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Investigation the effect of weightlifting training on apelin level and hematologic parameters of professional handball players.

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Abstract

Objectives: Apelin is a member of myokines which has recently been characterized. The purpose of this study was to examine the effects of a weightlifting training (WT) program on some biochemical (glucose, insulin and apelin) and haematological parameters in professional male handball players. It was hypothesized that significant increase would be found in apelin levels of subjects

Material and methods: Ten professional handball players (Trained Handball Player Group, THG) completed 6-week WT. Ten sedentary subjects (Trained Sedentary Group, TSG) also completed WT to compare with THG and investigate the effect of being a handball player. Ten subjects have been considered as control group (Control Group, CG).

Results: The apelin levels of THG and TSG have been increased significantly ($p<0.05$) but the increase in THG (55%) is more than TSG (38%). CG subjects did not exhibit any significant changes during the 6-week period ($p>0.05$).

Conclusion: It has been concluded that the WT has an important role on apelin level, especially in professional handball players.

Keywords: Apelin, Weightlifting training, Hematologic parameters, Professional team handball.

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Introduction

Team handball has been one of the most popular team sports at both national and international levels during the last sixty years [1]. Competitive team handball requires muscular strength, speed and endurance but it is not very clear that how these parameters change during the different exercise programs and season [2]. The lack of experimental data (haematological, biochemical or hormonal parameters of blood samples) on professional team handball players is one of the most important reasons for this phenomenon.

However, the haematological parameters and biochemical characteristics can be crucial for predicting optimal physical performance [3,4] there is not enough study which concerns these parameters about professional team handball players.

There is a very strong relationship between the muscle activity (exercises) and different body properties (mood, physical performance, haematological parameters and cognitive function) [5-8]. Some of the effects of different exercises including lower blood pressure, improved glucose homeostasis and lipid profile, higher resting energy expenditure and reduced fat mass [6-8]. There are several explanations for these benefits of exercise like increasing nutrient metabolism in various tissues by regulating the expression and activity of key metabolic control genes, leading to enhanced insulin sensitivity and metabolic flexibility [9]. But there is one more interesting issue, which is still unclear, the skeletal muscle exhibits remarkable metabolic adaptations to exercise [10,11]. Myokines, which are secreted in response to exercise and can regulate the function of muscle and other organs, may be one of the most sensible explanations [12].

Myokines are cytokines produced by skeletal muscles, especially induced by exercise, modulating different metabolic processes [13]. There are many well documented myokines like interleukin (IL6) and myostatin (MSTN) [14-16]. Apelin is a newly described myokine [17,18]. Production of apelin is induced by exercise and can behave as an exercise regulated myokine with autocrine-paracrine action [6]. Apelin is also related with insulin that is why it contributes to glucose homeostasis [19] and highly implicated in cardiovascular functions [20].

Hematologic parameters and apelin are clearly involved in exercise-associated metabolic changes, but also can be potentially effective in performance improvements of professional team handball players during weightlifting training [7]. We aimed to analyse the fluctuations of some biochemical (glucose, insulin and apelin) and hematologic parameters in professional team handball players and sedentary individuals after WT.

Methods

This study has been approved by the "Ethical Committee of Biomedical Researches" of Adiyaman University (Date: 25/03/2015, No: 2015/02-20, Chair Person: Prof. Dr. Haydar Bagis). All subjects were informed of the benefits and risks of the investigation.

Experimental approach

There are three groups of subjects in this study. The first group includes professional team handball players (THG: Trained handball group), second is sedentary group (TSG: Trained sedentary group) (who are not sportsmen) and the third group is control group (CG) (who are not sportsmen and did not train). The members of THG have been chosen from a city handball team which is a professional handball team in best league of related country. Each group composes from 10 subjects (totally 30 subjects). First group (THG) and second group (TSG) have performed WT three days in a week for six weeks (totally 18 training days). In the first training day of each week the subjects performed 3 × 10 bench press, 3 × 10 incline bench press, 3 × 10 dumbbells flyes, 3 × 10 butterfly, 3 × 10 pullover for chest workout and 3 × 10 squad, 3 × 10 leg extension, 3 × 10 leg lying curl, 3 × 12 standing calf raises for leg workout. In second training day 3 × 10 shoulder press, 3 × 10 front raise, 3 × 10 dumbbell side lateral raises, 3 × 10 upright barbell rowing for shoulder workout and 3 × 10 lying triceps extension, 3 × 10 seated overhead, 3 × 10 standing cable push down for triceps workout performed by THG and TSG. In the third training day 3 × 10 lat machine pull down, 3 × 10 cable row seated, 3 × 10 T-bar rowing for back workout, 3 × 10 standing barbell curl, 3 × 10 preacher curl, 3x10 concentration curl for biceps workout and 3 × 12 wrist curl for wrist workout performed by all subjects.

