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The Role of Exercising and Curcumin on the Treatment of lead-induced Cardiotoxicity in Rats

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Abstract

The present study aims to evaluate Cardioprotection effects of exercise training and curcumin on myocardial damage induced by lead acetate. Forty-eight rats were randomly divided into six groups of the base, sham, lead, exercise, curcumin and exercise+curcumin (EC). The rats in the exercise and (EC) groups performed the progressive treadmill running of 15 to 22 m/min for 25 to 64 min, 5 times a week for 8 weeks. Lead, exercise, curcumin and (EC) groups received lead acetate (20 mg/kg), and sham, curcumin and (EC) groups received curcumin solvent (ethyloleat) and curcumin solution (30 mg/kg). Cardiac tissue was removed of aorta hiratus and homogenized for the estimation of troponin I, using ELISA. CK-MB and lead was determined in serum by immunological DGKE method and atomic absorption Spectrophotometry methods, respectively. Injection of lead acetate into intra-peritoneal resulted in a significant increase of the CK-MB levels. However, treadmill running exercise and curcumin supplementation resulted in a significant decrease of CK-MB levels while there was no significant difference in troponin I levels. The results of this study suggest the cardioprotective potential of administration of exercise and curcumin in ameliorating the lead-induced cardiotoxicity in rats through a decrease of myocardial damage markers.

Keywords: Aerobic training, Antioxidant, Pollution, Cardiac damage, Rat

Introduction

The epidemiological association between exposure to air pollution and cardiovascular morbidity and mortality has been well documented in previous studies. The underlying mechanisms linking pulmonary exposure to air pollution with increased risk of cardiovascular events have also been investigated in the last decade [1].

Lead is one of the worldwide-used metals, which has been used since the ancient time. It is also a toxin, known to have adverse effects on the body, even at low level of exposure, inducing a broad range of physiological, biochemical and behavioral dysfunctions. Studies have shown that this metal has harmful effects on tissues such as nervous system, blood tissues, cardiovascular system, reproductive and urinary system [2]. Recent studies suggest that one of the mechanisms by which lead can exert some of its toxic effects is through the disruption of the delicate prooxidant/antioxidant balance that exists within mammalian cells. In vivo studies have suggested that lead exposure is capable of generating reactive oxygen species (ROS) and so altering antioxidant defensive systems in animals [3].

Curcumin{1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione}(diferuloyl methane), the principal coloring agents present in the rhizomes of Curcuma longa (zingiberaceae), possesses many therapeutic properties including antioxidant, anti-inflammatory and anticancer properties [3]. Curcumin has a wide range of therapeutic effects in numerous diseases including neoplastic and chronic inflammatory diseases (Alzheimer's disease, Parkinson's disease, multiple sclerosis, epilepsy, cerebral injury, cardiovascular disease, cancer, allergy, asthma, bronchitis, colitis, rheumatoid arthritis, renal ischemia, psoriasis, diabetes, obesity, depression, fatigue and AIDS) [4]. Recent research has shown curcumin to be a powerful scavenger of the superoxide anion, the hydroxyl radical and nitrogen dioxide [3]. Exercise is a deterrent of cardiovascular disease, and its antiatherogenic effects have been described in different animal models. Exercise can also positively influence risk factors that are associated

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with cardiovascular disease: hypertension, diabetes mellitus, obesity, increased plasma lipids, and endothelial dysfunction. However, the mechanism(s) by which exercise might be beneficial to cardiovascular disease is not known [5]. Therefore, the present study was designed to evaluate the cardioprotective role of exercise training and curcumin against lead-induced myocardial damage in rats.

Materials and methods

Animals

The experimental protocol was approved by the Department of Physiology, University of Mazandaran and was performed according to Guiding procedures in the Care and Use of Animals, prepared by the Council of the American Physiological Society. 48 wistar male rats, weighing between 200 and 250g, were procured from Iran Pasture Institute and acclimatized under standard laboratory conditions at 25 ± 2 °C, 50 ± 15% relative humidity and normal photoperiod (12 h light:dark cycle) for 7 days. Rats were fed with a standard rat chow provided by Pars institute for animal and poultry factory with a daily regimen of 10 gr/100 body weight for every rat. Also, water was available ad libitum.

Treatment of animals

After acclimatization, 48 animals were divided into six groups of eight animals each, and treated as follows: Group 1 (control): rats received nothing, Group 2 (sham): rats received ethyl oleate (30 mg/kg) 3 days a week, for 8 weeks. Group 3 (lead acetate or (pb)): rats received lead acetate (20mg/kg) 3 days a week, for 8 weeks. Group 4 (curcumin + pb): rats received lead acetate (20mg/kg) and curcumin (30 mg/kg) 3 days a week, for 8 weeks. Group 5: (exercise training+ pb): rats received lead acetate, as well they performed the progressive running exercise of 15 to 22 m/min for 25 to 64 min, 5 times a week. Group 6 (curcumin+ exercise training+ pb): rats received lead acetate (20mg/kg) and curcumin (30 mg/kg), in addition, they performed physical training protocol.

Aerobic training protocol

Rats in the aerobic training groups were trained by running on a level motorized rodent treadmill, 5 days a week, for 8 weeks. The speed of the treadmill and duration of the training sessions was gradually increased from 15 to 22 m/min to 25 to 64 min, 5 times a week.

Induction of myocardial injury

Myocardial injury was induced by subcutaneous injection of Lead acetate at a dose of 20 mg/kg, 3 days a week, for 8 weeks.

Estimation of cardiac biochemical markers

All groups were anesthetized with ketamine and Xaylozine and decapitated after 12-14 hours overnight fasting. Moreover, blood samples were collected from the heart of the participants in all the groups, 24 hours after the last dose of treatment was recieved as mentioned above. These blood samples were first centrifuged by a refrigerated centrifuge at 3,000 rpm for 15 minutes, within 30 minutes after collection, and then stored at -80 C before assay and serum were separated for biochemical estimations of CK-MB. Then Cardiac tissue was removed and perfused for 2 min by phosphate buffer saline (PBS, pH 7.2) to remove the remaining blood. Cardiac tissue at 0.2 g was homogenized on ice in 2 ml PBS, and the filtrate was collected. These samples were first centrifuged by a refrigerated centrifuge at 3,000 rpm for 15 minutes, within 30 minutes after collection and then stored at -80 C before assay and extract were separated for estimations of troponin I. CK-MB and troponin were measured by immunological DGKE method and sandwich-linked immunoassay (ELISA), respectively [6]. Lead was measured in serum atomic absorption Spectrophtometry [7].

Statistical analysis

Statistical analysis was performed using a commercial software package (SPSS version 16.0 for Windows). Results are expressed as means ± SE. The Data for troponin I and CK-MB markers were normally distributed after log- transformation. A one-way ANOVA was used to detect statistical difference between groups. Furthermore, a Post-Hoc test (Tukey test) was performed to establish change differences in markers mentioned above, between groups. The differences were considered significant at $p<0.05$.

Results

Lead acetate administration induced damage to the myocardium. Changes in cardiac tissue troponin I and serum CK-MB levels are presented in Table 1. We found that CK-MB and troponin I levels, tissue damage markers, increased in lead-induced myocardial injury in rats. As a result, serum marker enzymes (CK-MB) levels were significantly ($P < 0.0001$) increased in the lead group as compared to

other groups, whereas curcumin, exercise training and composed of both treatment significantly ($P < 0.0001$) reversed these elevated levels, but it was still higher than the CK-MB level of control group (Fig. 1).

On the other hand, troponin I level increased insignificantly by the end of the 8-week period in the lead group as compared to other groups. But There was an insignificant decrease in troponin I level in the lead group when compared with groups ($P > 0.05$) (Fig. 1).

Table 1: Troponin I and CK-MB levels in lead-induced myocardial injury in rats (mean ± SEM for eight rats)

Markers / Groups	CK-MB	Troponin I
Control	55.57 ± 1.54	0.1614 ± 0.0680
Sham	58.23 ± 1.73	0.1670 ± 0.0700
Lead	86.31 ± 3.56	0.1857 ± 0.0710
Exercise training+ lead	67.95 ± 2.32	0.1750 ± 0.0707
Curcumin+lead	65.00 ± 1.01	0.1571 ± 0.0786
Curcumin+Exercise training+ lead	57.45 ± 1.30	0.1500 ± 0.0755

Statistical significance $p < 0.05$: ⁎ more significant than in the control group: + more significant than in the sham group: # more significant than in lead group.

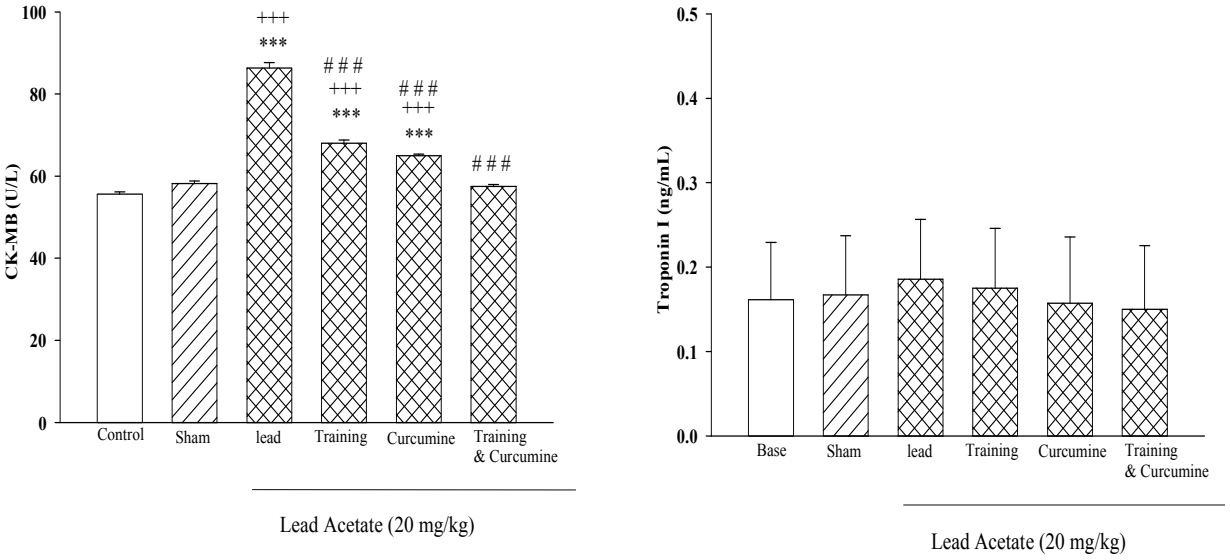

Figure 1: Shows CK-MB and troponin I concentrations in experimental animals. Statistical significance $p < 0.05$: ⁎more significant than in the control group: + more significant than in the sham group: # more significant than in the lead group.

Discussion

Creatin kinase-MB (CK-MB) mass concentration and troponin I are the recent biochemichal markers for the diagnosis of acute myocardial infarction or cardiac tissue damage markers [6]. The present study indicated that there appears to be a proximate correlation between lead-induced cardiotoxicity and cardiac tissue damage markers. We found that there was higher troponin I and CK-MB levels after subcutaneous lead injection as compared to the control group. But CK-MB and troponin I levels that increased after subcutaneous lead injection, decreased by regular training and curcumin supplementation for eight weeks.

Lead toxicity has been known since ancient times and many studies have explored the mechanisms and symptoms of this toxicity through the years [9]. Because the known mechanisms have not been successful in explaining some of the symptoms of lead poisoning, alternative mechanisms are now being investigated. Recent studies have reported lead's potential for inducing oxidative stress and evidence is accumulating in

support of the role of oxidative stress in pathophysiology of lead poisoning [9, 10]. The pathogenesis of lead toxicity is multifactorial, as lead directly interrupts enzyme activation, competitively inhibits trace mineral absorption, binds to sulfhydryl proteins (interrupting structural protein synthesis), alters calcium homeostasis, and lowers the level of available sulfhydryl antioxidant reserves in the body [10]. Recent research examining the etiology of lead toxicity-induced hypertension reveals that the free radical production and lowering of inherent antioxidant reserves resulting from lead toxicity are directly related to vasoconstriction underlying lead-induced hypertension. Many of the mechanisms of lead-related pathologies are a direct result of the oxidant effect of lead on tissues and cellular components [9, 10]. on the other hand, cardiovascular diseases, the most dreaded sequel among the diseases, are invariably followed by several biochemical alterations, such as lipid peroxidation, free radical damage, hyperglycemia and hyperlipidemia, leading to qualitative and quantitative alterations of myocardium[8]. In cardiovascular diseases, major injury is caused by free radical generation; hence, free radical scavengers (antioxidants) form an important therapeutic [8].

Ansari et al. have shown that CK-MB is inactivated by the curcumin supplementation [8]. Yeh et al. have shown that troponin I also decreases by the curcumin supplementation [11]. These results agree with our findings that Curcumin reduces troponin I and CK-MB levels in rat. The mechanisms of Protective curcumin is multifactorial, for: I) its unique conjugated structure, which includes two methoxylated phenols and an enol form of b-diketone[13] II) prevent lipid peroxidation and inhibit the generation of ROS[8] III) The effective antioxidant property of curcumin decreases the utilization of vitamin C and vitamin E in the liver and thus maintains their level[12] IV) interactions between curcumin and lead metal and metal–curcumin complex.Bboth the hydroxyl groups and the b-diketone moiety of curcumin are involved in metal–ligand complexation, either directly bonding to the metal, or in intermolecular hydrogen bonding[3].

Recep Aslan et al. have shown that CK-MB levels, by regular training for five weeks, returned to sedentary [14]. Frederico et al. have shown that Creatine Kinase - MB levels were markedly increased in hearts from isoproterenol -treated animals by twelve weeks of treadmill training, reduced and prevented the deleterious effects of isoproterenol [15]. Ascensao et al. reported that thetroponin I levels increased in doxorubicin - treated animals, by fourteen weeks of Endurance exercise training [16]. These findings are in agreement with our findings that exercise training reduces troponin I and CK-MB levels in rats. The mechanisms of Protective exercise training on cardiac tissue damage increases antioxidant enzymes (Superoxide dismutase, catalase, glutathione peroxidase) and antioxidant non-enzymes, and decreases oxidative damage, [5, 15, 17,18]. Therefore, it seems that the training-induced increases in both myocardial glutathione and SOD activity are potential mechanisms to explain the training- induced reduction in myocardial injury [18].

In conclusion, results from the present study suggest the cardioprotective potential of administration of curcumin and performed aerobic training protocol in ameliorating the lead-induced cardiotoxicity in rats through decreasing cardiac tissue damage markers.

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Comparing the Mental Health of the Athletic and Non- athletic Physically- disabled People

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Abstract

Body movement in disabled people is one of the important problems due to their physical and motor limitations. For this purpose, the present study is conducted to compare the mental health of the athlete and non- athlete physically disabled people in the city of Rasht .The sample population was 183(94 athletes and 89 non-athletes) disabled people from the city of Rasht, who were selected randomly. The measuring instrument of the study was The Multidimensional Health Questionnaire (MHQ) which includes 20 sub-scales of mental health. The collected data were analyzed using ANOVA test and t-student test. The results of the study indicated that there is a significant difference between mental health and sub-scales of the athletes and non-athletes physically disabled people ($P<0.05$).

The results of this study indicated that the mental health of the physically disabled people and the 20 sub-scales of the athletes were better than those of the physically disabled non-athletes. Therefore it seems necessary that sports and physical activities be more attended to in the daily schedule of disabled people.

Keywords: Mental health, Athletes and Non-athletes, Physically disabled people

Introduction

Over the last centuries, human beings were most vulnerable to infectious diseases; however, today thank to developments occurred in health conditions in most parts of the world he may encounter less dangerous diseases of this type . Today, what is remarkable is mental disorders with different types and different intensities .On the other hand, the last century's developments have led to lower amount of work. Besides, works that required body movement and energy expenditure were performed by machines, and so the efficiency of body has been decreased.

Disabled people also face the same challenges . On the one hand, disabled people, due to physical disabilities, have movement limitations which prevent them from some sport activities .So the category of physical activities and exercise in relation to disabled people is important from two aspects .The first aspect is a medical issue and it's aim is to provide health while the other aspect is the prevention of secondary problems and diseases[1,2]. Most researches that have been done to investigate the physical activity and mental health of disabled people show that disabled people with athletic physical-movement are in better mental and physical health conditions than disabled people with non-athletic physical-movement .The results of Coyel's research in 1993, studying changes in leisure life style of disabled people with spinal cord injury and some of psychological variables such as depression, life satisfaction, social interaction and some of reliable relations suggests that people with an active lifestyle feel more satisfaction with their life and are less depressed and have more reliable relations than non-active people[3]. Foreman, Cull and kirkby (1997), investigated the Factors associated with exercise in a sample of 121 people all of whom suffered spinal cord injury. Data analysis showed that there are significant differences between athletes (67 cases) and non-athletes (54 cases) concerningthe aspects of psychological dimensions[4]. Kennedy et al (2003), also investigate the effects of sport activities in order to reduce anxiety and depression in people with spinal cord injury and observed that an exercise program during 6 weeks led to a reduction in depression and anxiety .This effect was located by comparing with the control group following a training program [5]. Latimer & et al

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(2004) have also studied disabled people with spinal cord injury .Exercise program includes two practice sessions in the week that was performed in experimental and control groups for 9 months .The results showed that depression and stress had decreased in the experimental group and mental health of people had increased [6]. Warms & et al (2004) conducted a study on18 people with spinal cord injury with the purpose of studying the quality of exercise program and physical activity to investigate it's effects on people with spinal cord injury.The results showed that there are significant differences between physical activity with values attached to health, health self-assessment, the increase in health-related behaviors, motivation for health, and muscle strength .The results also showed that physical activity could promote the quality of life and reduce depression in the group under study [7]. Golmohammadi (1993) studied and compared the Self-esteem level of athletic and non-athletic disabled people, and he achieved the following results [8].

A).There was significant differences between the self-esteem of athlete and non-athlete disabled people.

B).A significant difference was observed between the self-esteem of disabled people in individual and social sports.

C).A significant difference was observed between the self-esteem of athletic disabled people in contact and non- contact sports.

Salesi (1993) investigated the effect of sport activities on mental health of physical disabled people and found significant difference between athletic and non-athletic disabled people in mental health factors, including : physical symptoms, anxiety and sleep disturbances, depression and social function. "… The results showed the condition of athletes is better than that of non-athletes[9]. Poursoltani Zarandi (2003) has studied the public health of veterans and the physical-movement of disabled athletes and non athletes in Iran .With hypothesis testing, it was clear that there was significant difference between the general health of veterans and athletic and non-athletic disabled people .Also, there was significant difference between the general health of two groups in individual and team sports [1]. In another hypothesis, there was found a significant difference between the general health of two groups with different disabilities. The results showed that exercise and physical activity can be effective in the direction of general health of physically-disabled people [10].

According to research records , ambiguities and uncertainties, there is still a question as to whether there is a significant difference between the mental health of athletic and non athletic disabled people,, and whether there is a significant difference in the sub-scales of mental health between athletic and non athletic disabled people,

Method

The present research is a survey study conducted to examine the athletic and non-athletic physically-disabled people in Rasht. The Number of participants was 183 subjects 94 of whom were athletes and 89 were non-athletes. They were selected randomly. In this study, Athlete refers to disabled people that participated in individual sports (swimming, track and field, shooting and power lifting) and team sports (wheelchair basketball, football, and volleyball), and non-athlete refers to disabled people that did not participate in any physical activity or sports. instruments used in this study were MHQ's mental health questionnaire designed by William Asnel and his colleagues .This Questionnaire evaluates 20 subscales of mental health. In order to make sure of correct translation and compatibility with the Iranian culture, proper and clear understanding of questions, and the adequacy of instruction, and the manner of completion of questionnaire, the questionnaire was piloted on a sample of 30 participants in Rasht. The independent t- test and ANOVA were used to test the research hypothesis.

Results

According to the information obtained, it was found that athletes enjoyed higher levels of mental health than non-athletes (figure 1).

Figure 2, shows that the type of amputation disability in athletes group and type of polio disability in non-athletes group is more than other types of disabilities.

After the analysis of statistical findings and testing hypotheses , it was clear that the mental health of athletic physically- disabled people is better than non-athletic physically- disabled people and this superiority is established in all subscales of MHQ questionnaire .

The results also showed that there is no significant difference between mental health of physically- disabled athletes in individual and team sports. The results of research concerning the mental health of physically- disabled people with different disabilities showed a significant difference .The results indicated a significant difference between amputation and polio disabilities, but among other types of disabilities, no significant difference was observed.

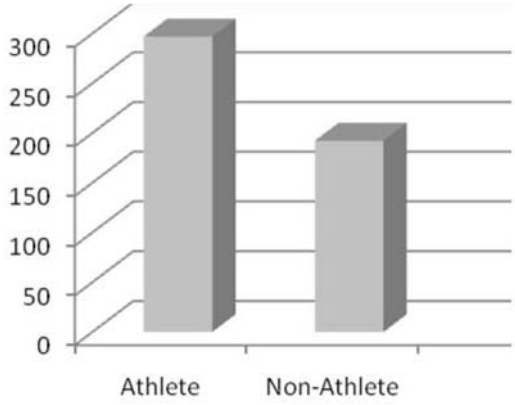

Figure 1: Mean of mental health of athletes and non-athletes

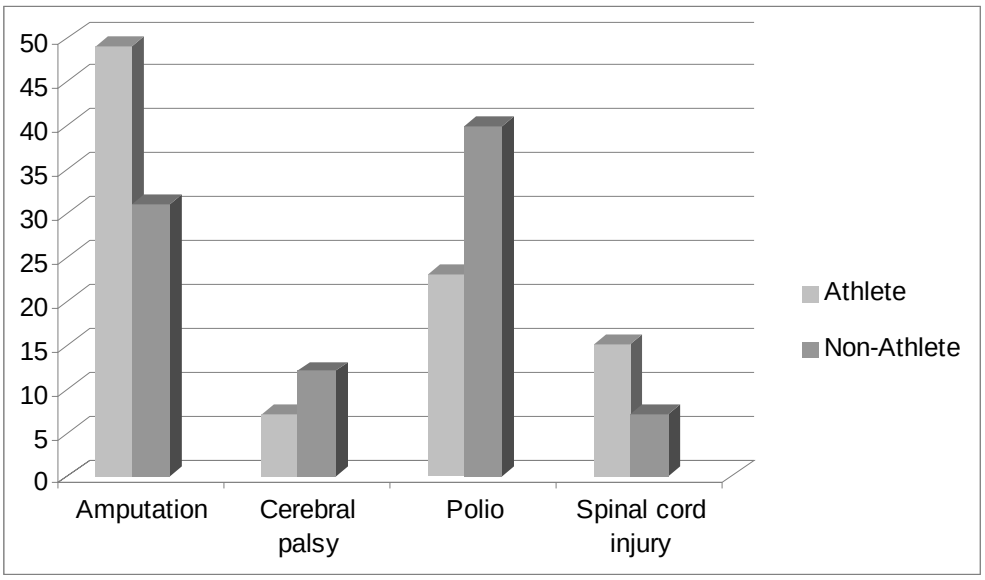

Figure 2: Comparison of disability condition in two groups of athletes and non-athletes

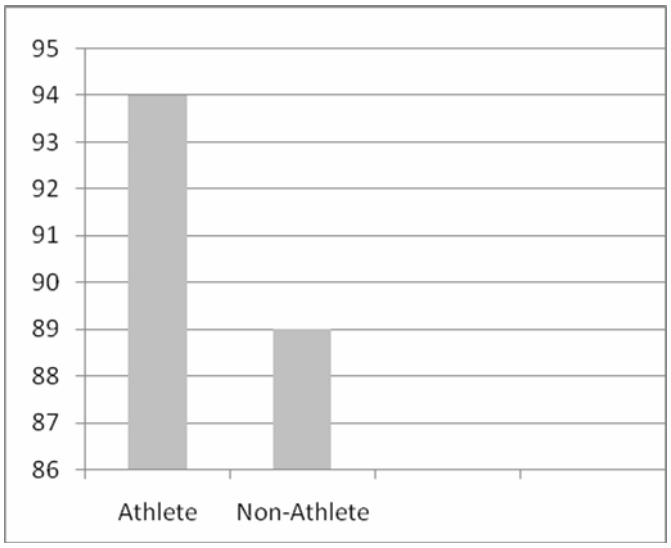

Figure 3: The amount of physical activity in athletic and non-athletic groups

On the other hand, there was not a significant difference between the mental health of athletic physically- disabled people who had different levels of physical activities .The results also showed that there is a significant difference between the mental health of physically- disabled people and the causes of disability .Other results of this study showed that there is not a significant difference between the mental health of physically-disabled people who have different levels of education and marital status.

