments of rest, and observed that exercise might not lead to any significant change in dehydroepiandrosterone, beside the present understandings [4]. And, Hakkinen *et al*, (2000) didn't find any significant variation in men's dehydroepiandrosterone, after resistance activities in a resistance trainings period [13]. They didn't find any change in dehydroepiandrosterone of elderly and old men, following resistance activity. Rather studies are needed to clarify reasons of opposite founds. However, expectation of observing anabolic responses following resistance exercises couldn't be simplistic. Along this matter, Kadi (2000) stated resistance exercises might increase Androgen expression receptors in trained muscle cells [16]. Also, Kraemer (1988) investigated acute (consequent on activity) and chronic (relaxation levels) responses of testosterone to resistance exercises and stated that a variety of variants affect on testosterone acute and

chronic responses [18]. Kraemer (1988) considered intensity, mass, duration, exercises rest intervals and also engaged muscular mass, in company to subject properties like age, fitness level and exercise situation as important parameters [18]. So, there might not be the same results in various research conditions. Difference in trainings protocols probably plays an important role in observation of contrary results. Also, rather cautions should be paid in results interpretation. Because, most of previous studies have investigated hormones serum levels, not hormones salivary levels, so interpretation of the understandings, which are concern to dehydroepiandrosterone, according to ones, which are concern to testosterone and other sexual hormones, might be simplistic. Therefore, performing rather investigations with estimating other variants beside to premier variables could be the best recommendation.

In contrary to the present understandings, Agha-Alinejad *et al*, (2013) reported increment of dehydroepiandrosterone in both continuous an intermittent training groups, during study period, by a similar study and with completely similar trainings protocol [1].

According to founds of the present study, there wasn't any significant difference in salivary dehydroepiandrosterone to cortisol ratio between the 3 groups, before and after the trainings period. Also, there wasn't observed any significant difference in salivary dehydroepiandrosterone to cortisol ratio between responses to 2 types of CT and IT activities, before and after a resistance trainings period. Androgens increased in response to activity, especially resistance exercises, whereas cortisol increased only after resistance exercises. Endurance trained subjects indicated smaller variations in hormonal concentrations, in response to activity. They had significant decreases in total and free levels of testosterone, during recovery following resistance activity, and anabolic hormones (total and free testosterone, and dehydroepiandrosterone sulfate) to cortisol ratios were low, during resistance exercise, which stated a less anabolic medium, paradoxically. In their study, cortisol had a sharp increment following resistance activity, and then returned to basic levels. Also, levels of dehydroepiandrosterone sulfate increased following activity, although its amounts following resistance activity were larger than its values after running. Dehydroepiandrosterone sulfate levels remained high in resistance trained men, following resistance activity. Androgens to cortisol ratios of resistance exercise sessions were significantly less than other sessions, because this matter was a consequent on sharp increment of cortisol following activity and also decrease in testosterone levels, during recovery.

These results are partly unexpected, because resistance exercise is usually dependent to anabolic response. Also, Ponjee *et al*, (1994) reported significant decreases in dehydroepiandrosterone and cortisol following longtime endurance exercises [26]. Agha-Alinejad *et al*, (2013) reported in a similar study, sameness of dehydroepiandrosterone to cortisol ratio between CT and IT, of course in serum levels of these mentioned hormones, too [1]. Rather studies should be carried out to acquire more reliable results, and it appeared a vast studious channel is provided. Based on founds of the present study, there wasn't any significant variation in salivary dehydroepiandrosterone to cortisol ratios of neither CT nor IT groups. Whereas, Agha-Alinejad *et al*, (2013), reported increases in dehydroepiandrosterone to cortisol ratios of both continuous and intermittent training groups, in a similar study [1]. Results of Agha-Alinejad *et al*, (2013) indicate that a resistance trainings period for active young women could cause increment of physical readiness level, creation of desirable physical consistencies and preparation of an anabolic medium [1].

Also, their results show the created consistencies haven't any relation to the matter that the resistance trainings are continuous or intermittent. But, the present understandings haven't any congruity with the first part of their results. In the other hand, by study of salivary dehydroepiandrosterone to cortisol ratio in karate players and triathlon athletes, Obminski and Stupnicki, (1997) reported that this ratio had a significant decrease in karate players [25]. Review of researches methodologies finds that the difference in trainings protocols is the major reason of observation of these incongruous results. Besides, Alen *et al*, (1988) reported increment of dehydroepiandrosterone to cortisol ratio, during resistance trainings [2]. Though, Hakkinen *et al*, (1987) reported decrease in dehydroepiandrosterone to cortisol ratio, in duration of resistance trainings [12]. It's clear that rather studies should be done, to eliminate existing ambiguities. Perhaps, because both continuous and intermittent trainings had the same intensities and spans, so they hadn't any different influence on salivary dehydroepiandrosterone to cortisol ratio. Indeed, maybe intensity and duration of exercise (and especially exercise intensity) are the major effective parameters. However, more studies are required.

Conclusion:

According to the understandings of the present study, it has been concluded, in response to exercise levels of salivary cortisol, dehydroepiandrosterone and dehydroepiandrosterone to cortisol ratio of active young women might not have any significant change, following 8 weeks CT and IT. This means, non-existence of significant physiologic consistencies of body and generally physical readiness level of active young women by these 2 trainings protocols. Besides, by comparison of CT and IT, which was the most important aim of the present study, it has been

determined there isn't any difference in the mentioned results, which have been arisen from resistance trainings between the 2 types of CT and IT. Eventually, it seems the implemented exercises of the present research might not lead to any excessive pressure on body. It's recommended to increase span of research, in a similar study, and compare more longtime consistencies, which are acquired by CT and IT, with together, too.

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