Blood samples of all groups have been analysed before and after the training period. The blood samples of CG have been also analysed to exclude the external factors (temperature, etc.). The blood samples have been analysed by means of haematological parameters (WBC, RBC, etc) and biochemical parameters (glucose, insulin and apelin). The differences have been calculated between two analyses (before and after weightlifting training) for each group. Calculated differences were considered to analyse the effect of WT to THG and TSG. Calculated differences subtracted, and the results were analysed statistically to understand if the weightlifting training has a meaningful effect on haematological parameters, insulin, glucose or apelin levels of THG (Table 1).

The averages of dTHG, dTSG and dCG were examined to understand the effect of WT to a single group, and averages of dTHG-dTSG was studied with a multi comparison (Benferroni) test to investigate if the WT has a special meaning on THG. dTSG-dCG parameter has also been considered to understand the effect of WT on non-sportsmen.

Table 1. *A representative table to explain the statistical methodology (BT: before training, AT: after training, WBC: chosen hematologic parameter).*

	WBC (BT)	WBC (AT)	Differences
THG	a	d	a-d=dTHG
TSG	b	e	b-e=dTSG
CG	c	f	c-f=dCG

The age, height, weight and body/fat averages were reported with standard errors on Table 2 for each group.

Table 2. *Weight, age, and body/fat % averages for each group, BT: before weightlifting training, AT: after weightlifting training.*

	Weight (kg)		Age		Body/fat %	
	BT	AT	BT	AT	BT	AT
THG	79.575	81.115	20.9	20.9	15.426	13.548
TSG	76.598	76.853	20.6	20.6	14.493	13.276
CG	78.391	77.286	20.4	20.4	15.353	15.142

Statistical analysis

Descriptive statistics were reported for all groups. A 3x2 (group x time) repeated measures analysed with ANOVA. One-way analysis of variance (ANOVA) was used to examine if there is a significant correlation between any two of three groups (THG, TSG and CG). If significant F values were determined, paired comparisons combined with a Bonferroni post hoc adjustment to determine differences. Raw difference scores were analysed with the use of a 1-way ANOVA. Pearson's product moment correlation coefficient was used to investigate the relationship between selected variables. Statistical significance was set at $p<0.05$. All statistical analyses were performed using SPSS [21].

Blood collection

Blood samples were collected from participants 30 minutes prior to first WT and within 30 minutes after the last WT. Twenty milliliters of blood was collected during each blood draw using one heparinized 10 mL tube and one 10-mL ethylenediaminetetraacetic acid tube. Plasma was isolated from the heparinized blood by centrifugation.

THG represents the weightlifting trained professional handball players, TSG represents the weightlifting trained sedentary group (not sportsman) and the CG represents non-trained sedentary participants. So, the comparison of TSG and CG was provided information about the effect of WT on hematologic and biochemical parameters of sedentary group and the comparison of THG and TSG was provided information about the effect of being a professional handball player because both THG and TSG performed same WT.

Results

Basically, two kinds of data were reported and discussed. The first one is the comparison of groups (table 1, between groups, dTHG-dTSG). The other is the differences between two blood sample analyses (dTHG and dTSG) in each group.

1st data type (between groups)

The statistical analysis of the groups (THG and TSG) provided useful information that how the weightlifting training effects the hematologic (WBC, RBC, PLT, HGB, HCT, MCH and PCT) and biochemical (glucose, insulin and apelin) parameters in professional handball players and sedentary individuals.

The one-way analyses, ANOVA test and multiple comparison Bonferroni post hoc adjustment have been reported on table 3. A "p" value<0.05 was considered significant in all analyses.

The first column on table 3 represents the analysed haematological parameters. "p" represents the statistical significance and tells that there is a meaningful correlation between groups, when smaller than 0.05. The other columns of table 3 gives chance to understand which groups are correlated, because there are three groups (THG, TSG and CG) and it should be clearly understood that which two of these three groups are correlated. The starred (*) numbers in "Mean Difference" column shows the correlated groups.

2nd data type (within groups)

A paired samples test has been performed for each group. The statistical analysis results let us to compare analysis of each blood parameter before and after WT. It has been concluded that a significant change observed at four hematologic parameters (WBC, p=0.000; RBC, p=0.002; PLT, p=0.001 and HGB, p=0.000) and three biochemical parameters (glucose, p=0.000; insulin; p=0.000 and apelin, p=0.000) for THG. None of these significant changes have been observed for hematologic parameters of TSG (all p values are higher than 0.05) but the biochemical parameters have changed significantly like THG (glucose, p=0.000; insulin; p=0.001 and apelin, p=0.000). And finally, none of the hematologic and biochemical parameters changed significantly for CG.