Discussion

After collecting information and analysis of statistical findings, the results indicated that athleticphysically- disabled people have better mental health than non -athletic physically-disabled people .Also, in all subscales of MHQ questionnaire, athletes are better than the non-athletes with significant difference ($P < 0.05$). The results of this research are consistent with similar studies. Green Wood and Dezoaltoski (1990) in a research showed that wheelchair athletes have positive psychological profile, better mood profile and less stress and anger, less depression and fatigue than non-athlete wheelchair persons [11]. A research by Forman and his colleagues (1997) has indicated that there are significant differences in the mental aspects of disabled athletes and non -athletes who have spinal cord injury [4].

Research results of Kennedy and his colleagues (2003) showed positive effects of sport activities in order to reduce anxiety and depression in people with spinal cord injury [5]. The research results of Campbell and Jones (1992) showed that the wheelchair athletes have a positive mental Welfare profile with the least tension, depression, and anger toward wheelchair non -athletes .The results also showed that wheelchair athletic group have better mental and welfare health than the control group[12].

On the other hand, the research of warms & et al (2004) on the disabled people with spinal cord injury showed that there is significant differences between physical activity with dimensions of mental health such as valuing health, health self-assessment, the increase in health-related behaviors, and motivation for health[7]. It seems that participation in regular physical activities have useful physiological and psychological effects for disabled people as healthy people [13]. The results showed that physical activity was effective not only in providing physical health but also in providing mental health. It seems that this effect may be due to improvement of mental conditions, the acquisition of physical imagination, and positive imagination [14].

The researchers expressed the Probability of alleviating the mentioned causes using the theory of Bandura's self-capabilities according to which "exercise enhances the sense of personal mastery and enhances self-capabilities and will have behavioral changes .Such changes are effective in reducing depression".

Therefore, the improvement of self-concept is the main element of therapeutic change in exercise, the improvement of physical ability and the gain of physical imagination. Self-concept in a collection of sport experiences provides positive feedback and a sense of satisfaction .Such satisfaction and pleasure may be extended to other situations and aspects of life [15]. According to the results obtained, it was found that exercise and physical activity increased mental health and it's dimensions .In summary, we can conclud that physical activity has a significant effect in reducing the negative aspects of mental health such as stress, anxiety, and depression.

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Acute Plasma Glucose and Lipoproteins Responses to a Single Session of Wrestling Techniques-Based Circuit Exercise (WTBCE) in Male Elite Wrestlers

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Abstract

Introduction: It has been shown that regular endurance exercise is a widely recognized modality to raise plasma high-density lipoprotein cholesterol (HDL-C) levels, but the results reported in studies of the effect of supra-maximal /maximal high intensity or power and anaerobic based sports and exercise on lipoprotein are conflicting. **Objectives:** The purposes of the present study were to investigate the effect of a single session of wrestling technique–based circuit exercise (WTBCE) on acute responses of glucose and lipoprotein profiles and the time course change of these metabolites. **Methods:** Twenty young, male elite wrestlers (age 20 ± .6 year, height 172.6 ± 2.10 cm, weight 71.05 ± 3.71 kg., and 24.54 ± 0.63 kg/m2 in BMI) volunteered to participate in the present study. **Design and Exercise Protocol:** Subjects were asked to complete a single WTBCE (10 techniques or stations separated by 10m, 3 non-stops circuits for 2 sets and one competitive wrestling practice). Blood samples were collected 30min before, immediately after the exercise, and 30min after the exercise. Repeated Measures Analysis of variance was used to analyze the data**. Results:** Plasma glucose and HDL-C were significantly (p <0.001, 0.04) changed. There was no significant change in TG and TC concentrations. **Conclusion:** The present data indicate that a WTBCE was able to generate an acute change in HDL-C and glucose concentration and it can be considered as a stimulus for improvement of plasma HDL-C levels.

Keywords : Plasma glucose, Lipoproteins, HDL-C, Wrestling technique-based circuit exercise.

Introduction

Regular endurance exercise is a widely recognized modality to raise plasma high-density lipoprotein cholesterol (HDL-C) levels [1-3], which is one of the metabolic adaptations contributing to the reduced risk of coronary heart disease (CHD) observed among physically active and fit individuals [4-6]. Although a low plasma HDL-C concentration is often accompanied by an elevated triglyceride (TG) level associated with abdominal obesity and insulin resistance-hyperinsulinemic states [7, 9], some individuals are characterized by low HDL-C levels without hypertriglyceridemia; a condition that has been referred to as isolated hypoalphalipoproteinemia [10, 11]. In addition, a low HDL-C has been reported in cigarette smoking [12], low fat /low cholesterol diet [13,14], self-administrated exogenous testosterone anabolic and androgenic steroids [15, 16] and physical inactivity [17, 18]. There is an agreement about the effects of an aerobic-based sports/endurance exercise on lipid and lipoprotein profiles, particularly on LDL-C, TG, TC, and HDL-C and its subfractions [19, 20, 21, 22, 23]. In contrast to aerobic-based physical activity, the results from the effects of acute exercise (aerobic or anaerobic) and also a power -anaerobic-based exercise/sports on lipid and lipoprotein profile are inconsistent [24, 25, 26, 27, 28, 29] . Additionally, a low level of HDL-C in power athletes, particularly wrestlers has been reported by some investigators [30, 31, 32]. In this regard, Eliakim et al. [30] suggested that in their study only one of the athletes had high levels of HDL-C (75mg/dl) and 24 athletes had mild low HDL-C (35-45mg/dl). They also reported that hypercholesterolemia and low HDL-C were found mainly in power sports (i.e., weight lifting, boxing, wrestling and judo) and anaerobic sports (i.e., tennis, sprints, and jumps, gymnastics, ice skating). According to a comparison by Tsopanakis and et al [26] a lower HDL- concentration has been observed in elites athletes in Olympic sports such as; wrestling, boxing, and sailing (46mg/dl, 41mg/dl,

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and 45mg/dl respectively). Sgouraki et al [31, 32] reported that after the maximal exercise bout [the ergometric test on treadmill ergometer), a preparation phase and then 5% inclination of the treadmill until the end of exercise test (100% VO2 max, 12-14min the maximum), all groups from basketball, swimming, long distance running and wrestling- the control included showed statistically significant increase in HDL-C levels as compared to rest values (11.4%, 17.1%, 15.0%, 12.7%, and 13.7%). Wallace et al [33] were studied 10 healthy, trained males (25.4 +/- 3.1 yr) before and after 90 min of resistance exercise to determine the acute effects of high volume (HV) and low volume (LV) sessions on alterations in lipid and lipoprotein concentrations as well as the activity of lecithin: cholesterol acyltransferase (LCAT). A significant changes were only found following the HV session. These included increases in HDL-C (11%) and HDL3-C (12%) 24 h post-exercise. Jurimae et al [34] were studied the lipid and lipoprotein responses to a single-circuit weight-training session in 15 untrained male students. In this study subjects performed three circuits using a work-to-rest ratio of 30 s:30s at 70% of one-repetition maximum and the whole program lasted 30 min. The HDL-C increased in 1-h period of recovery compared with the initial level. In the study by Hill et al [35] two intensities of 1RM were employed. To date, in our knowledge, a single wrestling technique-based circuit exercise has not been considered as a stimulus to bring about a change in lipid and lipoprotein metabolism in wrestlers. Thus, the first aim of this study was to see lipid and lipoprotein profiles in elite wrestlers. The second purpose was to investigate the acute responses of plasma glucose and lipoproteins to a single session of WTBCE program in this subjects.

Material and Methods

Subjects and Research Design

The study was approved by the ethic committee of the School of Medical Sciences of Tarbiat Modares University and conducted in accordance with the policy statement of the Declaration of the Iranian Ministry of health. Written consent was obtained from the twenty male young elite wrestlers (age 20 ± .6 year, height 172.6 ± 2.10 cm, weight 71.05 ± 3.71 kg, and 24.54 ± 0.63 kg/m2 in BMI, 5± 1.5 years history in wrestling) who volunteer to participate in the present study. The wrestlers had a high experiences in the national and international wrestling competitions. All subjects were asked to complete a medical examination and a medical questionnaire to ensure that they were not taking any medication, were free of cardiac, respiratory, renal, and metabolic diseases, and were not using steroids. Also, all the subjects were completely familiarized with all of the experimental procedures.

Exercise Testing Procedures

Before the main trial, participants were taken to the wrestling club three times. The first and second visits of all the participants performed a practice a wrestling-technique-based circuit exercise (WTBCE) (8 techniques/or stations) for familiarization. On the third visit, the subjects completed a practice session to insure that each participant was able to complete the entire exercise session and also to confirm that the program was producing fatigue at the end of the session. This was confirmed by visual and verbal feedback from the participants. The subjects were allowed to take as long time as they felt necessary to recover from each attempt. The experiment protocol was started at 08.30 AM and finished at 11.30 AM to avoid the effects of circadian rhythm. Subjects were asked to perform 2sets of 3 non-stop circuits exercise (8 techniques/stations with one- repetition for each exercise at their maximum speed) with a 4 minute rest between sets which followed by one competitive wrestling (2×3min with 30s rest between)(Figure.1). In meantime, the distance between each station was 10 meters and whole WTBCE exercise session lasting for 25 min the maximum (Fig.1). All the exercises were conducted after an overnight fast state. The subjects were instructed to follow a normal lifestyle maintaining daily habit-s, to avoid any medications, and to refrain from exercise 3 days before the experimental day**.**

Biochemical analyses: Blood samples were obtained from antecubital vein 30 minutes before exercise, immediately after the exercise and 30min following the exercise. Plasma was separated by centrifugation within 15 minutes of collection and divided into three aliquots. The aliquots were frozen and stored at -20°C and -80ºC for subsequent analyses (within 3-4 weeks). The samples were analyzed for glucose, TG, TC, HDL-C and LDL-C and VLDL-C. High density lipoproteins (HDL-C) by precipitation method with MgCl2-Na Phosphotungstate (Men Com Cat No 100, Tehran Iran) , Serum glucose(glucose oxidase, Men Com Cat No 428), TG (lipoprotein lipase and glycerolkinase, Men Com Cat No 337) and TC (Cholesterol esterase, Men Com Cat No 258). LDL-C was also calculated by using two equations as previously described (36, 37). **[** (TC-[VLDLC + HDLC]=LDLC or (LDLC= TC-(TG/5

+ HDLC)]. The TC/HDLC and LDL/HDLC ratios were adopted according to the atherogenic and CAD (CHD) risk factor indexes were calculated.

Statistics: the data were analyzed using SPSS package (version 10.1) by personal computer. The obtained data for plasma HDL-C glucose, GTG, TC, LDL-C, and VLDL-C were analyzed using analysis variance (ANOVA) with repeated measure variables. Statistical significance was accepted at $p<0.05$. Significant effects were followed by appropriate planned comparison.

Results

Table 1 shows the mean values (±SE) of age, height, body weight (BW), body mass index and other physiological, physical performance, and related parameters. Plasma glucose concentrations significantly changed (P<0.001) from 91 ±1.2 mg/dl to 153.68 ± 7.5 mg /dl immediately after exercise and still higher and significant (P<0.023) when compared with pre-exercise value (Fig.1). A significant changes were observed in HDL-C levels (F=5.018, P<0.025). HDL-C increased from 43.5 ± 2 mg/dl to 48.2 ± 1.5 mg/dl immediately after exercise. However, an insignificant (P<0.4) reduction was observed in HDL-C levels following 30 min of the exercise recovery period (Fig.1). As presented in Table.2, plasma TG, TC, LDL-C, VLDL-C levels showed an insignificant increase after a single session of WTBCE. An insignificant reduction in LDL/HDL (-0.681 or 20.4%) and in TC/HDL (-0.12) ratios were also observed.

Discussion

The purpose of the present study was to investigate acute plasma glucose and lipoprotein responses to a single session of WTBCE program. The main findings of this study were a significant increased plasma glucose and an elevation in HDL-C level (+ 4.2mg/dl) immediately after exercise. An insignificant changes in plasma TC and TG, and LDL-C concentrations in the present study are in disagreement with Sgouraki et al [32] who observed a significant increase in TG, TC, and LDL-C concentrations after an acute treadmill ergometer test. Hughes et al [38] found no significant difference in TC, TG, and LDL-C measures after 15, 30, and 45 min of an acute exercise at VO_{2max} 20% blow VT. Davis et al [39] did not observed any significant changes in blood lipid variables and LDL-C after an acute exercise at 50% (lasting 90min) and 75% VO_{2max} (lasting 60min). As reported by Imamura et al [40] the concentrations of serum TC, TG, and LDL-C showed no significant changes after an acute moderate exercise intensity (60%VO_{2max}) for 30 or 60min in duration in sedentary young women. Our results also are in agreement with Jürimäe et al [34] and Wallace et al [33]. In the present study a significant increase in plasma glucose was observed immediately after the exercise program and still significantly higher during 30min of recovery period when compared to before exercise value. Increased in blood glucose are consisted with some of the previous studies using different resistance exercise protocols [34, 43, 44, 45] and it also is disagreement with other reported results [46, 47]. Robergs et al. [43] reported glucose increases due to plasma volume shifts. In regards to HDL-C, post-exercise increased in HDL-C have previously been reported following prolonged endurance events lasting ≥2hr [41, 42]. Sgouraki et al [31] reported that after the maximal exercise bout of the ergometric test on treadmill for 12-14min the maximum, wrestling and control groups showed statistically significant increase in HDL-C levels as compared to rest values (12.7%, and 13.7%). In other study by Sgouraki et al [32] reported that after maximal effort wrestling and control groups showed significant increase in HDL-C levels compared to rest values (13% and 14.4% respectively). Gordon et al [42] reported no significant change sin HDL-C levels immediately and 1h after a single exercise on tread mill at 60 and 75% VO2 max. the same results also were reported by Gordon et al (1996)[48]. Angelopoluos et al [49] evaluated the effect of single bout and repeated bouts (30min) of treadmill exercise on HDL-c and its subfractions. They pointed out that total HDL-C remained higher significantly than the pre-exercise values 5 min after the exercise. In the study by Hughes et al [38] who used different exercise duration (15, 30, 40min) at certain intensity (VO2max 20% below ventilatory threshold) to investigate any changes in serum lipoprotein metabolism. They were found no significant changes in HDL in all exercise durations. Davis et al [39] studied the effects of acute exercise intensity on plasma lipid s in well trained runner in a high-intensity (at 75% VO2max and for 60min) and low intensity session (at 50% VO2max and for 90min). They did not observed any significant changes in HDL-C and HDL-C2 levels after exercise. Ferguson et al [51] who reported that HDL-C concentration was significantly elevated immediately after and 48h after exercise in the 1500kcal session. An increase in HDL-C levels (2 ± 4mg/dl) after a bicycle ergometer exercise at 80% of HR max in trained men was reported by Kantor et al [52]. Wallace et

Set	Rounds	Stations	Total preformed Techniques
1	3	8	24
3min rest (semi-active recovery)			
2	3	8	24
3min rest (semi-active recovery)			
3	2x3min (30s rest between) Competitive wrestling		

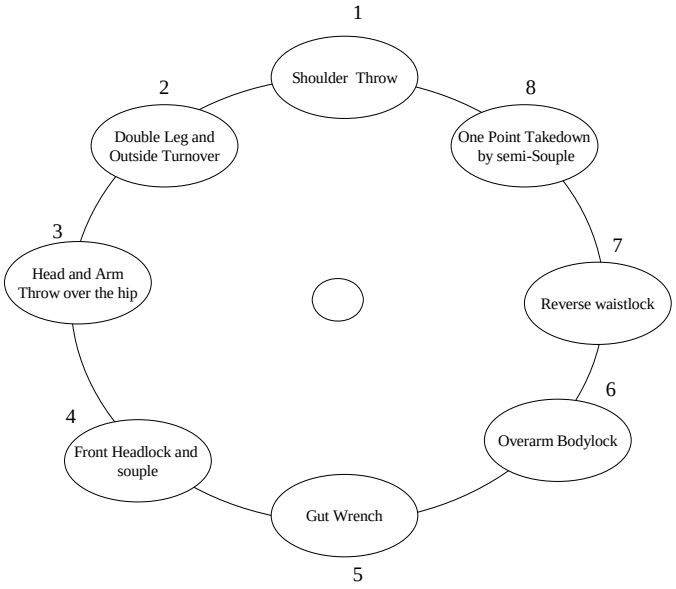

Figure 1: An experimental working plan

Table1: Physical characteristics of the participants (mean ± standard error, n =20)

Variables	**Values**
Age (year)	20 ± 0.69
Weight (kg)	74 ± 3.71
Height (cm)	172.5 ±2.10
BMI (Kg/m^2)	24.54± 0.63
HR_{Rest} ($beat/min^{-1}$)	69 ± 2
$CHR_{max\ 1}$($beat/min^{-1}$)	173 ± 3
CHR_{max2} ($beat/min^{-1}$)	177.0 ± 2
Wrestling HR_{Rest}	126.71± 4.35
Wrestling HR_{max}	179.23± 3.87
Avrage Time1 (min)	1.40 ± 0.029
Avrage Time2 (min)	1.42 ± 0.042
Practice sessions/week	3-4
Wrestling Experiences (y)	7.62±1.23

Table2: Biochemical variables: plasma TC, TG, LDL-C, VLDL-C concentrations and TC/HDL and LDL/HDL-C ratios. Values are mean ± SE. * $p<0.05$, ** $p<0.01$ compared with pre-exercise. + $p<0.05$, 30-Postexercise compared with pre-exercise value.

Variables	Pre-Exe	Post-Exe	30 min Post-Exe
TC (mg/dl)	163 ± 5.6	175 ±6.3	165 ± 5.6
TG (mg/dl)	108 ±11	121 ±11	115 ±12
LDL-C (mg/dl)	99 ± 6.4	102 ±7.4	97 ± 6
VLDL-C(mg/dl)	21.7 ±2	24.3 ±2	22.5 ±2.4
TC/HDL-C Ratio	3.9 ±0.3	3.8 ±0.2	4.1 ±0.2
LDL/HDL-C Ratio	2.4 ±0.22	3 ± 0.8	2.5 ± 0.2

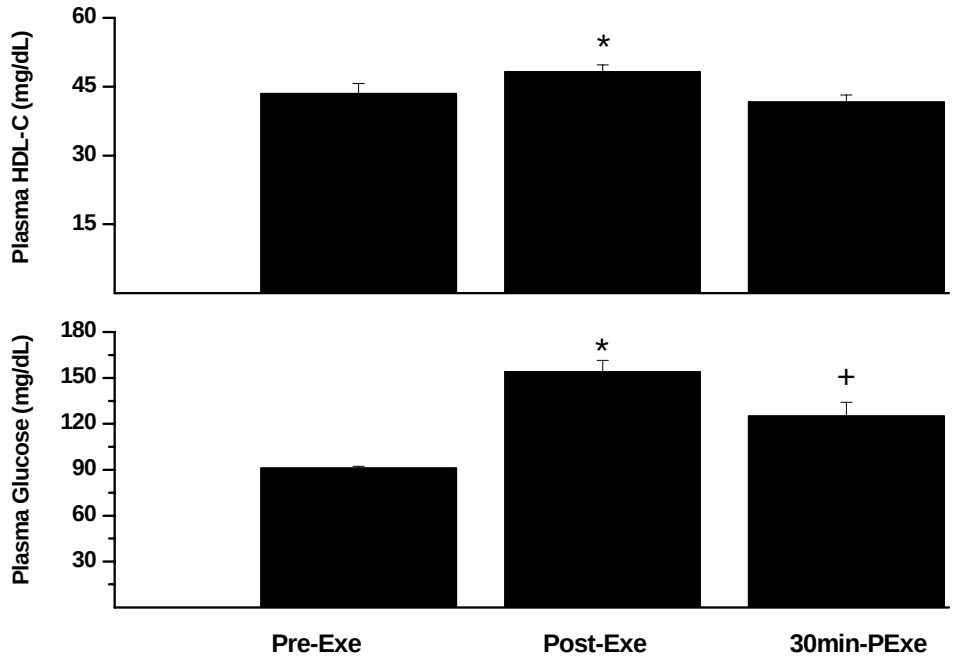

Figure 2: Plasma glucose and HDL-C concentrations to a single wrestling technique-based circuit exercise (WTBCE) plus a competitive wrestling practice before, immediately after exercise, and after 30min of recovery. Values are mean ± SE. * $p<0.05$, ** $p<0.01$ compared with pre-exercise. + $p<0.05$, 30min Post-exercise compared with pre-exercise value.

al [33] were studied the effects of 90 min of resistance exercise with different volumes (high volume and low volume) on alterations in lipid and lipoprotein concentrations as well as the activity of lecithin: cholesterol acyltransferase (LCAT). A significant changes were only found following the high volume session. These included increases in HDL-C (11%) and HDL3-C (12%) 24 h post-exercise. Jürimäe et al [34] who reported that the plasma HDL-C levels were insignificantly increased during a circuit resistance exercise(ten exercises, three circuits using a work-to-rest ratio of 30 s:30s at 70% of one-repetition maximum and for 30min)., but after a 1-h period of recovery the concentration was significantly higher than before exercise. As reported by Burns et al [53] plasma HDL-C concentration were significantly lower after a single resistance exercise trail than in the control trail. Wooten et al [54] did not find a significant change in HDL-C after an acute circuit resistance exercise and training. Our result is also in agreement with by Hill et al [35] who pointed out that the only significant effect of exercise in their experimental condition was to acutely increase in HDL-C in the immediate post exercise sample compared with the control. A discrepancies between our results with other previous reported findings, first of all could be explained by the general factors such as duration , intensity or energy expenditure per session [39, 55], interest resting period, mode of exercise [56], and diet [57]. The initial levels of plasma HDL-C is also can be considered as a determining factor. As reported by Eliakim et al [30] how suggested that in their study the hypercholesterolemia and low HDL-C were found mainly in power sports (i.e.,

weight lifting, boxing, wrestling and judo) and anaerobic sports (i.e., tennis, sprints, and jumps, gymnastics, ice skating). The same result was reported by Tsopanakis et al [25]. The underlying biochemical mechanism responsible for acute increase in HDL-C after a single WTBCE plus wrestling practice session is complex . Enzymes such as lipoprotein lipase (LPL), hepatic triglyceride lipase (HL) , and lecithin : cholesterol acyltransferase (LCAT) and cholesterol ester transport protein (CETP) play a role in mediating HDL-C concentration change. Acute increase in HDL-C probably related to catabolism of triglyceride rich lipoproteins via lipoprotein lipase[58, 52, 59, 51]. It has been suggested that the increases reported for HDL-C after endurance exercise, may be partly due to reduce recycling and catabolism velocities of lipoprotein in athletes compared to controls, than to lipoprotein increases *per se* (60). In addition to lipoprotein lipase (LPL), lecithin: cholesterol acyltransferase (LCAT) is known as a plasma factor in HDL-C remodeling which estrifies cholesterol in HDL particles, permitting its transports in HDL core and increase in cholesterol per HDL particles. An increased LCAT activity was reported by several investigators [61, 62, 63]. A post-exercise higher level of HDL-C has been attributed to a significant changes in HDL-C subpopulations ,such as HDL2-C and HDL3-C [4, 58, 49, 42, 48, 27,55 , 51, 31, 32, 64, 65, 66]. The HDL-C increased HDL-C concentration immediately after exercise may have been related to decrease CETP activity or concentration. CETP is responsible for the shuttling of lipid between HDL and other lipoproteins, and has been shown to decrease after exercise [67, 68]. The reverse cholesterol transport (RCT) has been reported after physical exercise in untrained subjects and athletes [69, 70, 71, 72, 73]. In this regard, Campaigne et al [74] reported that HDL-C was significantly increased after exercise for 30min on a cycle ergometer at 60% VO_{2max}. They also pointed out that cholesterol efflux was higher to HDL-C obtained from sedentary group compared with runner group before exercise. They conclude that acute exercise increased HDL's ability to act as an acceptor of cellular cholesterol in runner, whereas it decreased in sedentary group. In addition to above factors, the effects of exercise on apolipoproteins, particularly Apo-AI and AII [26,75,76] and pre beta-HDL has been reported by recent studies [77, 78]. This is the first report demonstrating that wrestling technique -based circuit exercise plus a competitive wrestling practice

resulted in an increased HDL-C and glucose concentrations.

Our results suggested that as single wrestling technique-based circuit exercise plus a competitive wrestling was able to bring a change in plasma glucose , lipid and lipoprotein profiles. Although we found an insignificant increase in TC, TG, and LDL-C, but the exercise program was more effective on the plasma HDL-C concentration. The HDL-C concentration between subjects was varied from 29-64 mg/dl with averages 41-47mg/dl. Thus, our data partially initially low HDL-C in wrestlers. The present results also suggest that this exercise program can be considered as a stimulus for lipid and lipoprotein changes. It has pointed out that we did not measure HDL-C changes during the exercise program and other plasma factors which are involve in HDL-C remodeling. Further work should investigate the possible role of pre-beta HDL and ATP-binding cassette transporter (ABC) family, particularly A-I (ABCA1) in cholesterol efflux and RCT processes during and after the WTBCE program.

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The Relationship between Salivary IgA and Cortisol Concentrations and Psychological Overtraining Symptoms in Elite Soccer Players

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Abstract

This study is to investigate the relationship between salivary IgA and cortisol concentration and the data elicited through the administration of French society of sports medicine questionnaire of psychological overtraining symptoms in elite soccer players.

Accordingly, from among the Iranian premier league players, 30 participants with the mean and standard deviation of 24.1± 3.79 in years, 180± 7.29 centimeters in height, 75.2 ± 8.09 kg in weight, 22.97 ± 1.21 kg/ square height in meter in body mass index, and 53.26 ± 2.79 milliliter per kilogram body weight per minute in aerobic power were selected voluntarily and purposefully as the sample. In the rest day following the exercise (24 hours with no exercise), the psychological overtraining symptoms questionnaire, including 54 "Yes/No" question items, were administered to the players. On the same day, three specimens of every player's saliva were taken at certain intervals (8:00 A.M., 11:00 A.M., and 5:00 P.M.). These specimens were used to measure the average concentration of cortisol during the day. In this sampling, IgA concentration was measured from the 11:00 A.M. specimen.

Subsequently, the data was analyzed using the descriptive statistical methods and Spearman rank correlation coefficient formula, which suggested a significant, positive relationship between the questionnaire results as the psychological overtraining index and cortisol concentration at 8:00 A.M. and 11:00 A.M., respectively ($r=0.71$; $r=0.62$; $r=0.61$; $p<.01$). However, there proved to remain a significant, negative correlation between the questionnaire results and IgA concentration ($r= -0.51$; $p<.05$).

The findings of the study suggest that the psychological overtraining symptoms questionnaire can be a positive tool in determining and preventing the overtraining phenomenon.

Keywords: Cortisol, Immunoglobulin A, Overtraining, Psychological overtraining questionnaire

Introduction

Many professional sportsmen spend a long time in different training camps and experience psychological and physiological pressures and stresses. Such pressures and stresses may exert unfavorable impacts on the sportsmen in the long run. Overtraining phenomenon is one these negative impacts which has been afflicted upon many professional sportsmen over the last years. Many experts believe the overtraining to be a long-term process caused by the lack of balance between heavy training sessions and the rest intervals[1,2,3]. Overtraining has certain symptoms and causes particular problems for the sportsmen including physiological, psychological, performance, and immunological problems [3].

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If overtraining is not timely recognized and prevented, it may sweep the sportsmen away into slumps for months. However, the training experts have always been trying to come up with methods to control the training pressure to some extent; although, it is difficult to exercise an exact control over the training pressures due to some problems such as the extent of sportsmen preparation. One of the clinical methods used to investigate the sportsmen status regarding the extent of training pressure and physiological response to it is the examination of variations in the sportsmen's endocrine secretion and immune system. In this regard, cortisol as the most important catabolic hormone and immunoglobulin A (IgA) play a crucial role. Some experts have asserted that the concentration of cortisol and IgA would vary in response to exercises and psychological-physiological pressures. This variation causes an increase in cortisol but a decrease in IgA

concentration, which may be considered as one of the important symptoms of overtraining in the long chronic run [1, 4, 5].

The chronic overconcentration of cortisol, as a stress hormone belonging to the glucocorticoid family, may damage proteins and cause a harm to the immune system [6, 7, 8]. IgA is the dominant antibody found in the epithelium-immune system, which functions as the major influential factor in the host defense against pathologic organisms. It is argued that heavy exercise may decrease immunoglobulin concentration and leave the body susceptible to damage. This damage can particularly affect the upper respiratory tract (URT)- [3]. On the other hand, clinical methods generally require much time and expenditure. That is why these methods are not always viable. Experts are seeking methods to yield similar outcomes with less time and expenditure. In recent years, they have developed a method which draws on the account the athlete gives regarding his psycho-physiological status. Utilizing this method requires such instruments as questionnaires and standard norms particularly designed for this purpose [10,11]. To be assured of the outcomes of these questionnaires and norms, experts have conducted studies on the extent of the relationship between the outcomes of these instruments and more precise indices dealing with training pressure and overtraining.

Maso et al. (2002) in their study on the professional rugby players found a significant, negative correlation between the results of psychological overtraining symptoms questionnaire and testosterone concentration [1]. Marita et al. (2003) found a significant, positive correlation between the results of psychological overtraining symptoms questionnaire and Hamilton depression symptoms, and cortisol concentration [12]. On the whole, many studies have affirmed that long, heavy exercise and psychological tensions and pressure may result in an increase in cortisol concentration but a decrease in immunoglobulin concentration, which may eventually weaken the immune system, as one of the overtraining symptoms [12,13]. With regard to the aforesaid, it is essential to develop methods through which to examine the pressures imposed by training on the players so that some contingent problems like overtraining may be avoided.

In this study, the researchers aim at investigating the relationship between some of the overtraining symptoms, cortisol concentration, and Immunoglobulin A (IgA) concentration in elite soccer players. In this regard, the psychological overtraining symptoms questionnaire is used.

Method

Participants

The present study is a descriptive one in general and a correlational in particular. The population was all the soccer players in the Iranian premier league. Using quota sampling method along with availability, 30 elite soccer players were chosen as the participants. None of the players were suffering hormone disturbances, and they used no hormone drugs at that time. The measurements were conducted subsequent to the agreements built up with their club officials and the completion of informed consent by the players. The saliva specimens were collected while the sportsmen were at rest in their hotels with no stressful training or match pressures. Other corresponding variables including height, weight, body mass index and maximum aerobic power measurements were consistent with their Bruce protocol.

Saliva specimens

On the day off (24 hours with no exercise), the players' non-stimulated salivary specimens were taken at three intervals, 8:00 A.M., 11:00 A.M., and 5:00 P.M. The specimens were taken at three stages to help avoid the effect of circadian rhythm and other factors such as eating on the secretion of cortisol. Moreover, taking specimens at three stages would reveal the daily cortisol variation rhythm in the elite soccer players [1, 14]. Subsequently, the IgA concentration was examined in the 11:00 A.M. specimen. Immediately after collecting the specimens at each stage, the tubes were sent to a specialized medical and pathology clinic [I]. In the clinic, the specimens were frozen to -20 degrees centigrade. To check the cortisol concentration in the specimens, the Italian RADIM kit was used while the IgA concentration was measured by Demedicate kit. In this regard, ELISA method was used for the diagnosis.

Psychological overtraining symptoms questionnaire

The Psychological overtraining symptoms questionnaire was given to the players on the same day that their salivary specimens were collected. As a standard questionnaire, it is developed by the French Society of Sports Medicine and used frequently by the researchers [1, 2, 15]. The questionnaire involves 54 "Yes/No" question items in which the scoring is based on the number of "Yes" answers [1,16]. To administer the questionnaire, the objectives of the study were clarified to the players first. Then they were asked to honestly fill out the questionnaire. Although the

questionnaire is a standard one, to ascertain the accuracy of outcomes, its validity was discussed with psychology and physical education experts. The questionnaire's reliability was calculated through using Cronbach's alpha coefficient which yielded an r=0.95. All the measurements were done in the league mid-season.

Data analysis

Eventually, according to the objectives of the study and the rank-ordered nature of the collected data, descriptive statistics and Spearman Rank Correlation Coefficient were used to analyze the data. In this regard, SPSS 14 was utilized.

Results

Table 1 illustrates the mean and standard deviation of the players' age, height, weight, body mass index, and maximum aerobic power. Table 2 illustrates the daily average of cortisol concentration and average IgA concentration at different sampling hours. Table 3 demonstrates the correlation between cortisol and IgA, and the results of Psychological overtraining symptoms questionnaire.

Table 1: The participants' physical and physiological profile

Maximum aerobic power Milliliter per kg per min	Body mass index Kg/square height (m)	Weight (kg)	Height (cm)	Age
53.26 ± 2.79	22.97 ± 1.21	75.2 ± 8.09	180 ± 7.29	24.1 ± 3.79

Table2: Cortisol and IgA concentration at different sampling hours

Immunoglobulin A (IgA) Milligram/liter	Cortisol Nanogram/milliliter	Variables Measurement hours
	12.29 ± 5.5	8:00 A.M
235.43 ± 59.6	10.5 ± 4.5	11:00 A.M
	9.07 ± 4.6	5:00 P.M
235.43 ±59.6	10.62 ±1.6	mean

Table 3: The correlation between the questionnaire results and average cortisol and IgA concentration

Variables	Correlation coefficient	Level of significance	Result
Cortisol 8:00 A.M 11:00 P.M 5:00 P.M Mean	 0.71 0.62 0.32 0.61	 P<0.05 P<0.05 P<0.05 P<0.05	 * * --- *
IgA	0.51	P<0.05	*

*significant

Analyzing the results of psychological overtraining symptoms questionnaire

The administration of the psychological overtraining symptoms questionnaire to the participants in this study yielded a Mean of 11.9 (M= 11.9), the highest score being 19 and the lowest 7. In their study on the rugby players, Maso et al. (2002) used this scale and found a Mean of 9.5 (M=9.5) and yet in another unpublished study in 2000, they reported a Mean of 8.9 (M=8.9)- [1].

Discussion

The study was conducted to investigate the relationship between salivary cortisol and IgA concentration, and the results of psychological overtraining symptoms questionnaire in elite soccer players.

Many studies have affirmed that taking heavy exercises without appropriate rest intervals along with sports competition stresses may bring about alterations in the athletes' physiological, immunological, psychological and performance status, as a result of which the athletes may suffer

slumps [1,17,18]. This is caused by alterations in the internal bodily systems and in response to psycho-physiological stresses and pressures the most important of which include the negative adaptation of endocrine and immune systems. Some of the symptoms of this negative adaptation include an increase in cortisol concentration and a decrease in immunoglobulin.

As explained earlier, the overtraining may cause alterations in the athletes' psychological status as well. However, it has not yet been understood whether or not the athletes with psychological overtraining symptoms suffer the physical overtraining too. In recent years, the researchers have paid more attention to the instruments by which they can measure the exercise psychological pressures exerted upon the athletes. Standard questionnaires, developed to fulfill this aim, are one of the most influential instruments in this regard [11,19,20]. Benhadad et al. (1999) suggest that the psychological overtraining symptoms questionnaire can be an appropriate instrument for diagnosing the overtraining symptoms in the athletes who perform heavy exercises. In their study, they focused on some professional soccer players, volleyball players, and Karate players. They witnessed a significant, positive correlation between the questionnaire results, athletes' blood viscosity and plasma, as well as Hematocrit concentration respectively ($r=0.41$, $p<0.02$; $r=0.38$, $p<0.05$; $r=0.51$, $p< 0.01$)- [5, 24]. Also, they suggested that the athletes with overtraining symptoms had less iron, ferritin, and IGF attached to proteins [2].

The present study demonstrated a significant, positive correlation between the results of psychological overtraining symptoms questionnaire and cortisol concentrations at 8:00 A.M. and 11:00 A.M., and average cortisol concentration ($r= 0.61$, $p<0.0$ 1, table 3). The findings also demonstrated a significant, negative correlation between the results of the questionnaire and IgA concentration ($r=0.51$, $p< 0.01$, table 3).

The findings of the present study concerning cortisol were consistent with those of many preceding studies [12, 21, 22] though inconsistent with Maso et al. (2002) who studied the rugby players [1]. This inconsistency seems to be due to the particular characteristics of rugby, exercise type, and psycho-physiological peculiarities of individual players. The hyperactivity of hypothalamus-hypophysis-adrenal axis may cause an increase in the secretion of cortisol. Heavy endurance exercise in the long run may stimulate hyperactivity in the hypothalamus-hypophysis-adrenal axis and eventually cause a chronic cortisol overconcentration in body [23]. Also, various studies have confirmed that there is a significant correlation between cortisol concentration immediately after waking-up and bodily stress conditions [24,25]. According to the findings of the preceding studies and those of the present one, it seems that cortisol concentration may vary due to psycho-physiological pressures, which may eventually result in a chronic increase in cortisol concentration. The degree of correlation between the results of the questionnaire and the daily average of cortisol concentration would signify the relationship between psycho-physiological stresses and cortisol concentration.

Besides, the findings proved a significant, negative correlation between the results of the questionnaire and IgA concentration. Klentrou (2002) contends that heavy exercise may decrease immunoglobulin concentration and exposes the body to health risks particularly in the upper respiratory tract, while medium-intensity physical activities may lead in the IgA concentration increase which consequently decreases infection risks [26]. Gleeson (1999) maintained that heavy swimming exercise in the long run may cause a significant decrease in immunoglobulin concentration in professional swimmers [27].

Many studies, carried out on the relationship between the exercise pressure and the immune system performance, have confirmed that the heavy long-term physical activities and the lack of balance between the exercise pressure and rest intervals- as the athletes may experience in overtraining- would repress the immune system and eventually make the athletes vulnerable to infection. Indeed, recent studies proved a significant correlation between the exercise pressure and vulnerability to infection in endurance sports athletes [28,29]. The findings of the present study seem to be consistent with those of the preceding studies since the researchers found a significant, negative correlation between the questionnaire results and IgA concentration. Accordingly, the athletes with higher levels of psychological overtraining symptoms- as discovered by the interpretation of the questionnaire results- had less salivary IgA concentration.

Conclusion

With regard to the high correlation between the questionnaire results and cortisol concentration at 8:00 A.M., and the daily average of cortisol concentration as well as the significant, negative correlation between the questionnaire results and IgA concentration, the psychological overtraining symptoms questionnaire may be thought of as an

effective instrument to diagnose and prevent the athletes' overtraining disorder.

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Massive Amount of Practice and Special Memory Representations, "Special Motor Program Hypothesis"

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Abstract

The purpose of this study was investigating the contradiction between different types of memory representations. These viewpoints are based on generality and specificity of motor skill learning and the practice outcome. Sixteen players, divided into different groups of less- experienced group (less than six-month experience) to well- experienced group (at least eight years of experience) participated in this study. Each player performed 147 shoots in 3 sets and 21 blocks. The results of the current study showed that, in well-experienced group, there was a significant difference between predicted and actual free throw performance in the foul line. However, in less-experienced group, no significant difference was observed between predicted and actual free throw performance in the foul line. Significant differences were observed between predicted and actual free throw performance in the foul line may be explained by different reasons such as visual context, specific motor program, specific parameterization, etc. Further studies need to be conducted in order to explain them. However, many concepts of schema theory such as variable exercise, the storage problem and generality of the schema should not be viewed as certain. A New theory is needed in motor control in order to explain the special effects and specific memory representations in the massed practiced skills.

Keywords: Motor control, Schema Theory, Specific memory representations, Highly practiced skills

Introduction

The concepts of specificity and generality of motor skill learning have long been discussed in the field of motor control and learning. Many researchers have considered two basic ideas for motor learning. Some researchers believe that people learn a broad range of activities as non - specific way. In contrast, some others believe to the specificity in motor skill learning. Many years ago, Lashley, [1] investigated the generality idea with the writing pattern of alphabets with different effector systems. He asked the participant to write some words with closed eyes, using different effector systems such as preferred hand, non-preferred hand, and feet. Analyzing participants' writing revealed that there is a significant similarity between writings, when participant used different effector systems. Bernstein and others [2, 3] conducted similar study. They confirmed these results. Researchers concluded that handwriting skill is controlled by the general memory representations. Schmidt [4, 5] formulated these findings via Schema Theory and proposed the generality in motor skill learning. Based on this theory, people have skillful performance in different conditions, and these conditions are not specific to the practice condition.

Therefore, each practice attempt (for example throwing from different distances) provides brief information that could be applied for similar conditions. They have not been practiced before, and this supports the schema. In summary, schema consists of two basic parts in memory: the first part is GMP which is required for covering features of a group of movements (invariant features include the relative timing and force), and another part is recall schema which can support GMP during performing the particular action. Therefore, these two parts are interrelated and confine the need to separate program for each particular action. This feature of GMP resulted in solving storage problem [4, 5]. Many researchers have also showed that having different parameters in training results in generalizability to the conditions which have never been practiced before [6, 7, 8]. All these findings emphasize on the generality of motor skill learning

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and general memory representations.

On the other hand, specific viewpoints in motor skill learning proposed that when skill is learned, it would be sensitive to the practice "conditions". If the practice conditions in transfer test are changed, performance is disturbed and if the practice "conditions" and the transfer test are similar, the person's performance will have optimum quality. Researchers believe that "conditions" may be provided due to context specificity, processing specificity and sensory–motor specificity. These are three kinds of information, each of them resulting in the dependence of the learner, and consequently leading to specified learning for those conditions [9]. Sensory-motor specificity refers to the involvement of the information gained from the human senses (audition, kinesthetic, vision, etc) and the dependence of the learner. Poteau [10, 11] studied these findings: participants aimed a lever toward a target and different conditions (from complete vision to complete deletion of visual feedback) were tested. In other experiments, other conditions were applied. For most of them, the results were the same [12]. The results showed that if the transfer test is done without visual feedback, those get the best performance in transfer test that has learned with the least visual feedback during practice conditions. Ultimately, Proteau and other researchers proposed the sensory-motor specificity hypothesis, which states motor learning includes sensory–motor representation, in a way that sensory and motor information are joined and specify the learning. In this case, where sensory and motor specificities (such as vision) are similar in practice and transfer sessions, memory representation is to be specified, and this issue leads the skill to be performed in optimal way.

Context specificity (context-dependant learning) states that several environmental factors including the context with an action (environment's temperature, color, etc) affect the performance in transfer test. In transfer session, when the performer attempts to remember the information from practice conditions, if context information is similar, the performer will represent practice context information more easily [13]. In addition, the "home field" idea is the kind of specific context information [14].

Processing specificity is also another kind of them, which is sensitive to practice and transfer conditions. Processing specificity suggests that, if these processing are similar during practice and transfer test, participants will perform the best in transfer test. In other words, conditions that are effective for one transfer test may not be effective for another. In addition, Concepts such as superiority of constant practice over variable practice [15], random practice over blocked practice [16], and predominance of observing a learning model over a skillful model in observational learning of novice learners [17] emphasize the specificity of memory processing. Ultimately, this hypothesis proposes that similarities between involved processing in practice and transfer sessions are the most important factor in the performance of the learners.

Adams [18] formalized the findings related to the specificity of motor skill learning as a theory: closed loop theory. This theory suggested that learning motor skills is due to the specific memory representations. He proposed that all of the movements are performed by comparing response-produced feedback with a correction reference, which he called "Perceptual Trace". In addition, closed loop theory has many restrictions that are pointed out in several researches [9]. Recent researches have provided instances that imply the existence of specific memory representations. Keetch et.al [19] studied this hypothesis, using experienced basketball players (more than 10 years experience in basketball). They asked players to perform the free throws from the foul line and other six locations. Statistical analysis based on prediction of regression equation, showed that performance in the foul line (4.5-meter from basket) was higher than performance in other locations and the regression predictions. Schema theory- even with massive amount of practice-predicted no specific effects for any locations. However, the results of the research were contrary to the principles of schema theory. Simons et al [20] also studied the existence of special memory representations in college baseball players. They asked them to perform baseball throws from different distances. Baseball players always throw from standard distance, which it is 18.75 meters (or 61.5 feet) from goal - the so-called Pitch throw. They allocate most of practice for throwing from the 18.75 distance. Researchers evaluated accuracy in throwing from 18.75 meters and other eight locations (30cm distant between them). Data analysis revealed that pitch throw executed from the 18.75 meters distance was 42% more accurate than regression prediction. These results and similar findings in the basketball show the existence of the special skills. It has confirmed the specific memory representations. Hence, a new approach is founded in literature of motor control and learning. These new findings are very interesting, but the results will be trusty if they are tested in many different conditions and so verified. Otherwise, these results does not provide strong basis for new viewpoints in

motor control and learning. In order to do further investigations, we provide this experiment to explore the type of memory representations in the skilled and novice basketball players. In comparison with previous researches, this study is conducted with different participant and scoring system, which is presented in next session.

Methodology

Participants: sixteen qualified players were chosen for this study (based on the inclusion criteria), and were divided into experienced (8 player) and novice groups.

All Participants were male and between 17-22 years old. The participants in the novice group were freshman students in physical education, having the least experience (less than 6 months) in basketball skills. In experienced group, participants had at least 8 years experience in professional basketball. They have experienced the different posts. All of them have already been a member of Iran national basketball team or have been invited to the national basketball team in recent years. The task used for this study was the free throw in basketball, which should be thrown only from the foul line. The reason for selecting this task was extensive practices in this location and the little variability in designing of practice conditions [19]. Therefore, a target skill is chosen that the experienced players have practiced for many years (more than 8 years), with massed and constant practices.

Equipments: The experiment for this study was performed in a standard basketball court, with standard floor. Ring diameter was 45 cm; the height was 3.05 meter, with a standard net. A Molten ball that is used for international competitions was chosen for the experiment. Players performed throws from seven locations that were measured as making right angle with the board, toward the center of the court. The distance between each location was 60 cm so that the first location placed on 2.70m and the final location was on 6.30m far from the center of the ring [19]. Special tapes (5×25 cm) marked throwing locations. Throws were recorded by Sony camera (Sony-CCD-TRV238E-PALLHI8-3352553), and then were reanalyzed. When participants perform the experiment, with the exception of experimenter 1 (supervisor), experimenters 2 and 3 (responsible for returning the ball), experimenter 4 (recording scores) and the participant, no one was present in the court. Experimenter 2 and 3 returned the ball to the participants in a same way, after each throwing (chest pass without ground contact).

Procedures: Before starting the experiment, participants admitted their satisfaction by filling an informed consent form. Players executed free throwing from the foul line and six other locations with right angle toward to basket. Seven locations were marked on the floor: 2.70, 3.30, 3.90, 4.50 (foul line), 5.10, 5.70, and 6.30 meters (shape 1). Each player performed 147 throws in three sets (7 blocks per set). Participants were asked to perform seven throwing from each location. The players rest for five minutes after each set and then prepared to perform next set. Experimenters 2 and 3 (figure 1) were responsible for returning the ball to the players.