Discussion

The most important result of this study was that the WT, which has been going on for six weeks, significantly changed the glucose, insulin and apelin levels of both THG and TSG but the apelin level of THG (55%) has been increased more than TSG (38%) (Figure 1). The different amount of muscle tissues of professional team handball players and sedentary group may be the main reason for this phenomenon. It is clear that apelin is produced by skeletal muscles and induced by exercise [6,13]. So, although the two-analysed group (THG and TSG) have been performed the same training the apelin level of THG, who have more muscle tissue because this group includes professional handball players, has increased more than TSG.

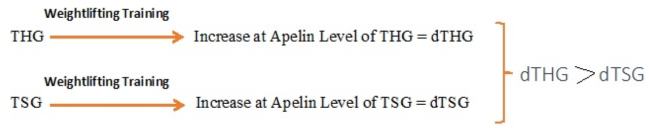

Figure 1. *Schematically comparison of apelin level increase of groups (THG and TSG) after WT.*

This is an important result because apelin is a newly described myokin and such findings to our knowledge are the first to demonstrate that a significant upregulation of serum apelin levels after WT in professional handball players. The result of this study supports a previous study on apelin levels of a diabetic population after exercise treatment [22]. A significant increase in levels of plasma IL-6, which is a well described myokine, has been reported [22] and this result is also supporting our results about apeline increase with training.

By means of group comparison (THG and TSG) it has been concluded that a significant increase in four haematological parameters of (WBC, RBC, PLT and HGB) have been observed (Table 3). WBC, RBC, PLT and HGB parameters of THG have been increased 34%, 9%, 22% and 8% respectively after the WT. There is no significant change in any hematologic parameter of TSG. These results confirm a previous study on the effect of exercise on haematological parameters [23].

In case of WBC while there is a meaningful change between THG and TSG, there is no such relation between TSG and CG. Thus, it can be concluded that WT has no effect on WBC level of sedentary participants but being a professional handball player is a significant factor. While same interpretation can be done for PLT level, there is no such relation between groups for RBC and HGB parameters (Table 3). P values of RBC and HGB are smaller than 0.05 but this result can't be interpreted because the relations ("*" on table 3) are between THG and CG. It is not clear that what is the driving factor for the differences of related parameters (RBC and HGB) between THG and CG, WT or being a handball player? There are not enough data to interpret this phenomenon.

Table 3. *One way analyze, ANOVA test (p<0.05) and multiple comparison Bonferroni post hoc adjustment of hematologic parameters (N=number of subjects, Mean= average of differences (AT-BT) with standard errors, p=statistical significance).*

Descriptive					**Multiple Comparisons (Bonferroni)			
		N	Mean	p	(I) Group	(J) Group	Mean Difference (I-J)	Sig.
WBC	THG	10	2.0 ± 0.1	0.000	THG	CG	2.0 ± 0.2*	0.000
						TSG	2.2 ± 0.2*	0.000