Five seconds rests were allowed for the participant between each trial. The players were required to finish a block of 7 throwing and then move to the next block. The experimenter 4 who recorded the scores, announced moving from one block to the next block (experimenter 4) by announcing the number of the distance (distances were numbered from 1 to 7). In order to remove the sequence effect, the sequence of throwing in each group was done counterbalance: Participants were randomly divided into two groups. In the each one, half of them executed their throwing from far to near locations, and other half from near to far (from the location 7 to 1 and vice versa). No emphasis was for any particular locations. Throwing from all locations was executed with the same effort. No dribbling or any other movement was done before throwing. the experimenter 4 recorded players' scores in the individual score table. Scoring was done based on a four-value system. Three scores were given, if the throwing turned into a goal with no ring contact. Two scores for turned into a goal with ring contact, if it hit the top of the ring, not turning into a goal, one score, and if it hit the bottom of the ring or did not hit it, 0 score was given to it [19, 21]. All participants were allowed to use visual feedback, (for example, they could see the ball flying), but they did not receive any other feedback Such as verbal or augmented one.

Results

The information from 147 throws executed was collected. In subsequent analysis, mean value of throwing scores for each distance was calculated. In addition, the average values of the performances were calculated for each player and for the distances of 2.70, 3.30, 3.90, 4.50 (foul line), 5.10, 5.70, 6.30 from the basket, for novice and experienced groups. These data were used to

calculate linear regression equation. Then, individual regressions were used to calculate predicted performance in the foul line. Using average amounts of intercept (a) and slope (b), regression equation was calculated for each group.

The amounts of actual and predicted performance in the foul line were compared using paired-samples t test. Results revealed that for the experienced group the predicted performance was 72.87 and the actual performance was 80.21 in the foul line. For the novice group the predicted performance was 42.30, and the actual performance in the foul line was 46.58. Analysis comparison of the results was done independently for each group. Results showed no significant difference between predicted and actual performance in the foul line, in the novice group, for $t(7) = 0.58$, $p > 0.05$; but there was a significant difference between predicted and actual performance in the foul line, in the experienced group, for $t(7) = 4.43$, $p < 0.05$.

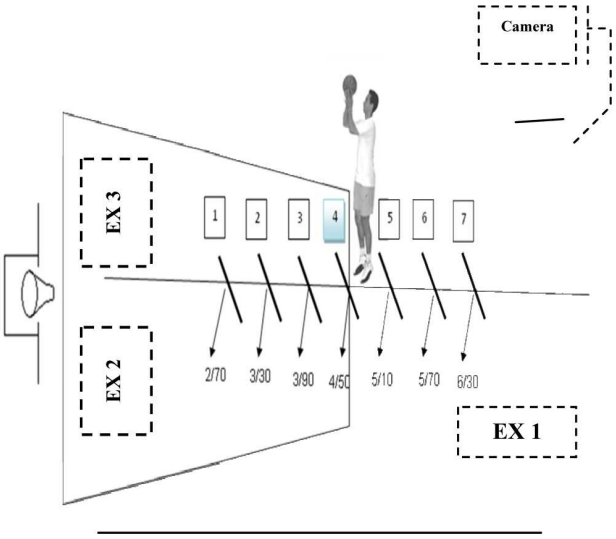

Figure 1: illustration of the court in during the experiment.

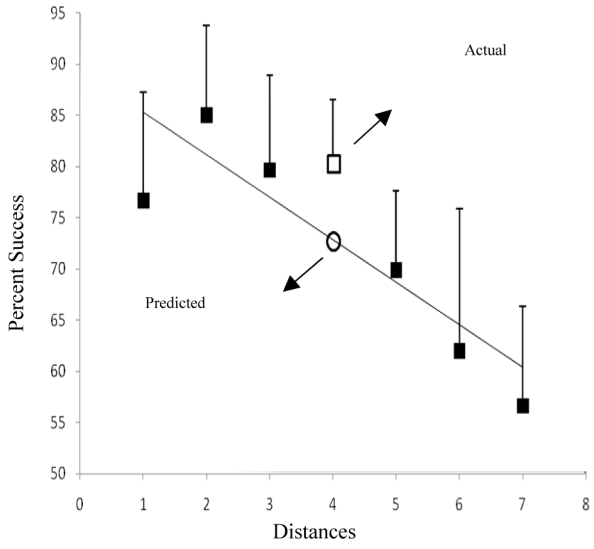

Figure 2*:* Comparison of actual and predicted performance in the foul line in experienced group (The filled squares represent the actual performance at the non-foul line distances; the unfilled square represents the actual performance at the foul line (4.5 meter); and the unfilled circle represents the predicted success at the foul line (4.5 meter).

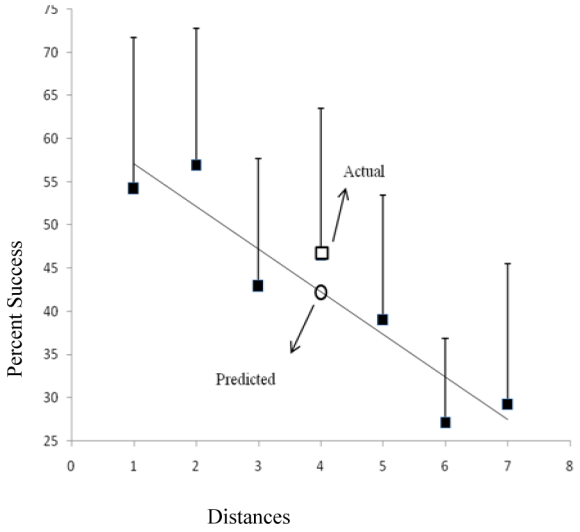

Figure 3*:* Comparison of actual and predicted performance in the foul line in novice group *(*The filled squares represent the actual performance at the non-foul line distances; the unfilled square represents the actual performance at the foul line (4.5 meter); and the unfilled circle represents the predicted success at the foul line (4.5 meter).

Discussion

Specific memory representations are evident in the performance of the experienced group in the foul line, and general representations are clearly observed in other locations (all distances except for the 4.5-meter distance) both in the experienced and novice players. Apparently, all the findings for the novice group and six locations for the experienced group confirm the general memory representations and general views in motor learning and result in representing general effects in all locations. Which factors cause this specific performance? Indeed, based on our current understanding of motor control and learning, these findings are challenging. However, specific memory representations and the simultaneous occurrence of the general effects would be related to the potential factors. New structures in memory are the probable factor that we will discuss it in the next paper that is performed on experienced dart player. However, some other factors can be the causes of the special effects in the 4.5 meter from basket. Also, these results would have subsequent effects in the motor control and learning principles. First, we refer to dynamical systems approach.

Dynamical systems approach

According to Dynamic Systems Approach, motor system tends to perform movements or actions as superior conditions and with minimum energy. These conditions are called stability. When an attractor state (this factor destructs system stability, for example Massive amount of practice) modifies the stability, motor system transitions to the new stable conditions [22, 23].

In the present conditions, massive amount of practice in the experienced basketball players works as attractor that disarranges stability of motor systems. But before and after the transition stage, the performance should be stable and fix (performance in 1 location called "closer area" and performance in 5, 6 and 7 locations called "further area") (figure 4). The expected stability in further area is quite logical, but condition in the closer area is challenging. Based on Fit's low [24] and principles of visual system, this state (closer area) is not considered as stability. It is expected that all experienced players perform the best own performances in the nearest location but we do not see any signals. Therefore, we see two critical stages:

1-First, the weak performance in the closer area

2-Second, the destruction related to massed practice in the transition stage.

This challenge is confirmed if we accept that dynamic systems approach principles support the class of skills (i.e. throws from different locations, as motor pattern do not alter). we discussed less about this issue in the literature. Now, how can we explain these two "consecutive unbalanced conditions" by Dynamic Systems Approach? We wait for the thoughts of motor control and learning scientist and theoreticians.

Visual context hypothesis

This probability considers that massed practices in the foul line have acquired specific visual capabilities that are specified to this location, such as visual context or sight angle. Many researchers

have confirmed the importance of visual cues in target skills [10, 11, 25, 26, 27]. Some of recent researches have studied visual attention in basketball throws [28, 29, 30]. Most of them have studied the importance of the online visual information during performing the movement. It has clarified that among visual variables, the experienced players learn the method of using the online visual information well, during performing the movement. Keetch et al [21] examined visual context hypothesis in another way. They asked experienced basketball players to execute free throws from seven locations that were 4.5 meters away from the basket (foul line distant). Results revealed that the performance of the players was better in the foul line (90') as compared to the locations with other angles. They discussed that a weaker performance in other locations might be due to a change in visual context and shoot angle. However, this hypothesis has not been considered yet. Based on the present finding, we propose "optimal visual area". As it is seen in the figure 2, massed practice causes in special performance in the foul line and nearest locations (2 and 3 locations). This hypothesis reveals the existence of visual area (not one special distance or degree) in the experienced players. Perhaps, investigation on this hypothesis is provided by the comparison of the experienced players' performance in the nearest environment of the foul line.

Gradual specification hypothesis

Memory representations are general in lower skill levels. Improvement in skill level cause in specialize memory representations [31, 21]. Several researches have studied the role of massed practices in memory representations. Some of these have supported this hypothesis [32, 33, 34]. In addition, in the novice players we can see general memory representations because of not enough practice in the foul line. However, considering immense complexities in human and central nervous system, and based on the existence of unlimited movements in the environment, it seems that memory representations are related to different mechanism (combination of two kinds of them in different conditions). Therefore, variations in memory representation seem to be clear. It is probable that there are different combinations of memory representations and different practice outcomes in different skill levels, different ages, and different development stages. This hypothesis is discussed in the next section.

Covariance Model of Memory Representations

What could we say about a covariance between memory representations and motor learning steps in different skill levels? Based on present findings and recent researches [19, 20, 21], there is probably a covariance between memory representations in motor skill performance and motor learning steps (and maybe individuals skill level and even their age) (figure 5).

In other words, at the first level of learning the motor skills, the high percentage of memory representations is general. With improving in the skill level, specific memory representations would enlarge in share, and general representations (represent as performance outcome) would be decreased. There is always a logical combination of general and specific memory representations, which is invariant in all motor learning conditions and steps. Also, other factors such as detraining, aging, physical injuries, damages, and similar factors reverse this process and contribute to increasing the share of general representations in memory. This model could be evaluated by examining the learning high practiced skills in retention and transfer test at different motor learning steps and other factors.

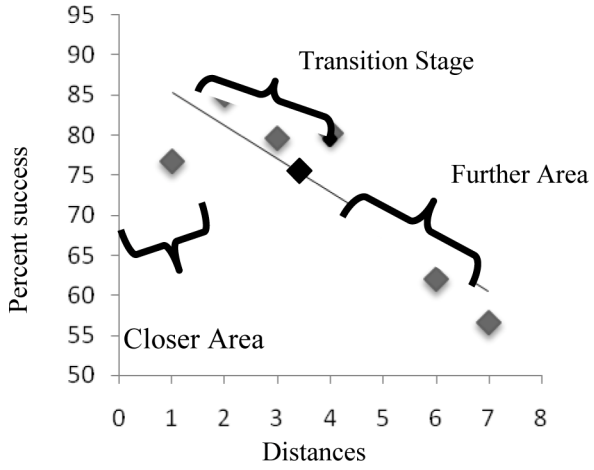

Figure 4: divided performances of experienced players in 7 locations to 3 sections based on dynamic systems approach.

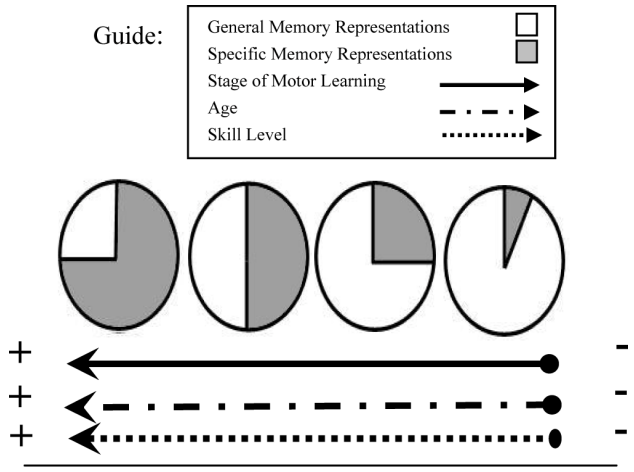

Figure 5: Possible relation between skill level, high level of practice and age with the type of memory representations

Which one: Variable or constant practice?

Priority of variable practice (even in close skills), has been described in many literature related to organization of practice for many years [4, 5, 7, 35, 15]. However, it is clear that due to restrictions in the basketball rules, and also because of the special conditions in performing the free throws (feet are not separated from the ground); basketball players rarely execute this throwing from other distances and angles (except for 90 degrees and 4.5 meters distance). This means the experienced players have practiced the free throws in a constant way through several years, and have no (or very little) variability during practices. Constant practice is probably more useful than variable practice for closed skills. However, how condition and context is the best choice for motor skill learning? This question will be answered in the future work, related to the organization of the practice session.

Special Motor Program hypothesis

Is it probable that there are the “special motor programs”? In relation to this issue, Keetch et.al [21] referred to "Special GMP" hypothesis, which this suggestion needs revision. It seems the name of this hypothesis raises some important questions. Schmidt [4, 5], by introducing Generalized Motor Program (GMP) instead of Motor Program (MP) proposed that storage problem and novelty problem could be answered. The reason for this claim is the great usage of GMP in a wide range of movements (a category of actions) and incredible generality, in comparison with the limited usage of MP in a particular action or movement. Now, is there the special GMP? This statement violates the basis of the GMP. It is better to refer to "special motor program" (or new structures in memory that differ from GMP), as the potential reason for the development of special effects in the players. However, proposing the "special motor program" hypothesis increases the probability of emersion of the motor programs. In addition, important challenges penetrate on general views, including schema theory.

Storage Problem, Forgotten or emerging again: "special motor program" hypothesis is an assumption now, and needs supplementary studies. If future researches confirm this hypothesis, it may result in the emergence of the problems such as "storage problem" and "novelty problem" again. This hypothesis would be tested by recording the brain activities before and during executing movements by the experienced players or recording the kinematics (i.e. relative timing) of free throwing performance in different locations (includung the foul line). If it is clarified in the future (existence the specific motor program), we hope that a new approach is formed in motor control and learning and indeed, many current concepts of general view will query.

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Keetch for their great help. In the end, I dedicate this study to the soul of my dear father, for he and my mother meant everything to me after God.

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Validation of the Physical Self-Perception Profile (PSPP) in a Sample of Depressed Danish Psychiatric Patients: Applying Factor Analyses

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Abstract

This study investigated the factor structure, validity, and internal reliability of the Physical Self-Perception Profile (PSPP) in Danish depressed patients. The mediating role of self-esteem in physical self-perceptions and negative affect relationship were examined. A sample of 96 Danish psychiatric patients completed the PSPP, the Rosenberg Self-Esteem Scale, the Beck Depression Inventory and the Hamilton Anxiety Rating Scale. The Danish version of the PSPP showed high internal consistency. Applying the exploratory and confirmatory factor analyses provided support for the PSPP to be used with depressed patients. The data were more consistent with the four-factor model than with a combined three-factor model. PSPP significantly discriminated between healthy subjects (n=46) and patients ($p<0.005$). A path analysis indicated the role of Physical Self-Worth as a mediator between the PSPP sub-domains and self-esteem and depression. The strong content validity and construct validity confirmed the PSPP application to depressed patients.

Key words: Physical self-perception, Self-esteem, Depression, Factor analysis, Path analysis

Introduction

Self-esteem is probably the most widely accepted indicator of emotional health and well-being [1]. Self-esteem is defined as an individual's positive or negative attitude toward the self as a totality and a measure of one's sense of self-worth based on perceived successes and achievements, as well as a perception of how much one is valued by others. Global self-esteem consists of four sub-domains, including academic, social, cognitive and physical self-esteem. Moreover, with the advent of multidimensional models, it is possible to measure all these different domains [2].

One dimension that has consistently emerged as being closely related to global ratings of self-esteem is the perception of the physical self [3]. In the physical domain, self-esteem is conceived as an important psychological outcome, correlate and predictor of physical activity behaviour [4,5]. Self-esteem is viewed as an important contributor to overarching, global perceptions of self-worth in multidimensional and hierarchical models of self-esteem [6]. Physical self-perception has consistently demonstrated moderately significant positive correlations with global self-esteem across the lifespan [7], and is potentially an influential factor on physical activity behaviour patterns [8]. It has been suggested that physical self-perceptions, as sensitive measures of real perceptual changes in the self [7,9], can be improved through participation in physical activity. Broadly speaking, Improvements in specific physical self-perceptions can be generalised into physical self-worth. In turn, physical self-worth is related to global self-esteem. Finally, increased global self-esteem can lead to a reduction of depression and anxiety [10,11].

Research on physical self-perception has been promoted by the development of assessment tools such as Harter's Self-Perceptions Profile for Adults [12], the Physical Self-Perception Profile (PSPP) [13,14], and the Physical Self-Description Questionnaire (PSDQ) [15].

The PSPP was developed to examine physical self-perceptions [13]. It represents a great contribution to the area of self-concept measurement. Using factor analysis extensively in the development of PSPP, Fox [14] found good support for high test-retest reliability of its subscales (*r* ranging from 0.81 to 0.88) and high internal consistency (α ranging from 0.81 to 0.92). This instrument has been widely reported on in the

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social, psychological, and sport psychology literature and has been translated into several languages, showing construct validity for different cultures [16, 17, 18, 19]. It has been featured in many published studies, and has been used effectively with a range of populations from college age through middle-age, for both males and females. The reliability and validity of the PSPP have been investigated in different populations and it is regarded as a well-established, reliable, and well-validated instrument.

From a clinical perspective, low self-esteem frequently accompanies psychiatric disorders and symptoms such as clinical depression, trait anxiety, neuroses, suicidal ideation, a sense of hopelessness, lack of assertiveness and personality disorders [20, 21, 7, 22]. Furthermore, there is evidence for an inverse relationship between level of self-esteem and severity of depression and anxiety in psychiatric outpatients and inpatients [18 , 23, 24].

The limited literature on the topic has indicated that hospitalised, clinically depressed patients show an increase in their initially low self-esteem, with decreases in depression, when participating in physical exercise interventions [24, 25, 26]. Because low self-esteem is often associated with low physical self-perception scores, there is particular interest in the exercise literature regarding the nature of the interaction between physical self-perceptions and affective states, including clinical depression [4, 27].

The physical self perception (PSP) variables, which have been identified as most susceptible to change through exercise, are physical conditioning, physical strength and physical self-worth. Body attractiveness, in contrast, appears to be the sub-domain least affected by exercise [7]. The application of these models, i.e., the relationship between exercise and PSP, has also been supported in clinical populations [13, 7, 11, 18, 28, 27]. However, there are few studies with strong methodology which have investigated the associations between exercise, self-esteem and negative affect [24, 25, 29]. While PSPs are more closely related to changes due to exercise than to global self-esteem measures, there is evidence that PSPs are directly linked to mental well-being, and so the effects of exercise on PSPs are likely to be of practical and clinical importance [7, 22].

However, not much research has been conducted that examines PSP and clinical populations with low self-esteem [4, 18]; therefore, more studies are required to investigate changes in emotional adjustment, reductions in depression, as well as increases in self-perception, self-esteem and life satisfaction. Fox [7] stated that clinical criteria associated with self-esteem or PSP levels have not been developed as yet, so it remains difficult to attach practical significance to self-esteem change scores. To date, few studies have examined the equivalence of the factor structure of the Fox and Corbin model across clinical population.

Taking into consideration the aforementioned points, this study aims to: (1) investigate the psychometric characteristics of the Danish version of the PSPP as applied to a clinically depressed population, to establish its factor structure and internal reliability and to test for discriminant validity when compared with normal adults; and (2) to investigate associations of the five sub-domains of PSP with global self-esteem, depression and anxiety to see if they are applicable to samples of depressed Danish psychiatric patients.

Method

Participants

Participants were 44 healthy adults (10 male, 22.7%, and 34 female, 77.3%) and 96 Danish psychiatric patients (28 male, 29.2%, and 68 female, 70.8%) from the DEMO trial [30] framework, who were recruited for the study at Bispebjerg Hospital, Copenhagen, Denmark. Patients were included if they fulfilled diagnostic criteria for mild or moderate depression, based on ICD-10 diagnostic criteria [31] (F32.0, F32.1, F33.0 and F33.1). Patients were evaluated by a psychiatrist. Overall, they had elevated depression scores on the BDI (94.8% >20, M = 23.19). Their ages ranged from 21 to 55 years (M = 38.2 ± 17). In clinical sample, 92.7% were Caucasian (n = 89), with the remaining 7.3% categorised as another ethnic origin (n = 7). In the healthy sample, 41(93%) were Caucasian and 3(6, 8) others.

Instruments

The PSPP was the main assessment tool administered in this study. Based on Harter's [2] work and Shavelson, Hubner and Stanton's [32] multidimensional self-concept model, consistent with Rosenberg's approach, Fox and Corbin [13] suggested a multidimensional and hierarchical model of PSP, postulating that global self-esteem is at the apex of the hierarchy, followed by a more general dimension of Physical Self-Worth (PSW) at the domain level, and four sub-domains; namely, Sport Competence (Sport), Physical Strength (Strength), Physical Conditioning (Condition), and Bodily Attractiveness (Body) at the sub-domain levels. These sub-domains were regarded as changeable aspects of the self [4] (see Figure 1).

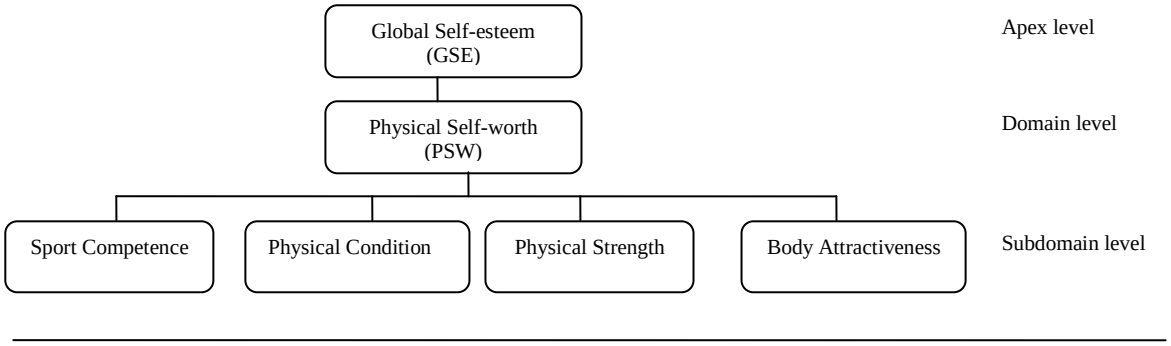


Figure 1: Hierarchal model of Physical Self-Perception Profile in physical domain adopted from Fox and Corbin (1989)

The PSPP is an instrument with 30 questions comprising five 6-item subscales. Each item has a four-point structured-alternative format. Fox [14] explained that this format was chosen to avoid the common problem of collecting socially desirable responses [14, 7]. Four of the subscales are designed to assess perceptions within specific sub-domains of the physical self: Sports Competence (SPORT), Physical Condition (CONDITION), Bodily Attractiveness (BODY) and Physical Strength (STRENGTH). A separate subscale is designed to measure general overall Physical Self - Worth (PSW). Scores range from 6 to 24 on each subscale, with high scores representing positive perceptions. Half of the items are worded in the negative direction.