	CG	10	0.1 ± 0.2		CG	THG	2.0 ± 0.2*	0.000
						TSG	0.2 ± 0.2	0.875
	TSG	10	-0.1 ± 0.2		TSG	THG	-2.2 ± 0.2*	0.000
	Total	30	0.7 ± 0.2			CG	-0.2 ± 0.2	0.875
RBC	THG	10	0.5 ± 0.1	0.036	THG	CG	0.5 ± 0.2*	0.032
						TSG	0.2 ± 0.2	0.793
	CG	10	0.004 ± 0.1		CG	THG	-0.5 ± 0.2*	0.032
						TSG	-0.3 ± 0.2	0.365
	TSG	10	0.3 ± 0.1		TSG	THG	-0.2 ± 0.2	0.793
	Total	30	0.3 ± 0.1			CG	0.3 ± 0.2	0.365
PLT	THG	10	50.0 ± 10.0	0.009	THG	CG	48.1 ± 16.0*	0.017
						TSG	45,0 ± 16.0*	0.026
	CG	10	2.3 ± 8.1		CG	THG	-48.1 ± 16.0*	0.017
						TSG	-3.1 ± 16.0	1.000
	TSG	10	5.4 ± 14.7		TSG	THG	-45.0 ± 16.0*	0.026
	Total	30	19.4 ± 7.5			CG	3.1 ± 16.0	1.000
HGB	THG	10	1.2 ± 0.1	0.001	THG	CG	1.1 ± 0.3*	0.001
						TSG	0.6 ± 0.3	0.105
	CG	10	0.08 ± 0.2		CG	THG	-1.1 ± 0.3*	0.001
						TSG	-0.5 ± 0.3	0.216
	TSG	10	0.6 ± 0.2		TSG	THG	-0.6 ± 0.3	0.105
	Total	30	0.6 ± 0.1			CG	0.5 ± 0.3	0.216
HCT	THG	10	0.3 ± 0.1	0.151	THG	CG	0.5 ± 0.6	1.000
						TSG	-0.6 ± 0.6	0.819
	CG	10	-0.2 ± 0.5		CG	THG	-0.5 ± 0.6	1.000
						TSG	-1.1 ± 0.6	0.163
	TSG	10	0.9 ± 0.4		TSG	THG	0.6 ± 0.6	0.819
	Total	30	0.3 ± 0.2			CG	1.1 ± 0.6	0.163
MCH	THG	10	0.3 ± 0.1	0.579	THG	CG	-0.1 ± 0.3	1.000
						TSG	-0.3 ± 0.3	0.939
	CG	10	0.3 ± 0.2		CG	THG	0.1 ± 0.3	1.000
						TSG	-0.2 ± 0.3	1.000
	TSG	10	0.6 ± 0.3		TSG	THG	0.3 ± 0.3	0.939
	Total	30	0.4 ± 0.1			CG	0.2 ± 0.3	1.000
PCT	THG	10	0.004 ± 0.002	0.650	THG	CG	-0.003 ± 0.007	1.000
						TSG	-0.007 ± 0.007	1.000
	CG	10	0.007 ± 0.006		CG	THG	0.003 ± 0.007	1.000
						TSG	-0.003 ± 0.007	1.000
	TSG	10	0.01 ± 0.006		TSG	THG	0.007 ± 0.007	1.000
	Total	30	0.007 ± 0.02			CG	0.003 ± 0.007	1.000

Related groups by means of the differences (AT-BT) of hematological parameters; * WBC: White blood cells, RBC: Red blood cell, PLT: Platelet blood test, HGB: Hemoglobin test, HCT: Hematocrit blood test, MCH: Mean corpuscular hemoglobin, PCT: Post Coital Test

THG, TSG and CG have been compared by means of three biochemical parameters (glucose, insulin and apelin) on Table 4. It can be concluded that both WT and being a professional handball player are effective on glucose, insulin and apelin levels because all values are marked with a star (*) in "Mean Difference" column of multiple comparison Bonferroni test (Table 4).

Table 4. *One way analyze ANOVA test (p<0.05) and multiple comparison Bonferroni post hoc adjustment of glucose, insulin and apeline.*

	Descriptive				Multiple Comparisons (Bonferroni)			
		N	Mean	p	(I) Group	(J) Group	Mean Difference (I-J)	Sig.
Glucose	THG	10	13.0 ± 1.0	0.000	THG	CG	12.2 ± 1.1*	0.000
						TSG	9.3 ± 1.1*	0.000
	CG	10	0.8 ± 0.6		CG	THG	-12.2 ± 1.1*	0.000
						TSG	-3.0 ± 1.1*	0.045

	TSG	10	3.7 ± 0.7		TSG	THG	-9.3 ± 1.1*	0.000
	Total	30	5.8 ± 1.1			CG	2.9 ± 1.1*	0.045
Insulin	THG	10	-4.0 ± 1.1	0.000	THG	CG	-3.7 ± 0.4*	0.000
						TSG	-2.0 ± 0.4*	0.000
	CG	10	-0.3 ± 0.2		CG	THG	3.7 ± 0.4*	0.000
						TSG	1.7 ± 0.4*	0.003
	TSG	10	-2.0 ± 0.4		TSG	THG	2.0 ± 0.4*	0.000
	Total	30	-2.1 ± 0.3			CG	-1.7 ± 0.4*	0.003
Apelin	THG	10	1289.3 ± 140.0	0.000	THG	CG	1201.1 ± 143.6*	0.000
						TSG	515.9 ± 143.6*	0.004
	CG	10	88.2 ± 63.0		CG	THG	-1201.1 ± 143.6*	0.000
						TSG	-685,2 ± 143.6*	0.000
	TSG	10	773.4 ± 86.0		TSG	THG	-515,9 ± 143.6*	0.004
	Total	30	717.0 ± 107.4			CG	685.2 ± 143.6*	0.000

*Related groups by means of the differences (AT-BT) of haematological parameters.

Apelin is one of the responsible hormones for the occurrence and development of cardiovascular diseases [23] that is why the relationship between the WT and apelin should be well described.

Conclusion

The results of this study may help the professional handball coaches to associate the WT status and apelin levels of players. As a result of this study a strong relationship has been detected between the apelin levels and WT, especially in professional handball players.

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