Other psychometric tools used in the current study included the Danish versions of the Rosenberg Self-Esteem scale (SES), the Beck Depression Inventory and the Hamilton Anxiety Rating Scale. However, the PSPP is the only assessment tool that had not been translated into Danish. Therefore, back-translation techniques [33] were employed to develop a language-specific version of the PSPP. The PSPP was translated into Danish from the original English version by a research assistant (with a Master's degree), followed by a back-translation procedure into English by an independent bilingual expert who is a native English speaker. Finally, the back-translated version was compared with the original English version to check for accuracy and correct meaning. Three experts in psychiatry, sport psychology and medicine (two authors of this article) eliminated the incompatibilities and ambiguous words, resulting in further translation and re-translation, which was repeated until the versions were interchangeable.

Procedure

The data of the current cross-sectional study were collected as a part of the DEMO trial [30]. Recruitment and assignment of participants to research groups was a continuing process within the DEMO study, so that every patient who met the eligibility criteria joined the DEMO project, throughout the duration of the current study. Four months after the DEMO study began, we started the current study, and from 165 depressed participants identified by the DEMO staff, 96 patients in addition to 44 healthy consented upon the current study. The procedures of the study were explained to the DEMO participants and those who agreed to participate signed a consent form. Subsequently, the PSPP, SES, HAMA and BDI questionnaires were administered to the participants. A research assistant was available to provide instructions concerning how to complete the questionnaires.

Statistical analyses

Descriptive statistics and Pearson correlations with significance at the 0.05 level were used to calculate inter-item reliability of PSPP constructs. These are presented in Table 1.

To determine whether Fox and Corbin's model [13] is applicable to depressed Danish psychiatric patients, we used exploratory and confirmatory factor analyses. We applied exploratory factor analysis (EFA) to identify latent factors that explain the covariation among the PSPP constructs and the degree to which the variables are related to the factors. To assess how well the model fits the observed data, we used goodness-of-fit indices which included: (1) Chi-square (χ^2); the non-significant χ^2, established by its degrees of freedom, indicates how well the model fits the data; (2) the chi-square-degrees of freedom relative likelihood ratio (χ^2_{GoF} / df) which is not effected by

Table 1
Descriptive, reliability and discriminant validity statistics for PSPP subscales, Self-esteem, Depression and Anxiety scales

	Depressed(n=96)			Healthy (n=44)			Discriminant validity	
Scale	**M**	**SD**	**α**	**M**	**SD**	**α**	**Wilks' λ**	**F**
SPORT	10.29	3.44	0.87	14.64	3.38	0.57	0.75	44.82**
BODY	10.88	3.88	0.86	14.89	3.23	0.66	0.80	44.82**
STRENGTH	12.05	3.53	0.86	14.92	3.04	0.60	0.87	19.80**
CONDITION	9.95	3.10	0.81	13.79	2.63	0.32	0.74	46.45**
PSW	9.68	3.05	0.78	14.46	3.24	0.68	0.67	65.93**
SES	23.19	2.67	0.22	24.72	3.85	0.36	0.94	7.74**
BDI	29.74	7.39	0.80	2.64	3.18	0.79	0.22	194.20**
HAM.A	14.78	5.54	0.59	2.13	1.81	0.35	0.41	485.98**

SPORT= perceived sport competence; BODY = perceived body attractive; STRENGTH = perceived strength; CONDITION = perceived condition competence; PSW = physical self-worth; SES = global self-esteem; BDI = depression; HAM.A = Anxiety.
**P<0.01

sample size, but is based on the number of fixed model parameters [34], χ^2_{GoF} / *df* less than 2 indicates an acceptable fit of the proposed model; (3) Bentler's Comparative Fit Index (CFI) compares the improvement of the fit of a model over a more restricted model, which ranging from 0 to 1.0, with values closer to 1.0, indicates a better fit; (4) The root mean square error of approximation (RMSEA) which corrects for a model's complexity, its value of .00 and an associated 90% confidence interval (CI) indicate that the model exactly fits the data; and (5) The Standardized Root Mean Square Residual (SRMR) index is based on covariance residuals, with smaller values indicating better fit (0.00) indicates perfect fit[35].

Confirmatory Factor Analyses (CFA) were used to confirm that the hypothesised factor structure provides a good fit for the data, and to test individual parameters and the initial four-factor model [13] as a whole, which was identified in the EFA. Using the STATISTICA 7 (Statsoft, 2005) program to analyse the variance-covariance matrices for each sample, the researchers drew on a maximum likelihood procedure. Along with information about the significance of individual parameters, such as pattern coefficients and factor intercorrelations, CFA provides overall goodness-of-fit tests of the match between the theoretical factor structure and the data. We tested some additional indices in the CFA. The goodness of fit index (GFI); the Adjusted Goodness-of-Fit Index (AGFI) adjusts for the number of parameters (the fewer the better); The Normed Fit Index (NFI) [36] and the Non-normed Fit Index (NNFI) are incremental fit indices that test the proportionate improvement in fit. Values for the GFI, AGFI, NFI and NNFI are scaled to be between 0 and 1, with a minimum criterion of 0.90 as indicative of a relatively well-fitting model [35].

To measure the reliability of the PSPP, we used Cronbach's alpha (α) formula measuring how well the set of items measures the latent construct. To discriminate between depressed patients and healthy subjects, and to know on which variables they differ, discriminant function analysis and one-way ANOVA were employed.

Additionally, a path analysis (PA) was included to search for associations among PSPP subscales and self-worth, self-esteem, depression and anxiety, as the relations are described in the Van de Vliet et al. [28] model. The PA was analysed using the LISREL 8.52 (2002) program. To test the mediating role of variables (e.g., PSW) in the relationship between the PSPs and depression, the direct and indirect effects of first-order and partial correlations were calculated on one or more latent variables, with coefficients describing the strength of these relationships. The correlation matrix served as a database for the path analysis, and maximum likelihood was used as the method of estimation (see Table 2). To examine the hierarchical structure of the PSPP, partial correlation coefficients, controlling for physical self-worth and self-esteem among the PSPP subscales, depression and anxiety, were tested. For the sake of brevity, the associated table is not depicted in this paper.

Results

Descriptive statistics and internal consistency

The descriptive statistics concerning the variables are presented in Table 1. It appears as if patients had high levels of depression as measured by the BDI (94.8% > 20, *M* = 23.19) and low levels of self-esteem, as measured by the Rosenberg Self-

esteem Scale (SES), with most patients scoring around 20-25 (M = 23.19). Their anxiety was measured by the HAMA, and the mean score was less than 17 (M = 14.78), which is categorised as low to mild. The means of all the subscales of the PSPP were between 9.65 and 12.05, demonstrating a low physical self-perception.

Table 2: Associations between physical self-perceptions, self-esteem and negative moods in Danish psychiatric patients based on Pearson correlation coefficients

	(1) SPORT	**(2)** CONDITION	**(3)** BODY	**(4)** STRENGTH	**(5)** PSW	**(6)** SES	**(7)** HAM.A
(1) SPORT							
(2) COND	.57**						
(3) BODY	.38**	.58**					
(4) STRENGTH	.36**	.35**	.23*				
(5) PSW	.50**	.70**	.67**	.60**			
(6) SES	.26**	.22*	.29**	.18*	.41**		
(7) HAM.A	.100	.051	.085	-.014	.066	.088	
(8) BDI	-.22*	-.29**	-.44**	-.27**	-.34**	-.18*	.26**

** p< 0.01; * p< 0.05 (1-tailed). SPORT = perceived sport competence; CONDITION = perceived condition competence; BODY = perceived body attractive; STRENGTH = perceived strength; PSW = physical self-worth; RSE = global self-esteem; BDI = depression; HAM.A = Anxiety

Correlations among the PSPP subscales were fairly consistent with our expectations. In particular, the strong correlations with the PSW as a superordinate domain factor (r = 0.50 to r = 0.70, p < 0.01), on the one hand, and the correlations between PSW and depression (r = -0.34, p < 0.01), on the other hand, demonstrated the robust mediating role of PSW [14, 26, 13, 18, 28]. The present research contradicted the previous ones only in the RSE. None of the PSPP subscales were significantly correlated with self-esteem. Even the association between PSW and RSE didn't reach significance (r = -0.10). However, these correlations were extinguished when the effects of PSW were removed in a second partial correlation. Accordingly, the associations between SPORT, CONDITION, BODY, STRENGTH with self-esteem (r = 0.02,-0.04, -0.12,-0.14, respectively) and SPORT, CONDITION, STRENGTH with depression (r = -0.06, -0.08, -0.09, respectively) became non-significant when the effect of PSW was removed. However, the association between BODY attractiveness and depression remained significant (r = -.0.30, p = 0.001).

To see how the associations between physical self-perception with depression and anxiety could be influenced by global self-esteem, partial correlations were also computed, controlling for self-esteem. The correlations between SPORT (r = -0.22, p < 0.05), CONDITION (r = -0.28, p = 0.01), BODY (r = -0.43, p < 0.0005), STRENGTH (r = -0.25, p = 0.007) and PSW (r = -0.33, p < 0.001) with depression still remained significant.

Exploratory factor analysis

The PSW subscale, as a measure of global self-perception of the underlying sub-domains (e.g. SPORT, CONDITION, BODY and STRENGTH), was eliminated from the analyses because of its spurious loading across the factors, as earlier EFAs conducted by Fox indicated [14]. Therefore, our application of EFA indicated a four-factor structure model. As a prerequisite, a Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Bartlett's test of sphericity based on the correlation matrix were computed (KMO = .836; Bartlett's Test: Approx. Chi-Square = 1135.78; df = 276, p <.0005) and showed a good fit for factor analysis. The extraction method was Principal Components Analysis (PCA) using varimax rotation with Kaiser Normalisation converging in 5 iterations. Four components were extracted. Examining the anti-image correlation matrix in which there is a KMO statistic for each individual variable, we kept the four factors in the model, with coefficients ranging from 0.68 to 0.90. The criteria for retaining factors were based on Kaiser's criterion, with unrotated eigenvalues of approximately 1.0 or greater, and a scree test. The analysis revealed 4 components which were extracted (for more detail see Table 3).

Compared with Fox's PSPP four sub-domains, the current analysis for items in a 4-factor extracted model indicated some discrepancies. Items 2, 12, 17, 19, 23 and 27 loaded on more than one factor. Particularly, items 2, 12, and 17 were loaded more

highly on SPORT than on CONDITION.

Table 3: Exploratory Factor Analysis (EFA): Principal components factor loading for PSPP items of depressed samples

Subscales	Item			Factor			
		Mean	S.D	1	2	3	4
SPORT	1	1.81	.82	.81			
	2	1.38	.58	.53			
	6	1.48	.65	.69			
	11	1.84	.78	.79			
	12	1.41	.62	.56			
	16	1.56	.68	.81			
	17	1.99	.82	.50			
	21	1.96	.85	.70			
	26	1.61	.72	.67			
BODY	3	2.01	.96		. 87		
	8	1.72	.84		.73		
	13	2.00	1.02		.73		
	18	1.95	.84		.72		
	23	1.46	.61		.50		
	28	1.76	.77		.78		
STRENGTH	4	2.15	.89			.80	
	9	1.98	.77			.85	
	14	2.19	.88			.60	
	19	1.68	.58			.60	
	24	1.85	.73			.83	
	29	2.00	.64			.70	
CONDITION	7	1.80	.86				.81
	22	1.89	.86				.73
	27	1.46	.63				.58
Rotation Sums of Squared loadings			Total	5, 3.8, 3.6, 2.5			
			% of Variance	20.7, 15.7, 14.9, 10.4			
			Cumulative%	20.7, 36.4, 51.3, 61.6			

Confirmatory factor analysis

The results of the CFA for a 4-factor model are summarised in Table 4.The chi-square test (χ^2_{GoF}) for the 4-factor model was 409.48 with 246 degrees of freedom, which was statistically significant ($p < .001$). The χ^2_{GoF} / *df* of 1.66 indicated acceptable fit of the proposed model. Examining the other fit indices, and according to the correlated subscales, the CFI was 0.84, and the SRMR was 0.10, both indicating acceptable model fit. The RMSEA was 0.08 (CI = 0.07 to 0.10), which is well above the cut-off for good model fit. The GFI was 0.72 and its variant AGFI was 0.65. Finally, the incremental fit indices of NFI and NNFI were 0.68 and 0.81, respectively. As all the above indices are scaled to be between 0 and 1, with larger numbers indicating a better fit and with a minimum criterion of 0.90, there is combined evidence concerning how well the current model fits the data.

Since the results of the EFA using the 4-factor extracted model demonstrated some conflict with Fox's PSPP four sub-domains, a model of three-factors was also applied. In this second model, two different subscales, SPORT and CONDITION, emerged as a new combined factor namely COND-SPORT. The results of the CFA for the PSPP three-factor model are presented in Table 4.

The CFA outcomes on the 3-factor model revealed that the chi-square test (χ^2_{GoF}=464.25, *df* = 246) was statistically significant ($p < .001$). Furthermore, the χ^2_{GoF} / *df* of 1.86 indicated an acceptable fit of the proposed model to data. Other fit indices, including the CFI (0.78) and the SRMR (0.11), indicated acceptable model fit. The RMSEA of 0.10 (CI = 0.89 to 0.11), GFI (0.72), AGFI (0.65) as well as the NFI and NNFI (0.63, 0.76, respectively) revealed a good fit for the 3-factor model with the data.

Comparing the results for these two models indicated that although both models displayed acceptable fit with the data, the data were more

consistent with the 4-factor model.

differences were found for both groups (chi square = 227.88, df=8, p<0.0005).

Table 4 :
Confirmatory Factor Analysis (CFA) statistics for PSPP 4-Factors (left column), PSPP 3-Factors (right column)

PSPP Four Factors				**PSPP Three Factors**			
Subscale	Items	Factor loadings	T-values	Subscale	Items	Factor loadings	T-values
SPORT	1	0.70	11.00		1	0.55	6.64
	6	0.74	13.15		2	0.42	7.44
	11	0.76	13.98	COND-	6	0.44	6.77
	16	0.88	24.34	SPORT	7	0.35	3.70
	21	0.65	9.29		11	0.59	7.88
	26	0.65	9.41		12	0.45	7.46
STRENGTH	4	0.71	11.34		16	0.54	8.63
	9	0.79	15.07		17	0.50	5.93
	14	0.56	6.85		21	0.56	6.51
	19	0.63	8.54		22	0.31	3.28
	24	0.84	18.26		26	0.42	5.60
	29	0.64	8.64		27	0.42	6.64
BODY	3	0.77	14.28		4	0.64	7.173
	8	0.68	10.25		9	0.61	8.241
	13	0.69	10.66	STRENGTH	14	0.50	5.305
	18	0.77	14.33		19	0.37	6.072
	23	0.70	10.84		24	0.61	8.925
	28	0.70	10.70		29	0.40	6.135
CONDITION	2	0.81	17.25	BODY	3	0.76	8.29
	7	0.51	5.76		8	0.56	6.54
	12	0.78	15.36		13	0.72	7.09
	17	0.59	7.45		18	0.65	7.89
	27	0.42	4.34		23	0.41	6.73
	22	0.74	12.99		28	0.54	7.00
χ^2_{GoF}		409.475		464.252			
df		246		249			
χ^2 GoF / *df*		1.66		1.86			
P-level		0.000		0.000			
RMSR		0.101		0.111			
RMSEA (Lower-upper CI)		0.086 (0.070 and 0.101)		0.103 (89% and %117)			
CFI		0.835		0.783			
GFI		0.716		0.681			
AGFI		0.654		0.616			
NFI		0.677		0.634			
NNFI		0.813		0.757			

To have high reliability with different populations, because we translated it into Danish and used it in a clinical population, its reliability was determined. The internal consistency and reliability of the PSPP was good, as indicated by Cronbach's alpha coefficients (α ranged from 0.81 to 0.87).

Discriminant analysis

Discriminant validity at the level of patients vs. the normal population has been shown by a few studies [18]. Discriminant function analysis was used in our study to test the ability of the PSPP to statistically separate the healthy and depression groups. As shown in Table1, significant overall

One -way ANOVA revealed that both samples were significantly different on each predicted variable. A canonical R correlation of 0.91 was obtained. When function scores were used to classify subjects as depressed or in normal health, the function correctly classified 95 out of 96 as depressed and 39 out of 44 subjects categorized as healthy. Overall, the classification was done with 99.3% precision. In the structure matrix, the pooled within-group correlation coefficients indicate that PSW (-0.32) subscale best discriminates among the groups, whereas Strength (-0.18) and RSE (-0.11) improve the differentiation slightly. The criterion validity and the strength of the association provide

the PSPP with strong content validity and construct validity.

Path Analysis

Fox and Corbin's 4-factor model [13] was validated on the Danish clinical data set using confirmatory factor analysis; thus, in this third phase of the analyses, a path analysis was applied to search for direct and indirect paths from PSP sub-domains to self-esteem, depression and anxiety. Although the Fox model has stimulated research in physical self-perception, it still needs to be tested in the clinical area.

Self-esteem has been regarded as a mediator between physical self-perceptions and affect [37, 5, 3]. On the other hand, it is suggested that independent from self-esteem, physical self-perceptions through PSW produce a direct effect on mental well-being [3, 4], clinical depression and/or anxiety [18, 28]. In this regard, and based on the work by Harter [36], Sonstroem and Potts [38], Van de Vliet et al. [28] recently investigated a new model of physical self-perception and negative affect on psychiatric patients.

To provide more evidence for the connection between physical self-perceptions and mood disorders, we replicated a path analysis with our data, using a model that consists of the Van de Vliet model [28] with Fox's four subscales of the PSPP (Figure 2). Path analyses were conducted separately for directions from PSP sub-domains to depression and anxiety. Hence, for the directional effects, we analysed the unidirectional effects from perceptions of Sport, Condition, Body attractiveness, and Strength, to (a) physical self-worth and self-esteem, and (b) depression and anxiety separately.

The inter-correlations are reported in table 2 for the measured variables. Figure 3 depicts the results of the conceptual path diagram for physical self-perceptions, self-esteem and depression. The bottom middle section of the figure shows the fit indices used to evaluate the adequacy of this model. With a Normal Theory Weighted Least Squares χ^2 of 15.19 and $p = 0.056$, there is high probability that this model fits the population (i.e., models with $p > 0.05$ are more likely to fit the population).

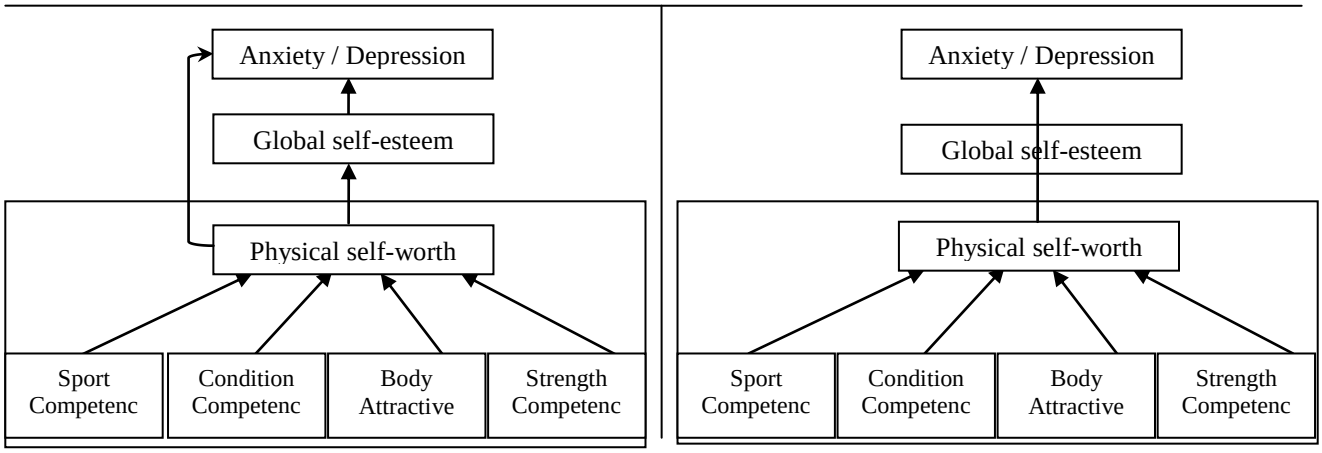
Further measures of fit were examined for all indices measuring the relative amount of variance and covariance accounted for by the model [13]. The comparative fit index (CFI = 0.97) compares the model with a null model, which assumes that the variables are uncorrelated. As the GFI approaches 0.96, the fit improves. This model appeared to fit well enough, with the GFI and CFI both greater than 0.90. Additional indices also indicate that the model fits the data appropriately: the appropriacy of Fit index adjusted for degree of freedom (AGFI) was 0.85; RMSEA = 0.099 (90% CI, 0.0 to 0.17; *P*-Value = 0.13); SRMR = 0.05.

The same analysis was done for the model with four paths from PSP sub-domains to anxiety. Model of fit statistics confirmed the model fit to the data, as $\chi^2 = 4.16$, $df = 8$, $p = 0.84$, CFI = 1.00, and the RMSEA was 0.000, with 90% CI (0.00, 0.07, *P*-Value for test of Close Fit was 0.91). Further support for the fit of the model can be seen in the SRMR (0.026), GFI (0.99), and AGFI (0.96) indices, indicating that the model fits well. However, none of the hypothesised paths from PSW (0.04) and self-esteem (0.07) to anxiety was significant.

To explain the direct and indirect effects among the variables, equations in the structural portion of the model (diagram in Figure 3) specify the hypothesised relationships among latent variables. In the model depicted in Figure 2, it is hypothesised that physical self-worth mediates the effects of the four specific sub-domains of physical self-perception on global self-esteem and depression. As Figure 3 reveals, the path coefficients from all variables (i.e., CONDITION, BODY and STRENGTH) to PWS are significant with the exception of one, from SPORT to PWS ($p > 0.05$). As is shown, the highest effect is for STRENGTH and there is a weaker effect for CONDITION to PSW (0.38 and 0.34, respectively). Moreover, the path coefficient is significant from PSW to RSE ($p < 0.05$). The direction from PSW to depression is also significant (0.32). With both direct and indirect effects, PWS fully mediates the impact of physical self-perception sub-domains on self-esteem and depression. However, the path coefficient from self-esteem to depression was not significant ($\alpha = 0.05$, $t = -0.49$).

From among the total and indirect effects on the model, the direct effect accounts for (1) paths of SPORT, CONDITION, BODY and STRENGTH to PSW, (2) then from PSW to self-esteem, (3) depression and (4) anxiety. The coefficients describing the strength of the unidirectional relationships were significant for the pathways from the physical self-perceptions of CONDITION, BODY and STRENGTH to PSW (0.34, 0.37 and 0.38 respectively). The exception was for SPORT, which indicated a low coefficient of 0.03. The path from PWS as a predictor variable to self-esteem (0.41) and depression (-0.34) was also significant.

Figure 2: Conceptual Diagram for Paths on hierarchal model of Physical Self-Perception subscales to depression and anxiety (after Van de Vliet et al., 2002: 311-312)



Path analyses permit us to estimate indirect relationships from all four physical self-perception sub-domains mediated by PWS and self-esteem variables in the analysis as well as direct associations. They are not directly defined in the conceptual model and are formed based on the correlations [34]. Hence, the non-significant coefficients for indirect relationships from CONDITION, BODY and STRENGTH (0.14, 0.15 and 0.15, respectively) and the lowest one from SPORT to self-esteem (0.01) are considerable. The weak direct effect from self-esteem to depression (-0.05) demonstrates that independent from self-esteem, the physical self-perceptions through PSW produce an inverse effect (-0.34) on clinical depression [28]. None of the indirect or total paths from physical self-perceptions through physical self-worth to anxiety were significant.

These results partially confirm the hypothesis suggested for the role of physical self-worth as a mediator between the physical self-perception sub-domain and negative affect [28], except for depression.

Discussion

Low self-esteem is a major feature of clinical depression, and it is assumed that people with low self-esteem may develop psychiatric disorders such as depression. On the other hand, low self-esteem is often associated with low physical self-perceptions, and the valid assessment of self-esteem in psychiatric patients has significant clinical implications. However, few research studies have been conducted on physical and global self-perceptions in depressed populations [18, 28, 10]; thus, the present study was conducted to test such relationships in depressed patients.

The first goal of this study was to validate the Danish version of the PSPP; thus, we examined the validity and reliability of its factor structure in a representative clinical sample. The scale's internal consistency and reliability were strong (α = ranged from 0.81 to 0.87). The PSPP also shows adequate discriminant validity to discriminate patients with depression from healthy group. The partial correlations among the PSPP, global self-esteem and depression revealed the hierarchical structure of the PSPP. Except for body attractiveness competence [7], all other PSPP subscales became non-significant in terms of their correlations with self-esteem and depression, when the effect of PSW was removed. In addition, this strong inverse direction from body attractiveness to depression was explored in a secondary path analysis. Fox [14] reported that body attractiveness is not closely associated with activity involvement levels and has negative associations with dieting behaviour in one of his research samples.

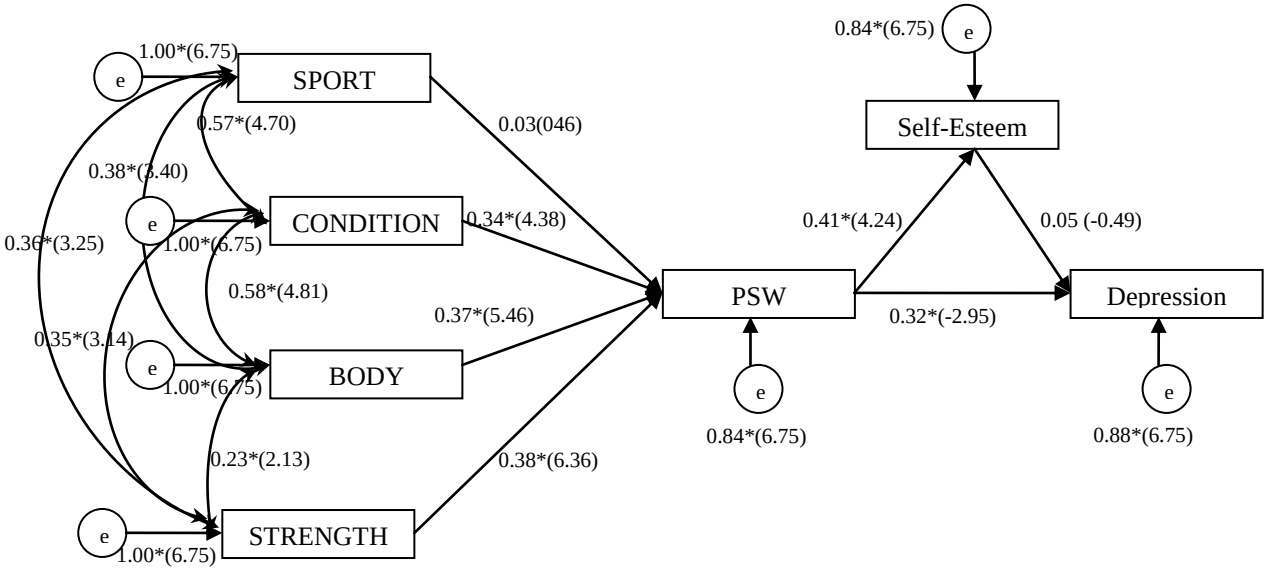
Numerous investigations have indicated a strong inverse correlation between level of self-esteem and level of depression, more specifically suggesting that low self-esteem is an accompanying factor of depression [24, 6, 28]. Regarding the nature of the interaction between physical self-perceptions and affective states [13, 4, 27], we examined the mediating role of self-esteem between physical self-perceptions and depression. The associations were still significant for depression. This confirms that the PSPP subscales, independent of self-esteem, directly affect the depression as well. Additionally, no significant associations between PSPP sub-domains and anxiety were observed even with the partial correlations.

Consistent with Fox's [14] findings, the results of our EFA analysis indicated that four factors emerged, with all significant factor loadings ranging from .50 to .87. However, the application

of factor analysis to our study exhibited some cross loading among factors, such that six items were loadable on more than one factor, and three items from CONDITION loaded on the SPORT subscale. Additionally, the CFA indicated that both the three-factor and four-factor models fit the data adequately; however, the data were more consistent with the four-factor model.

One limitation, which we dealt with, was the sample size. The total sample size was below the minimum suggested sample size of 200 (based on findings from meta-analyses). The findings were limited by sample selection in that the majority of the participants were female.

Figure 3: Model depicting the hypothesised associations among physical self-perception sub-domains, self-esteem and depression among Danish depressed samples. Coefficients and *t*-values in parentheses are provided for the significant paths. The circled "e" indicates the disturbance term associated with each endogenous variable of the path analysis model.



Chi-square= 15.19, df=8, α=0.056, RMSEA=0.099, *p<.05

Several explanations can account for this finding. Cross-cultural and language differences may have precluded distinguishing precisely the differences between exercise and sport. Moreover, because of less engagement in physical activity, sedentary depressed people may not be able to differentiate between distinctive aspects of physical activity, exercise and sport.

With respect to the secondary aim of the study, we applied a path analysis to examine the associations among *PSP* subscales, PSW, self-esteem, depression and anxiety. The hypothesised model suggests that physical self-perceptions of sport, strength, body attractiveness and condition competence influence self-esteem through physical self-worth, and these variables directly and indirectly influence negative moods; the data fit this model. Three of the hypothesised paths to depression were statistically significant. The only path not significant was from sport competence. Path analysis revealed, however, that the direct effect of physical self-perception on mood disorders was greater than its indirect effect through self-esteem.

The low number of male participants (n = 29) precluded the factor analysis being done based on gender differences. The model should be re-tested with a larger sample size of both males and females.

The findings of this study have indicated that the Danish version of the PSPP is appropriate for use with clinically depressed people to assess their perceptions of the physical domain, as the results provide evidence for its reliability and validity. And finally, the results support the functioning of PSW as a generalised outcome of perceptions in the four sub-domains and as a mediator between the sub-domains and global self-esteem and depression.

Perspectives

The present study provides an evaluation of the PSPP, a psychometric measure of the physical self-perception construct in the physical domain, using a sample of depressed Danish psychiatric patients. Although originally the validity of the PSPP was established for college-age students [13], according

to our findings, it is possible to administer the PSPP to a non-physically active population such as clinically depressed people. However, we recommend that researchers in the domain of exercise psychology modify and develop a shorter version of the PSPP. Some items of the instrument may need to be revised and perhaps omitted in order to maintain similar meanings for a non-healthy population (i.e., individuals with mood disorders). Generally, clinically depressed people are sedentary and may be reluctant to participate in sports activities; therefore, there is particularly a need to replace the SPORT competence items with a new subscale.

People who are in poor physical condition, such as those people who have been diagnosed with mood disorders, are more likely to benefit from exercise participation; thus, the greatest improvements in self-esteem and self-perception can occur in this group. This has implications for professionals in exercise work.

Further longitudinal research is needed to examine the development of physical self-perceptions across broader clinical samples compared with non-clinical samples. The use of a longitudinal research design would help to clarify factors that influence depressed people's self-perceptions and help to reveal the impact of these perceptions on other outcomes. This will provide important evidence for the relationship between exercise, PSPs and depression, but in order to determine whether a causal relationship exists between exercise and changes in depression, clinical trials that manipulate exercise and examine change in self perceptions, self-esteem and depression scores over time are also needed.

The results of the present study suggest that the PSPP model holds for clinically depressed out-patients. There is enough evidence for the effect of exercise on aspects of PSPs, other than self-esteem, and they are directly linked to mental well-being [7].

We plan to use the PSPP to assess the long-term effects of different forms of exercise on self-perceptions, self-esteem and depression at intervention and follow-up in the clinical setting.

Acknowledgment

We would like to express our appreciation to Dr. Mohammad Asghari, a bio-statistician from Tarbiat Modarres University, Iran, who provided statistical assistance with this study.

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The Comparison of Sport Injuries of Professional and Nonprofessional track and field, in Iranian Female Students

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Abstract

The aim of the research is to study the differences between sport injuries made at professional and nonprofessional track and field in Iranian female students. The present study is a descriptive and causative-comparative one, using retrospective technique. This study was conducted to determine the amount of injuries in professional and nonprofessional track and field female athletes participating in Country-wide Students competitions in 2009, and to compare the injuries in these two categories. The data related to all competitors including weight, age, athletic record, and also the type of injury and the location injured were recorded using a researcher-made closed questionnaire with Cronbakh α (α=0/9), the validity and reliability of which were reexamined on the statistical sample. The data were analyzed using U-man Whitney descriptive and inferential statistics and SPSS-11 software. Considering the findings of the research, no significant difference was found between the injuries in different body parts, in professional and non-professional groups. (p=0.577, u=170.5). Most injuries were that of muscle-tendon injuries, and the lower limbs were determined as the most vulnerable parts. In the present study, no significant difference was found between injuries in professionals and nonprofessionals. Perhaps one reason is that in Iran, athletes do not exercise constantly, and no demanding and exhausting exercise is done by track and field players. Further research should be done on the isssue to determine if there is any difference between professionals and nonprofessionals in terms of injuries, and for the reasons as well, to provide strategies to decrease the injuries in both groups. Results of this research can be used in pre-semester examinations to prevent from further subsequent injuries, considering the strategies available. Consequently, the most important usage of this research is to prevent the occurrence of subsequent injuries by identifying apt injured athletes, and to provide preventive strategies.

Keywords: Sport injuries, Track and Field, Professional, Nonprofessional

Introduction

It is necessary for all age groups to have a healthy lifestyle [2]. People participate in physical activity programs due to various reasons, but notwithstanding all benefits of regular physical activity, the risk of injury in competitive and championship sport is undeniable [3]. The issue of athletic injury has become a concern for athletes, coaches, and athletic authorities [4]. Lack of sufficient attention to the prevention of injuries in students can entail numerous undesirable consequences, including physical and psychological problems, and disappointing the students [5]. Among various sport fields, track and field is one of mother sports. Due to various motional paradigms and the variety in this field, injuries frequently occur, leading probably to interruption of exercises and even quitting the competition battles [1].

However, considering the increasing number of people participating in athletic activities, it seems necessary to find strategies to prevent and decrease athletic injuries [6-7]. Hence, it is possible to prevent injury factors through recognition of athletic injuries [1]. And introduction of research findings makes planners, informed of the probability of the occurrence of injuries, so they may restrict and/or control the injury factors through necessary measures and curtail their vulnerability. Much of athletic injuries are preventable, but if we do not contrive solutions for them, the occurrence of athletic injuries increases. Hence it is necessary for coaches and physical educators to get familiar with injuries and athletic losses, preliminary treatments and prevention of athletic injury development [8].

In the researches done by Rezvani on the high schools' students, and by Ebrahimi Atri et al on female elite gymnastics students, injuries among the research samples were reported to be high [9-

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10]. The purpose of this research was to answer the question that whether the background and duration of athletic activity and being professional or nonprofessional can affect the injuries in different parts of the body. Since little research has been done on sport injuries, particularly on female students, further research seems necessary on the issue.

Methods

Current research is descriptive, causative–comparative, which applied retrospective technique. The society which has been studied includes all female students who participated in university championship in 2009. The statistic sample included 133 female students who were professional in track and field and had more than two years of continuous exercises, of the mean age of (22/01±2/1yr), the mean weigh of (55/61±7/7 kg), the mean height of (165/12±5/2 cm) and the mean body mass index of (20/36±2/5 kg/m2), and nonprofessionals who had a maximum of two years of continuous exercises, the mean age of (22/48±1/6 yr), the meanweigh of (55/32±8/8 kg), the mean height of (164/68±12/75 cm) and the mean body mass index of (21/07±2/69 kg/m2). Data collection instrument is a researcher-made closed questionnaire with Cronbakh α (α =0/9). A schedule was prepared to gather the information and then the questionnaires were completed by the students. Before proceeding to complete the questionnaire, necessary recommendations and guidelines were provided to facilitate the completion thereof. The data were analyzed by spss version 11, using descriptive and inferential statistics. (Mann Whitney u).

Results

Findings of research on the prevalence of injuries in different limbs, as shown in figure 1 indicates that head and face, with 6 percent in professionals and 3.2 percent in nonprofessionals, were the least, and lower limbs, with 64.7 percent in professionals and 53.2 percent in nonprofessionals were the most vulnerable areas. Meanwhile, in professionals trunk was the affected area by the rate o 11 percent of injuries. In professionals the injury percentage in upper limbs was 18% and in non-professionals was 28%.

Research findings regarding injuries in different parts of the body:

The information provided in table 1 indicates that both in professional and nonprofessional groups, most injuries have occurred in nose and cheek in the head and face, in the trunk in both groups, most injuries were related to scapula, in upper limbs most injuries were related to the elbow, and in lower limbs most injuries were in the knee, toe and foot.

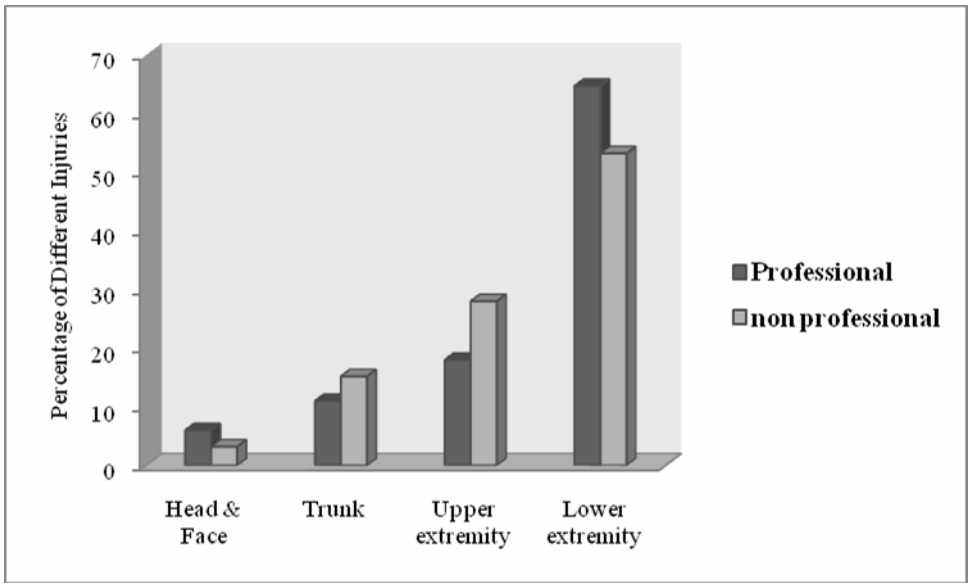

Figure 1: Determining the Percentage of Different Injuries in different limbs in research samples

Table 1: Variance Distribution of Different Types of Injuries in Research Sample

Non-professional				Professional			
Injury locality	**Injured organ**	**Percentage**	**Total**	**Injury locality**	**Injured organ**	**Percentage**	**Total**
Head and face	Eye	0	3.2	Head and face	Eye	2	6
	Nose	1.6			Nose	2	
	Lower jaw	0.8			Cheek	1	
	Mouth	0.8			Mouth	2	
Trunk	Mouth	3.2	15.2	Trunk	Neck	1	11
	Upper back	0			Upper back	1	
	Lower back	2.4			Lower back	2	
	Scapula	5.6			Scapula	4	
	Rib	0.8			Chest	1	
	Stomach	3.2			Stomach	2	
Upper extremity	Shoulder	4	28	Upper extremity	Shoulder	1	18
	Clavicle	2.4			Clavicle	2	
	Arm	4.8			Arm	3	
	Elbow	4.8			Elbow	4	
	Forearm	2.4			Wrist	1	
	Wrist	4			Palm	4	
	Fingers	5.6			Fingers	3	
Lower extremity	Pelvis	4	53.2	Lower extremity	Pelvis	6.1	64.7
	Femora	5.6			Femora	5.1	
	Patella	4.8			Patella	4	
	Knee	9.5			Knee	14.1	
	Lower leg	6.3			Lower leg	9.1	
	Ankle	8.7			Ankle	10.1	
	Foot	4			Foot	7.1	
	Toe	10.3			Toe	9.1	

Considering the information offered in table 2, and regarding the distribution of different injuries in different parts of the body, it is clear that in the category of skin injuries abrasion has been the most common injury in both professional and nonprofessional groups, and in category of muscle-tendon injuries spasm was the most common injury. In the category of joint-ligament injuries the highest percentage was related to sprain in both groups. In the category of bone injuries capillary fraction was the most common injury. In the category of pain injuries, acute pain had the highest percentage in both groups.

Regarding the distribution of injuries and considering the injuries presented in figure 2, bone injury by occurrence of 9.1 percent in professionals and 4 percent in non-professionals constituted the least injuries, and muscle-tendon injuries with the occurrence of 40.3 percent in professionals and 49.9 percent in nonprofessionals constituted most injuries.

Considering the findings of the study in table 3, no significant difference was found among the injuries in different parts of the body in both professional and non-professional groups (p=0.577, u=170.5).

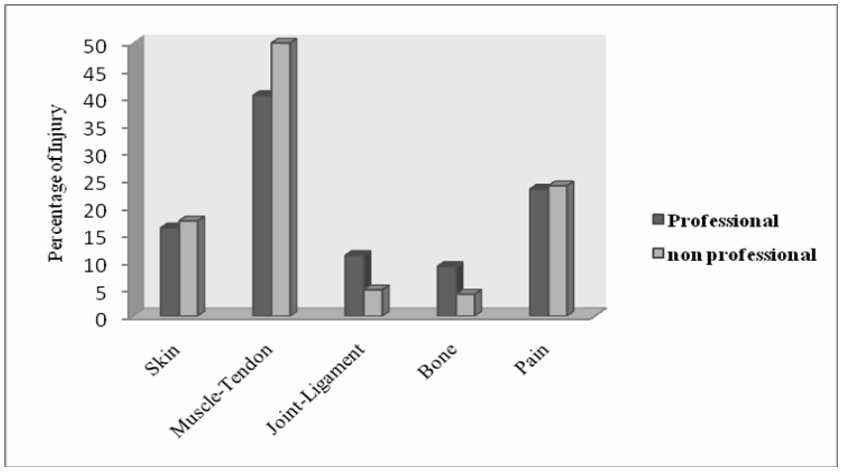

Figure2. Determining the percentage of vulnerabilities in research samples

Table 2. Distribution of different injuries in research samples

Non-professional				Professional			
Injury		**Percentage**	**Total**	**Injury**		**Percentage**	**Total**
Skin injury	Abrasion	8.7	17.4	Skin injury	Abrasion	7.1	16.1
	Laceration	6.3			Laceration	2	
	Blister	0.8			Blister	4	
	Fungus infection	0.8			Callus	2	
	Corn	0.8			Corn	1	
Muscle-tendon injury	Spasm	13.5	49.9	Muscle-tendon injury	Spasm	14.1	40.3
	Contusion	11.9			Contusion	5.1	
	Bruise	6.3			Bruise	4	
	Hematoma	6.3			Hematoma	2	
	Strain	9.5			Strain	11.1	
	Muscle tear	2.4			Muscle tear	4	
Joint-ligament injury	Sprain	2.4	4.8	Joint-ligament injury	Sprain	5.1	11.1
	Dislocation	1.6			Dislocation	3	
	Ligament tear	0.8			Ligament tear	1	
	Meniscus tear	0			Meniscus tear	1	
	Joint cartilage	0			Joint cartilage	1	
Bone injury	Open fracture	0	4	Bone injury	Open fracture	2	9.1
	Closed fracture	1.6			Closed fracture	2	
	Capillary fracture	2.4			Capillary fracture	5.1	
Pain	Acute	12.7	23.8	Pain	Acute	12.1	23.2
	Chronic	11.1			Chronic	11.1	

Table 3. The percentage of injuries in different parts of the body in both professional and nonprofessional groups, and the level of significance

Sig	**Pain**		**Bone**		**Joint-Ligament**		**Mus-Tandon**		**Skin**		**Injury**
U=179.5	Non –P	P	Non- P	P	Non- P	P	Non -P	P	Non –P	P	**Part**
	0.32	1.11	0.32	1.11	0	0	0.65	0	0.65	1.66	Head
	1.96	2.22	0.32	0	0.32	0.55	6.20	4.44	1.30	0.55	Trunck
P=0.577	5.55	3.33	0.65	0.55	0.65	0	7.51	7.22	1.30	1.66	Upper
	14.7	13.88	0.32	3.8	4.57	12.77	44.77	35	7.84	10	Lower

Discussions

The results of many studies in this regard indicate that, generally, in the entire athletic fields, lower limbs have had most injuries. Meanwhile, head and face injuries have had the least occurrences [11-12-13-14-15-16-17-18-19].

In the researches carried out by many of Iranian researchers in the field of athletic injuries, the majority have had consensus on the point that the most injuries belong to the muscle- tendon group of injuries and bone injuries have the least number of occurrences [9-10-14-15-20-21-22].

In this study, muscle-tendon injuries were realized as the most prevalent injuries in both groups, matching with the results gained by lysholm (1987), Schmidt. (1990), and Fuladian (1998), Rezvani (1996), Atri (2007), Elyasi (1998), Funick (1989), Ytterstad (1996), Soltani (1998), Shahidi (1996), Zakani (2005) [1-9-10-14-15-20-22-23-24].This can be justified by the fact that muscles are the first limbs in body contacting the objects and also all the body is covered by muscles. Hence, they are proportionately more exposed to injuries.The highest number of injuries was reported in lower limbs, matching by the results found by Moradi (2007), Schmidt (1990), Funick (1989), Ytterstad (1996), Morgan (2001),Chan (1984), Elyasi (1998), John (2006), Astrid (2006), and Khosravizadeh (2007) [11-12-13-14-15-16-17-18-19] and is presumably related to constant usage of lower limbs in comparison with other limbs. It may also be due to the lack of warming up, insufficient use of protective devices, and high

engagement of muscles and joints in lower limbs. In the study done by Souza (1990), there was a significant relationship between the level of competition and the number of injuries [25]. However, in the present study, no significant difference was found between injuries in professionals and nonprofessionals. Perhaps one reason is that in Iran, athletes do not exercise constantly and no demanding and exhausting exercise is done by track and field players. Further research should be done on the issue to find whether there is a dierence between professionals and nonprofessionals and to provide strategies to decrease the injuries in both groups. Results of this research can be used in pre-semester examinations to prevent from further subsequent injuries, considering the strategies available. Consequently, the most important usage of this research is to prevent the occurrence of subsequent injuries by identifying apt injured athletes and to provide preventive strategies. These tests can be used in rehabilitation and determination of the size of impairments and disabilities of injured athletes and their readiness for the purpose of designing more exact rehabilitation plans.

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Talent Identification in Iranian Youth Soccer Players Aged between 12 and 16 Years Old Using a Multivariate Approach

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Abstract

To determine the applicability of a multivariate test battery in youth soccer players, we made a comparison between 45 elite and 51 sub-elite youth soccer players concerning physiological, psychological, anthropometrical and technical factors. Some researchers (e.g., Reilly et al., 2000) have also proposed similar TI models to be applied on soccer schemes. The players completed the ACSI-28 questionnaire as a psychological test. Also, all players performed the FA soccer star tests in order for their technical characteristics to be determined. The seven measures in anthropometrical cluster analysis include: height, body mass, body fat percentage and four girths (waist, shoulder, mid-thigh, calf). Besides, five tests performed by players to determine their physiological characteristics: Vertical jump, sit-ups, 280 meter shuttle run, 10 and 40 meter sprints. The results of present study demonstrated significant differences between elite and sub-elite players in the four measured clusters. A significant difference was also found in age as a covariate. The most distinguishing factors, accentuating the importance of speed in TI models, were 40-m sprint and shuttle run (among physiological factors), peaking under pressure (among psychological factors) and speed (among technical factors).. There were significant differences between U14 and U15 groups in physiological and technical factors. Besides, the elite U16 players scored better than their sub-elite peers in psychological and technical measurements. The results indicated that a multivariate approach, considering age differences, can successfully distinguish elite soccer players from sub-elite players at young ages.

Keywords : Talent identification, Youth Sports, Performance level, Age differences

Introduction

The Talent Identification (TI) process may take several forms. The systematic form of talent identification was established by Eastern European countries, although the viability of such programs has been questioned [1]. Despite applying different modifications on those programs, this process is still highly dependent on observational assessment. The coach is essentially being asked to evaluate the potential of the child, and if the child meets the criteria considered as important by the coach, he or she is identified and selected. However, this process must involve more formal identification and selection of individuals who presumably have the skill, physical, and behavioral prerequisites for success in a given sport [2].

Talent identification is the process by which children are persuaded to take part in sports they have potential to become successful in, based on the results of specific tests [3]. Understanding the key factors of this process is important for all people associated with youth development in sports including soccer [4, 5, 6]. Hence, clubs always seek for scientific guidelines to allocate their resources and education facilities to future elite players [7, 8], trying to invest their money to identify and develop really- talented youngsters [9, 6]. Researchers who focus on TI models in youth sport can help clubs and coaches to attain this goal; however, TI in team sports such as soccer is a complicated process and requires a multidisciplinary approach [10, 9, 6, 11]. Williams (1998) noted that the potential predictors of soccer talent include anthropometric, physiological, neuro-motor, cognitive-perceptual and psychosocial attributes. Hoare and Warr (2000) indicated that potential elite female soccer players can be selected based on anthropometric, physiological, and technical variables. Nonetheless, researchers suggest that assessment of essential soccer skills should also be applied in multi-factorial battery of tests used in the soccer TI models [9]. A multidisciplinary test battery, adopted by Reilly (2000) to contribute to skill measurements, appeared to be practical in distinguishing elite players from their sub-elite counterparts.

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The focus of previous researches in the field of talent identification in youth sports often has been on comparisons between youth players at different performance levels at specific stages of development [12, 9]. Vaeyens et al (2006), using performance-outcome measures on elite, sub-elite and non-elite youth soccer players, demonstrated that the results of anthropometry and functional capacity tests significantly differ with performance level. Their results also suggest that specific tests that discriminate youth soccer players vary at different ages during adolescence. Furthermore, Williams and Reilly (2000) mentioned that to enhance the talent development process in soccer players, it is critical to identify talented players at early ages. Hence, the present study assessed the characteristics of youth elite and sub-elite players aged between 12 and 16 years old to identify talented soccer players. This age range is referred to as the specializing stage in which the individuals focus on one or more specific sports [4].

One of the questions, this study aimed to answer, was that in which characteristics the elite youth soccer players score higher than their sub-elite peers. Moreover, this question might be asked to address the age groups in which our multivariate battery of test can differentiate successfully between elite and sub-elite youth soccer players.

Materials and Methods

A sample of 96 soccer players (45 elite and 51 sub-elite) aged between 12-16 years old participated in this study (mean age= 15.07). Subsequently, Participants were assigned to four groups based on their chronological age: U13, U14, U15 and U16 (Table 1).

Elite athletes were the current or previous members of Iranian national team playing in Tehran province clubs, and sub-elite participants were playing at the highest level possible for their age group in Tehran province clubs too, but without national games. Having excluded goalkeepers, the analysis was limited to defenders, midfielders and attackers. Players, their parents/guardians and club officials were informed of testing protocol, and the informed consent was obtained from them. Clubs ethics committee approval has also been obtained. Experiments were performed during 2009-2010 soccer competitions season.

Multi-factorial parameters were assessed in elite and sub-elite youth players in all age groups. These parameters are described as follows into four clusters:

Anthropometrical measurement

Seven measures in this cluster include: height, body mass, four girths (waist, shoulder, mid-thigh, calf) and body fat percentage. The circumferences of mid-thigh and calf were measured on dominant limbs. Body fat estimation was done by measuring skinfold thickness at four sites (triceps, biceps, subscapular and suprailiac) on the dominant side of the body using a Harpenden skinfold caliper (British Indicators Ltd., Luton) and putting the quantities into appropriate equations [13]. Skinfolds were measured according to the International society for Advancement of Kin anthropometry protocol [14].

Physiological measurement

Five tests performed by players to determine their physiological characteristics included: Vertical jump (explosive power), sit-ups (abdominal muscular endurance), 280 meter shuttle run (cardio-respiratory endurance), 10 and 40 meter sprints (speed). All participants had 10 minutes favorite warm-up before performing the tests. Also, the environmental conditions (weather, testers, etc.) were stable during the measurements.

Psychological measurement

The players completed the ACSI-28 questionnaire (Smith et al 1995) that contains 7 sub-scales including: coping with adversity, peaking under pressure, goal setting and mental preparation, concentration, freedom from worry, confidence and achievement motivation, and coachability. They were asked to fill in the questionnaire honestly to ensure maximum accuracy and validity of the results. Previous Research has shown that ACSI-28 can be used as a good tool for predicting future elite athletes [15]. The internal consistency of ACSI-28 has shown to be high for both male (0.84) and female (0.88) athletes. Besides, test-retest reliability coefficients were high for all the subscales [16].

Technical measurement

All players performed the FA soccer star tests (including running with the ball, turning with ball, speed, dribbling, heading and shooting). The tests reflect the technical ability of the players in these techniques. These tests have been validated by Professor Tim Holt (1988). Likewise, they have been proven to display 95% reliability and 88% validity by Dadkan and Daneshjoo (2005) in Iranian players (unpublished observation).

Analysis

The statistical analysis was performed using SPSS version 15.0 with a $p<0/05$ level of significance. A multivariate analysis of covariance

(MANOVA) with age as covariate was used to compare the dependent variables among players within each group in all age groups and expertise levels. Univariate analysis of variance using Bonferroni method was used as follow-up test, where appropriate. Finally, stepwise discriminant analysis was used with the level of performance as dependent variable.

Results

The mean and standard deviation of players' scores in four clusters of the test battery (Physiological, psychological, Technical and Anthropometrical), are presented in table 2.

The results of the MANCOVA revealed main effects for age, F = 4.542, Wilks' Lambda = .624, p <0.001, and expertise level, F = 13.149, Wilks' Lambda= .278, p <0.001. Age as the covariate significantly affects the players' scores on physiological tests in U13, U14 and U15 groups, and on technical tests in U14 and U15 groups. It also significantly influences psychological factors in U16 players (Table 3).

Follow-up univariate analyses showed that there are significant differences between elite and sub-elite players in the following variables: Vertical jump (F=18.502, P <0.01), Shuttle run (F=27.845, P <0.01), 10-m sprint (F=15.373, P <0.01), 40-m sprint (F=38.747, P <0.01), peaking under pressure (F=16.119, P <0.01), freedom from worry (F=8.943, P <0.01), confidence and achievement motivation (F=9.352, P <0.01), turning with the ball (F=7.255, P <0.05), technical speed (F=21.653, P <0.01), dribbling (F=10.739, P <0.01), and body fat (F=19.533, P <0.01). Overall, the elite group scored significantly higher than the sub-elite group in four of the physiological variables, three of psychological variables, three of technical variables and one of anthropometrical variables.

The summary of stepwise discriminate analyses is presented in Tables 4 and 5. The most discriminating factors between the two groups (elite and sub-elite) were 40-m sprint, shuttle run, speed and peaking under pressure. As the average squared canonical correlation was 0.730, it can be inferred that by knowing the players' scores on the above-said factors, we can classify them into the appropriate groups with 73% precision.

Table 1: Number of players at different age groups and expertise levels

Expertise and age	**U 13**	**U 14**	**U 15**	**U 16**
Elite	8	9	12	16
Sub-elite	12	12	17	10
Total	20	21	29	26

Table 2 - means and standard deviations of participants' scores in four clusters of tests

Physiological	elite	Sub-elite	**Technical**	elite	Sub-elite
Sit-ups	45.37 (1.74)	44.04 (1.77)	Running with the ball (s)	5.65 (.35)	6.07 (.55)
Vertical jump (cm)	83.15 (2.10)	80.92 (2.02)	Turning with the ball (s)	24.72 (1.53)	26.13 (1.62)
Shuttle run (s)	17.72 (1.49)	18.83 (1.26)	Speed (s)	11.45 (.82)	13.01 (1.01)
10 meter sprint (s)	1.80 (.08)	1.93 (.07)	Dribbling (s)	15.68 (1.3)	17.40 (1.50)
40 meter sprint (s)	5.59 (.37)	5.97 (.31)	Heading	2.77 (.52)	2.51 (.92)
			Shooting	16.50 (1.95)	15.86 (1.69)
Psychological	elite	Sub-elite	**Anthropometrical**	elite	Sub-elite
coping with adversity	8.39 (1.45)	8.49 (1.27)	Height (cm)	1.61 (.07)	1.59 (.07)
peaking under pressure	9.36 (1.49)	8.82 (1.36)	body mass (kg)	45.82 (3.65)	45.09 (5.19)
goal setting and mental	8.95 (1.18)	8.86 (1.20)	waist girth (cm)	66.41 (1.97)	68.12 (2.06)
concentration	9.39 (1.48)	9.28 (1.39)	shoulder girth (cm)	98.50 (1.91)	97.51 (2.27)
freedom from worry	9.55 (.92)	8.61 (1.32)	mid-thigh girth (cm)	45.82 (1.25)	44.02 (1.30)
confidence and achievement	10.55 (1.17)	9.13 (1.65)	calf girth (cm)	35.57 (1.14)	34.34 (1.28)
coachability	9.06 (1.23)	8.67 (1.59)	Body fat (%)	11.8 (1.6)	13.3 (2.1)

Table 3: result of MANCOVA with age as the covariate: differences by age groups and expertise level

	age groups				**expertise level**			
	Wilks' lambda	**F**	**df**	**p**	**Wilks' lambda**	**F**	**df**	**p**
Physiological								
U-13	.295	24.783	5	.010	.594	1.706	5	.203
U-14	.316	16.537	5	.005	.295	14.239	5	.000
U-15	.257	25.845	5	.002	.281	15.768	5	.000
U-16	.576	4.494	5	.105	.624	2.484	5	.047
Psychological								
U-13	.835	1.536	7	.446	.704	.853	7	.359
U-14	.869	.880	7	.614	.498	12.740	7	.065
U-15	.737	1.875	7	.262	.633	2.359	7	.207
U-16	.309	17.723	7	.015	.587	2.127	7	.142
Technical								
U-13	.774	1.706	6	.203	.886	.783	6	.342
U-14	.533	4.239	6	.015	.776	1.527	6	.278
U-15	.204	13.768	6	.000	.642	2.045	6	.075
U-16	.498	5.484	6	.001	.213	20.394	6	.005
anthropometry								
U-13	.679	.776	7	.377	.639	2.778	7	.265
U-14	.903	.274	7	.896	.867	.839	7	.766
U-15	.628	1.490	7	.328	.785	.983	7	.652
U-16	.754	.835	7	.589	.873	.467	7	.745

Table 4: variables entered/removed in stepwise discriminant analyses [a]

Step	**Entered**	**Wilks' Lambda**							
		Exact F							
		Statistic	df1	df2	df3	Statistic	df1	df2	P-value
1	40 meter sprint	.497	1	1	92	64.297	1	92	.000
2	Shuttle run	.414	2	1	92	34.703	2	91	.000
3	Technical Speed	.378	3	1	92	31.882	3	90	.000
4	Body fat	.323	4	1	92	25.373	4	89	.000

[a] At each step, the variable that minimizes the overall Wilks' lambda is entered. Maximum number of steps is 50. Minimum partial F to enter is 3.84. Maximum partial F to remove is 2.71. F level, tolerance, or VIN insufficient for further computation.

Table 5: variables in the analyses in stepwise discriminant analyses

Step		**Tolerance**	**F to remove**	**Wilks' Lambda**
1	40 meter sprint	1.000	64.297	
2	40 meter sprint	.945	51.313	.793
	Shuttle run	.945	10.530	.727
3	40 meter sprint	.943	49.893	.785
	Shuttle run	.905	12.310	.671
	Technical Speed	.936	9.076	.653
4	40 meter sprint	.930	40.439	.715
	Shuttle run	.908	14.621	.624
	Technical Speed	.912	12.648	.601
	Body fat	.916	9.947	.589

Discussion

As Bompa (1985) noted, an ideal accepted model is necessary for both athletes and coaches to compare their own sport qualities with, but there is no consensus among experts regarding the factors which must be applied in TI process [7]. Therefore, the more focused researches need to be conducted in this area [2]. The present study by adopting a multidisciplinary model showed that a combination of anthropometrical, physiological, psychological and technical characteristics may distinguish properly between elite and sub-elite youth players.

The physiological measurements were the most discriminating of the four clusters with statistically significant differences between two groups on four of the seven tests. The elite players scored higher than their sub-elite peers in vertical jump, shuttle run, 10-m sprint and 40-m sprint measurements. These results are consistent with those of the studies indicating the critical role of aerobic and anaerobic capacity measures in soccer success (e.g. Reilly, Bangsbo, and Franks, 2000).

Elite players were also better in the subscale of confidence and achievement motivation from psychological measures. This finding is in line with the previous studies showing that self confidence and motivation should be more emphasized in TI models [17]. The elite players also had higher scores in peaking under pressure and freedom from worry.

The results presented that elite players performed better than their sub-elite counterparts on technical tests, with statistically significant difference on turning with the ball, technical speed and dribbling. As indicated in Table 4, technical speed is the most discriminating factor in this cluster.

While body fat was significantly different in favor of the elite group, from girth measurements, only the waist girth was slightly bigger in sub-elite group, and there was no significant difference in other anthropometrical measures. Thus the results suggest that in spite of little difference in body girths, the sub-elite players have more adipose tissue than their elite peers. The poor performance of sub-elite players in physiological tests could be attributed to their higher levels of body fat [18, 19].

The physiological and technical factors discriminated most successfully in U14 and U15 participants. Physiological characteristics also were important discriminating factors in U13 players. These results are in line with the study of Vaeyens and his colleagues [3, 15], in which elite and sub-elite youth soccer players were significantly different in functional capacities and sport-specific skills. Further, the elite youth players in U16 group scored higher than their sub-elite counterparts on psychological and technical characteristics. This primacy could be referred to the effects of neuro-motor development, as elite players at older ages have had more opportunities to gain experience and benefit from good education. This age-related and gradual development is attributed to maturational process of the central nervous system [20].

In summary, we measured physiological, psychological, technical and anthropometric characteristics of 45 elite and 51 sub-elite players to identify characteristics that could help to predict future elite soccer players. The battery of test applied in this study appeared to discriminate successfully between elite and sub-elite soccer players. Of our measurements, 40 meter sprint, shuttle run, technical speed and body fat were the most distinguishing factors. Our findings are consistent with those of Hoare and Warr (2000), suggesting that more weight should be given to speed and acceleration [21, 22]

Lastly, it is difficult and possibly immoral to separate the talented children from their ordinary peers. Talent Identification should be a continuous process, and should not be dependent on an individual's performance during a single performance test. It must be recognized, therefore, that the identification of talent is complex, with many factors that must be noticed if the process is to be optimally effective. But, in case of emergency for selecting a group of talented young soccer players preparing for competition, the battery of test used in this study can be helpful.

Conclusion

This study used a battery of test which is comprehensive in structure, although convenient in administration. As opposed to studies in which the technical measures were ignored [23, 22], the present study highlighted the importance of these factors in TI Studies. In many ways, the model used in present study is identical to the model proposed by Reilly (2000), and like the Reilly’s, it seems to be appropriate for identifying talent in youth soccer players, although it is most practical in U14 and U15 players. However, endeavors to establish more appropriate methods of identifying sports talent are highly suggested (24). As Du Rant (2008) noted, this efforts will continue as long as countries want to outstand at international competitions. We also suggest performing more refinements on this model as well as selecting samples of women soccer players in future studies.

In conclusion, the future elite soccer players can be predicted using multivariate measurements. Besides, it appears that age differences must be

considered in choosing the measurements in youngsters to identify the soccer talent.

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The Comparison of Serum Calcium, Phosphorus, Parathormone, Calcitonine, Alkaline Phosphatase and Acid Phosphatase in Active and Inactive Menopause Women

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Abstract

Objective: Sport mechanical stresses are effective stimuli for strengthening bone tissue. By the beginning of Menopause, assimilation of bone tissue increases. The object of this study was to compare some bone and Calsium metabolism indices in active and inactive Menopause women (MW). For this purpose, urinary and serum Calcium and Phosphorus, Alkaline Phosphatase (AP), Acid Phosphatase and Parathormone and Calcitonine hormone (CH) were measured.

Method: 14 MW who had an experience in sport, in Sabsevar sport clubs, were taken as active group and 14 MW who used to go to park of Mellat as leisure were chosen as the inactive group. There were no significant differences between two groups in height, age of menopause, weight, BMI and body fat percentage. Also, for the sake of accurate comparison, other variables such as: blood pressure, rest heart rate, WHR and Vo2max were measured .Subjects did not take any specific drugs. 80 cc of second morning urine and 10 ml of vein blood were taken from subjects before the breakfast. In order for the data comparison of two groups, t-student test was used.

Results: 1- Serum calcium rate, serum Parathormone and bone AP in active MW were significantly lower than inactive women, and CH rate in active MW was significantly higher than inactive women ($p<0.05$). 2- There were no significant differences between urine calcium, serum and urine Phosphorus, Resisted Acid Phosphatase to serum Tartarate and between Calcium ration to urine creatinin, among active MW and inactive women.

Conclusion: It seems that prolonged regular physical activity can influence calcium and bone metabolism indices in MW and prevent bone degeneration, and with the reduction of Parathormone and the increase of CH, the bone tissue is prevented from losing calcium and other minerals**.**

Keywords: Calcium, Alkaline Phosphates, Acid Phosphates, Calcitonine, Menopause women

Introduction

In 1991, the World Health Organization introduced osteoporosis, heart attack, cerebral apoplexy, and cancer as the four major enemies of humanities and asked the world to begin fighting them. The studies conducted by Iran Rheumatology Center showed the mineral density of bones in normal people was lower than the standards of Halogic system [1, 2]. Reduction of bone density has no evident external symptom and progresses so much that the bones are fractured with the smallest pressure [3, 4, and 5]. Until now, there has been no effective therapy for preventing this reduction of bone density in menopausal women. Although the Anti-receptions process tends to slow down the decline of bone density, it has no bone making activity. Hormone replacement therapy also slows down the decline of bone density; however, there is substantial evidence that it also increases the risk of strokes, cardiovascular diseases, and breast cancer, tending to weaken its advantages against osteoporosis in menopausal women [5, 6, 7 and 8]. Indices of bone metabolism may be used to diagnose bone diseases, slow down bone decline, prevent future fractures or assess the effects of anti-absorption therapy (9, 4 and 10). Research indicates that mechanical stress during sport activities is a good stimulus for effective bone making in all age groups. Since most active women tend to reduce their activities as they age, they may use some light exercises to maintain their level of activity at the bone making margin during their menopausal life [11].

Bone is a dynamic tissue adapting to the weight

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applied to it [8]. This bone tissue suffers a higher rate of decline during menopause [11]. Since change in bone tissues occurs at a slow pace we cannot demonstrate bone dynamics only through measurement of mineral bone density [12]. Given the effect of exercise on the bone density of menopausal women, most studies report the effects of physical activity on biochemical indices of bone metabolism. Bone absorption and production indices enable us to assess bone changes in response to mechanical stress [13, 14]. Weight exercises affect bone metabolism and biochemical bone indices are used to assess the effects of these mechanisms. Bone production indices such as "osteocalcin or alkaline phosphatase" or absorption indices such as "dioxipyridinoline or tartrate-resistant phosphatase acid" reflect bone changes. Studying parathyroid density, which has both productive and reductive effects on bones and increases during different exercise, provides more information [12]. There is no sufficient information about the influences of mechanical stress on bone metabolism and the effects of physical activity on bone mechanisms of menopausal women are yet to be determined [15].

Changes in lifestyle and decreased physical activity are among the causes of increased rates of thigh bone fracture in the past 30 years. Recently, other than the hormone replacement therapy, much attention has been focused on physical exercise and calcium supplements [16]. Regular physical activity may be effective in the treatment of bone density reduction. Regular physical activities has no sort of side effects, has low costs, and is associated with other advantages such as body strength and prevention of falling [14]. Although the positive effect of exercising on bone mass is quite known, results of all studies do not go in the same direction. Some studies indicate walking at the aerobic margin and weight exercises tend to reduce serum and urinary osteocalcin. This is while other studies have shown that aerobic and anaerobic exercises increase serum levels of osteocalcin, or that fast walking has no great effect on bone indices. Thorson (1996) and Yamazaki (2004) showed that average intense walking in menopausal women had a minor positive effect on bone metabolism [15]. While there was a weak relationship between regular physical activity and reduced bone density decline [17]. Regular daily physical activity reduced urinary disposal of bone absorption indices. He argued that having regular physical activities is essential for prevention of bone absorption from increasing during menopause. There was little relationship between regular physical activities and maximum oxygen consumption with bone metabolism indices in menopausal women. But regular walking by menopausal women for 2 years failed to make any change in their bone indices, yet indices related to absorption were increased in the inactive group [8]. Studies conducted on the relationship between the effects of physical activities and bone metabolism indices are different in terms of findings and conclusion. Despite the lack of harmony among results, it is possible that physical activities have positive effects on bone masses of menopausal women and may, in effect, prevent bone absorption or reduce urinary calcium disposal. Given the possible benefits of exercise and physical activity on bone and calcium metabolism in menopausal women, it seems necessary to pay more attention to such studies and topics. The positive effects of physical activity on slowing down bone decline process have made researchers interested in the effects of physical activities on bone metabolism. Thus, the question is posed whether or not having an active lifestyle and indulging in regular exercise and physical activity is effective on the bone decline process, or whether menopausal women having regular physical activities are different from inactive menopausal women in terms of bone decline. In other words, they want to see if calcium and bone metabolism indices are different among active and inactive menopausal women.

This study was aimed at comparing some bone and calcium metabolism indices between active and inactive menopausal women. Indices such as urinary calcium and phosphorus, serum creatinine, calcium and phosphorus, as well as bone-specific alkaline phosphatase were taken as the indexes of bone production, tartrate-resistant phosphatase acid as the index of bone absorption and parathyroid and calcitonin hormones were measured for the comparison of calcium and bone metabolism between the two groups.

Materials and Methods:

This study was of descriptive-scientific-comparative post-occurrence type.

Statistical Population: It included menopausal women of the ages of 50-60 from Sabzevar city.

Statistical Sample: 28 menopausal women (active group = 14, inactive group =14).

Sampling Method: Active samples were taken from among menopausal women attending sport clubs in Sabzevar city; they had at least one year of regular physical activity. There were 350 menopausal women in about 17 official clubs, 74 of which expressed willingness to participate in our tests by filling the questionnaires. Among the 25

people qualified to take part in our study 14 were chosen by a simple random method.

Inactive samples were taken from among middle aged women going to public parks and places and were willing to participate in the tests. From among 40 people qualified to take part according to their physiologic factors, 14 were taken by random. The samples were arranged so that each inactive and active pair were similar in terms of age, menopause age, height, weight, body mass index (BMI), waist to hip ratio (WHR) and body fat percent.

Independent Variables: menopause, regular physical activity.

Dependent Variables:

1. Serum and urinary calcium,
2. Urinary calcium to creatinine ratio,
3. Serum and urinary phosphor,
4. Urinary phosphor to creatinine ration,
5. Serum bone-specific alkaline phosphatase content,
6. Srum tartrate-resistant phosphatase acid,
7. Serum parathyroid and calcitonin hormone levels.

Controlled Variables: Age, height, weight, menopause age, maximum aerobic power, working power capacity, BMI, WHR, fat percent, blood pressure, physical activity and the food taken in two days prior to running the tests.

Measurement Instruments:

1. Soehnle-Medica medical balance, made in Germany,
2. Seca height measuring instrument, made in Germany,
3. Biospace body composition analyzer, made in Korea,
4. Ateye Ergo Meter bicycle, EC1600, made in Japan,
5. Braun digital blood pressure measurement tool, made in Germany,
6. 5-channel gama counter gentis, made in USA,
7. RA-100 auto analyzer, made in USA,
8. Awareness statfay 2100, made in USA,
9. Centrifuge machine made by Behdad Company of Iran.

Methods of Collecting Urinary and Serum Samples: Test subjects were asked to be fasting for 12 hours and be present at the lab at 9:00 a.m. First, 80 cc of second morning urine sample was taken and then 10 ml of blood sample was taken from arm vain in resting stance. Blood samples were left at room temperature for 15 minutes to coagulate. They were then centrifuged for 10 minutes at a speed of 800 rpm. The resulting serum was kept at -70°C until the analysis time.

Statistical Methods

1- To describe the data we used mean value, standard deviation, and change percent.

2- We used Student t-test for independent groups to study the differences between variables of the two groups, and to study the relationship between the variables we used Pearson's moment correlation at an alpha level of 0.05.

Results:

Once the data were analyzed it was found that:

1- The rate of serum calcium, serum parathyroid hormone, and serum alkaline phosphatase in active menopausal women was significantly lower than inactive menopausal women, and the rate of calcitonin in active menopausal women was significantly higher than inactive ones ($P<0.05$).

2- There was no significant difference between urinary calcium, serum phosphor, urinary phosphor, serum tartrate-resistant phosphatase acid, and urinary calcium to creatinine ratio in active and inactive menopausal women (Table 1).

Discussion and Conclusion

Test subjects of the two groups were similar in terms of variables such as weight, height, BMI, WHR, fat percent, menopause age. But active samples were significantly higher than inactive ones in variables such as maximum aerobic power ($P=0.0001$) and working power capacity ($P=0.001$). But variables such as systolic and diastolic blood pressure and resting heart beat showed no difference between the groups. The differences were significant for some indices such as serum calcium ($P=0.02$), serum bone-specific alkaline phosphatase ($P=0.004$), parathyroid ($P=0.027$) and calcitonin ($P=0.025$) hormones.

Serum calcium index of active menopausal women was significantly lower than inactive women, yet according to mean and standard deviations, (8.56 ± 0.44 for active group, 9.31 ± 0.7 for inactive group) values of both groups were in the natural range of serum calcium. This findings are in agreement with those findings [15, 19]. But was been reported increased serum calcium due to physical activity, observed no significant change in serum calcium [20].

Urinary calcium index with creatinine correction was not significantly different in active and inactive menopausal women, though the urinary calcium with creatinine in the active group was 26.89% higher than the inactive group. Yet the two values were inside the normal range of urinary calcium given the means and standard deviations (0.93 ± 0.03

Table 1: Comparison of Variables in Active and Inactive Menopausal Women

Variables	Groups	Mean±SD	Change * Percent	t	P
Serum calcium (mg/dl)	Active	8.56±0.44	-1.12	3.35	0.002
	Inactive	9.31±0.70			
Urinary calcium (mg/dl)	Active	8.78±3.84	+26.65	1.6	0.12
	Inactive	6.44±-0.88			
Urinary Calcium to creatinine ratio	Active	0.93±0.03	+26.89	1.5	0.12
	Inactive	0.68±0.05			
Serum phosphor (mg/dl)	Active	4.09±0.33	-1.21	0.44	0.66
	Inactive	4.14±0.35			
Urinary phosphor (mg/dl)	Active	36.53±15.22	+0.69	0.04	0.96
	Inactive	36.28±16.02			
Serum bone-specific alkaline phosphatase (IU/I)	Active	199.71±23.5	-14.45	2.3	0.004
	Inactive	233.43±31.5			
Serum phosphatase acid (IU/I)	Active	3.72±1.50	-22.5	1.5	0.12
	Inactive	4.80±2.09			
Serum parathyroid hormone (pmol/l)	Active	23.0±3.70	-18.27	2.38	0.027
	Inactive	28.14±7.30			
Serum calcitonin hormone (pg/ml)	Active	3.23±1.26	+33.44	38.2	0.025
	Inactive	2.15±1.14			

* Change of variables between active and inactive groups

for active group, 0.68±0.05 for inactive group). This finding is in line with some researches [21, 22].

There was no significant difference observed in the serum phosphor of active and inactive menopausal women. The values of both groups were inside the normal range according to means and standard deviations (4.09±0.33 for active, 4.14±0.35 for inactive). This finding is in agreement [20]. Also there was no significant difference in the urinary phosphor indices of the two groups and the values were inside normal range (36.53±15.22 for active and 36.28±16.02 for inactive group). This finding was in line with [21], but was reported increased urinary phosphor due to physical activities [3].

Serum bone alkaline phosphatase in active menopausal women was significantly lower than inactive women. The values of both groups were inside normal range (199.71±23.49 for active, 233.43±31.51 for inactive group). This finding matches with [18, 22]. Yet some researchers have reported no significant change [12, 15, and 20]. Many researchers have reported increased serum phosphatase [16, 21].

Tartarate-resistant phosphatase acid, which is the index for bone destruction, showed no significant difference between active and inactive menopausal women (P=0.12). The value is inside the normal range for both groups (3.72±150 for active and 4.80±2.09 for inactive group). Though the difference is not significance, Tartarate-resistant phosphatase acid was 22.5% higher in the inactive group than the active group. These findings were in line with [8, 14] but some researchers reported a reduction of phosphatase acid due to physical activities [12, 20, 22].

Parathyroid hormone index of active menopausal women was significantly higher than the inactive group, being inside the normal range (23.0±3.70 for active and 28.1±7.30 for inactive groups). The finding matches with [8, 19] But some researchers reported no significant difference; even some of them reported a reduction [15, 20].

Calcitonin in active menopausal women was significantly higher than inactive women. The values were inside the normal range (3.23±1.26 for active and 2.15±1.14 for inactive groups) according to mean values and standard deviations. The finding matches with Thorson [15].

According to the findings of this study, the indices for making and destruction of bones in inactive menopausal women were higher than active women. Also, serum parathyroid of inactive menopausal women was higher than active ones, while serum calcitonin was more in the active group rather than the inactive. Then, serum calcium was higher in the inactive group. It also seemed that bone metabolism of inactive menopausal women was higher than active women. These findings accord with those Iwamoto, Ashizawa and Yamazaki [18, 20, 22]. But other researchers reported increased bone metabolism (making and destruction indices), e.g. Thorson [15]. Some researchers said they did not observe any significant change in bone making and destruction indices due to physical activity [15, 20].

Some researchers only reported the increased

bone production index due to physical activity, including Grimes and Sarah [7, 10]. Some others only reported the decrease of absorption index, including Murph and Ashizawa [14, 22]. Another group reported that physical activity causes an increase in bone production and destruction indices Iwamoto [20]. This difference may be due to the type of exercise, duration, intensity, test subject, measurement method, or different production and destruction indices. Though it seems that the effect of one session of physical activity (endurance or power) or short term exercises might have more acute effects on bone regeneration and increase of indices [4, 15, 16]. In studies taking exercises for about one year bone regeneration was decreased [7, 11, and 12]. It seems physical activity affects the indices in two ways: long-term effect results in bone regeneration and short-time acute effect results in increased bone production and absorption indices [15].

Overall Conclusion: According to the results it seems regular and long-time physical activity may influence the indices related to bone metabolism and menopausal women calcium rates or prevent bone decline by reducing bone regeneration. It can also reduce parathyroid hormone and increase calcitonin to prevent bone tissues made of calcium and minerals. Although, most studies report the positive effects of exercise in decreasing bone tissues, the effects of exercise on biochemical bone indices are not easy to assess [3, 6, 9] and results of studies conducted on women before and after menopause are contradictory at best [5, 17,18]. Future studies may provide better answers to our questions.

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The Effect of Six Weeks of a Massage Program on Sub Skin Fat at Stomach Area

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Abstract

This research aims to study the impact of massage on decreasing subcutaneous fat of the stomach area in non-sportsperson male university students. In order to do that, 16 non-sportsperson male students of the ages of 20 to 27 who were of good general health were chosen randomly to participate in the research. The thickness of subcutaneous fat of stomach area was measured using a SKIN FOLD Caliper (Made in Iran with American spring and measuring error of 0.5 millimeters), before and after the research. After the first measuring, all the participants were subjected to a 6-week massage program designed specifically for the stomach area, which included 5 sessions a week, 15 to 20 minutes of massage per session. Descriptive analysis was used to calculate mean values and standard deviation values of the age, weight, and height of the participants, and correlated t statistic method ($p<0.05$) was used to calculate the difference between subcutaneous fat values before and after the research. The results of the study showed that a 6-week massage program had an impact in decreasing subcutaneous fat of the stomach area of the participants and there was a significant difference between the mean values of subcutaneous fat of the participants before and after the massage program, at the level of $p<0.05$. Therefore, regarding that the results of this study confirm the role of a designed massage program in decreasing the subcutaneous fat of the stomach area, using massage as a method for increasing local metabolism, and as a result, for stimulating local fat burning, can be an effective method for decreasing local fats of stomach area.

Keywords: Massage, Subcutaneous fat, Non-sportsperson male university students

Introduction

Obesity and weight control are of the problems which have recently been subjected to the attention of experts and researchers. Obesity is resulted from excessive fat piling in the body, and is regarded as a serious problem in developed countries [1]. Generally, when body, by means of exercising, cannot insert body fat in the process of energy production via metabolism, some of it is piled in subcutaneous layers, mostly in the areas of breast, stomach and leg. In this paper, by fat it is meant as excessive storage of fat under the skin, and clearly, this fat is as an extra load to body and has no role in increasing power and improving performance, and it may even have negative effects [2]. Furthermore, increased fat storage in the body endangers the health and is a risk factor in cardiovascular diseases and diabetes. 80% of insulin-independent diabetes cases which are prevalent among adults are due to diseases related to obesity. Based on ACSM reports, increased body fat is related to chronic diseases such as cardiovascular diseases, high blood pressure, diabetes, a particular kind of cancer, etc. in addition, the risk of atherosclerosis and also insulin-independent diabetes development is significantly more in the adults who have extra fat in their upper body, particularly stomach, as compared to the adults which have extra fat in lower body and legs. Also, fat storing pattern in men (mostly in trunk and stomach) is a lot more dangerous than fat storage pattern in women (mostly in bottom, pelvis and legs) [1]. There are several ways to prevent the increase of fat storage in the body, including exercising and doing sports, going on diets, and using medical methods, although these methods may not be quite effective. Therefore, a complementary method is needed to solve this problem. Since the ancient times, many people of different nations used massage therapy as a common therapy for maintaining good health and treating some diseases, and this method has recently become of use in health management and treating diseases. People in America use several alternate and complementary treatments such as significance. A multivariate analysis of covariance (MANOVA) with age as covariate was used to

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massage therapy in order to maintain good health [3, 4, 5]. Massage therapy is also used by mothers and professionals to lessen children's weight [6]. Different reports show the development on massage therapy in preserving good health. Excessive fat storage is one of the general health problems [7] and local massaging is an effective method in increasing the metabolism of the area during the rest time, and also, until about 15 minutes after the massage, increased metabolism stimulates fat burning and consequently decreases local fat [8]. Due to the importance of the issue, and regarding that all the methods used in previous studies were mechanical, the current study has combined massage with exercise to show the importance of this method, especially to the people who suffer from limited movements of the joints for they can use the method to decrease the extra fat at the stomach area. Also disabled people, who cannot decrease fat body through typical exercise methods like running, cycling, and activities of this kind, can use this method. In addition, regarding the probable dangers during physical activities, people suffering from overweighting and obesity are looking for the easiest and most effective technique and method for decreasing weight and fat storage, particularly local fat. Also, most of these people, while losing weight and fat, do not want to become very thin, do much exercise or lose their beauty [7]. In addition, regarding that many nonscientific and nonstandard methods have become prevalent and sport clubs have claims which are not scientifically proved, finding a scientific answer for the question about the impact of massage on decreasing subcutaneous fat of the stomach area can help many people in decreasing extra body fats correctly and provide us with useful information about the impact of massage on decreasing subcutaneous fat.

Regarding that this research is looking an alternative method for decreasing fat storage, massage is used as a method for stimulating fat burning and increasing local metabolism, and as a method for decreasing local fat, particularly for people who cannot have physical activities. In addition, friction and petrissage massaging can directly lessen fat layers and increase food absorption, break fat layers and consequently overcome obesity, stimulate lipid glands and sweating glands due to its impact on the skin and through enforcing their activity it refusing body toxins, and this way also has impact on the side effects of obesity and treats them [9]. Hence, regarding what we mentioned and the importance of the issue, this study was designed to evaluate the impact of a massage program on decreasing subcutaneous fat at the stomach area in non-sportsperson male students.

Research Methodology: this is a semi experimental and practical research with a pretest and posttest design. The statistic population consists of all the obese male students of Mashhad Ferdowsi University who have picked general physical education (1 or 2) for the second semester of the academic year 2008-9. After a public call 80 students who were interested in the issue made a written declaration that they were willing to participate in the research. From among them, by measuring skin fold fat 16 students of the mean age of 23.56 ± 1.69 years, the mean height of 175.31 ± 5.18 centimeters, and the mean weight of 85.04 ± 5.95 kilogram who were in good general health state and their skin fold fat at the stomach are was 25milimeters, filled a questionnaire about their individual information and medical and athletic background, then had an appointment with a doctor to have their health confirmed in a letter, and ultimately, they were chosen as the statistic sample. Before the primary test, participants were orally informed about the importance of their regular presence in the research, not changing their diet (the food prepared for them in the dormitories), and not participating in any particular physical activity. Then, based on the schedule, participants filled the general information questionnaire, and before starting the program, their height was measured using a Height gauge, their weight was measured using a BEEM digital scale (Made in Germany) of 100 gram accuracy, and their subcutaneous fat was measured using a SKIN FOLD Caliper (Made in Iran with American spring, with the measurement error of 0.5 millimeters), and after participating in a 6-week program of the research, 5 sessions per week, their skin fold fat of the stomach area was measured again 24 hours after finishing the last session.

Measuring Skin Fold Fat:

A caliper was used to measure subcutaneous fat of the stomach area of the participants. Before measuring, it was assured that the caliper was correctly working, and then its hand was set on zero.

In order to measure subcutaneous fat of the stomach of the participants, the place was held between the left thumb and index finger, and the caliper was held in by the right hand. The opening of the caliper was placed 2 centimeters below the two left fingers, and the caliper lever was slowly released, and after 2 seconds by counting 1001 and 1002, the place of the caliper hand on the scaled plate was read and recorded immediately.

The subcutaneous fat of the stomach area was

Table 3: **result of MANCOVA with age as the covariate:** measured for two times, and in case there was a significant difference between the measures gained, the last measurement was carried out and recorded in a form (based on ISAK form). It should be mentioned that all the measures were taken from a point at 5 centimeters to the right of bellybutton by the tool error and measurement error of 0.63 millimeters.

Massage Program:

In order to prepare the area, the massage program consisted of patting, then friction (massage by using fingers) and then petrissage. In general, the program was light at first and became heavier gradually, patting was used in the intervals between techniques, and then deep and painful massage was used in a way that no sign of fat squashing or bruise was observed. The local fat was pressed between hands to stimulate fat burn. It should be mentioned that at the beginning of each session, patting, friction and surface rubbing was done for about 5 to 7 minutes, and then deep and painful massage was done for about 10 to 20 minutes, and in total, the program consisted of 20 minutes massage [10, 11].

After the course was finished, posttest was given to the participants in the same environment and the same method as for the pretest, on the variable aimed by the research. Descriptive analysis was used to calculate mean values and standard deviation values of the participants' height, weight and age. Also using the software SPSS-13 and the statistic method of correlated t ($p<0.05$), the impact of the program of 15 to 20 minutes massaging on decreasing skin fold fat of the stomach area was evaluated.

Results:

The information about the participants of this research is presented in table 1.

The results of correlated t test show that the mean values of skin fold fat of the stomach are of the participants before and after the massage program was 36.81 and 36.12 respectively, which shows a significant decrease after 30 sessions of massage ($p=0.036$). Therefore, based on the results given in table 2, a 6-week massage program has a significant impact on the decrease of subcutaneous fat of the stomach area ($p=0.036$, $t=2.300$).

Table 1: Individual Features of the Participants

Variable	Age (year) M±MD	Height(cm) M±MD	Weight(kg) M±MD
Massage	23.56±1.69	175.31±5.18	85.04±5.95

Table 2: The comparison of pretest and posttest mean subcutaneous fat of the stomach area of the participants

Statistic indicator	Test	Mean Value	Standard Deviation	T value	sig
Skin fold fat	pretest	36.8125	6.0135	2.300	0.036
	posttest	36.1250	6.1087		

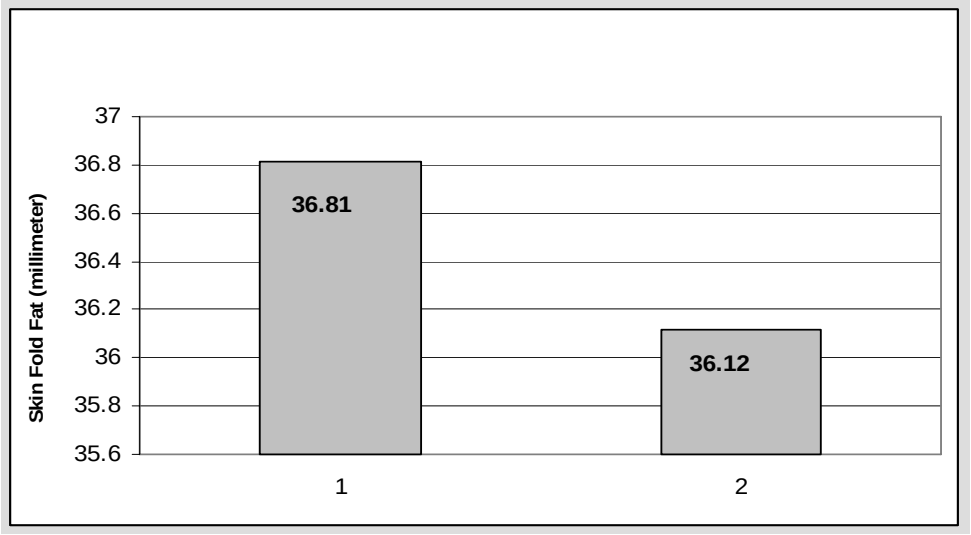

Figure 1: pretest (1) and posttest (2) mean values of the subcutaneous fat of the stomach area of the participants

Discussion:

This research aims to study the impact of a 6-week massage program on the level of subcutaneous fat of the stomach area in non-sportspersons male university students. The results of this showed that the 6-week massage program resulted in a significant decrease in subcutaneous fat of the stomach area ($p<0.05$). Hence, based on the statistic data and significant decrease in skin fold fat of the stomach area, it can be stated that a local massage program results in a decrease in subcutaneous fat of the stomach area.

The risk of developing atherosclerosis and insulin-independent diabetes in the adults who have extra fat in their trunk, particularly the stomach area, is significantly higher that adults who have fat piling in lower body and legs [1], and this is one of the most important problems and concerns related to health. Many studies have shown that a massage program can decrease subcutaneous fat of the stomach area, and the result of the current study is in agreement with those studies [7, 8, 9, 10, 11, 12, 13, 14 and 15].

Denis Wilcho Brawn believes that friction massage decreases fat layers and therefore is a useful and effective way for overcoming obesity, particularly local obesity. On the other hand, petrissage is a very good way for decreasing the fat stored in legs, bottom and shoulders [12]. In addition, Valerian Nicolapovich Fookin (2003) has studied the impact of massage on different parts of the body and has emphasized that 10 minutes of stomach massage results in fat burn, and in addition, affect the internal organs and stimulates and increases the smoke movements of the colon [13].

Additionally, O. A. Petrosian, in his "Massage When Being Obese" (2003), discusses about the impact of massage in releasing energy in the body, the impact of massage on the body of obese people, and the massage techniques for different parts of the body of fat people, particularly the parts with fat piling such as stomach, legs, etc. and the results of the discussions show that massage facilitates metabolism and the refusing of the extra substances in the body, and also increases the absorption of metabolized food [11].

Subcutaneous fat increases by decreasing physical activities. While exercising the muscles oily acids are used as the main fuel source [14]. But there is no evidence to show that the oily acid burnt in the muscle is provided from the fat surrounding that very muscle. This means that exercising any group of muscles will burn oily acids from all over the body [14]. In a research conducted by Serin Purn et al, titled as "Losing weight and decreasing the size of waistline by means of massage with herbal cream", it was concluded that massaging with a specific cream decreases the size of waistline and the weight of women by means of decreasing stomach fat storage, which was reported to be the result of the warming caused by massaging with the cream which resulted in the lipophese of the brown tissue of the stomach fat storage [7].

Also, Eliot Latch, in his study on the impact of massage and the combination of massage and electric waves on decreasing local fat piled in lower body, found that both methods of massage and massage combined with electric waves had a significant effect on decreasing local fat [15].

Regarding the agreement between the results of the present study with the results gained by the other researchers, it could be suggested that massage stimulates local fat burn. Hence, using massage as a way of stimulating local fat to be inserted in the metabolism cycle, results in more decrease in skin fold fat of the stomach area. Also, based on different references, it can be stated that the performed program stimulates local fat and as a result metabolism, during the execution of the program and even until several minutes after the end of the session, during the rest time, which consequently, decreases the skin fold fat of the stomach area.

Conclusion:

In general, findings of the present research showed a decrease in subcutaneous fat of the stomach area. Regarding the significant difference between the mean values of subcutaneous fat of the stomach area of the participants before and after the program, the decrease in the fat can be related to the impact of massage in stimulating fat burn and local metabolism during the massage sessions and even several minutes after the sessions, and it can be concluded that the local massage of the stomach area can be used as a way of decreasing local fat in the people who suffer from local obesity, particularly people who cannot have physical activity, while aerobic exercises immediately after the massage maximizes the effect of massage in decreasing local fat.

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Investigating the Effect of Aquatic Aerobic Training on the Speed of Walking in High and Low-Degree Multiple Sclerosis Patients

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Abstract

Background and objective: Multiple Sclerosis (MS) is a chronic disease afflicting the central nervous system and destroying the myelin sheath of the central nervous system. The most common complications of MS are fatigue, Muscle cramps, Chills, squint, imbalance and gait disorders. This study aims at investigating the effect of aquatic aerobic training for 8 weeks on the speed of walking in female MS patients with high and low-degree Multiple Sclerosis.

Materials & Methods: In this quasi-experimental study**,** 46 female MS patients were randomly assigned into 4 groups based on the degree of Illness and age range. The participants' average duration of illness was 4 ± 1 years, and their age ranged from 20 to 25 years. They were divided in two experimental groups with EDSS 1-4 (15 people) and EDSS 4.5-6.5 (11 people) and two control groups with high and low EDSS (10 people). The experimental group participated in the training program for 8 weeks, three sessions per week with the intensity of 40-50 percent of the maximum heart rate. The speed of walking (SOW) was measured in both the experimental and control groups before and after the exercise. Then the collected data was analyzed using independent and paired t-test.

Results: The results of the study showed that there was a significant improvement in the SOW in the two experimental groups after 8 weeks (High EDSS $P<0/044$ and low EDSS $p<0.003$). Accordingly, we observed a significant difference between the SOW in patients with high EDSS and low EDSS ($p<0.001$).

Conclusion: As the results of this study indicate, aquatic aerobic exercise can improve the SOW in MS patients, particularly those with high degree MS. Thus, we recommend that therapists use aquatic aerobic exercises as a supplementary treatment beside medical treatments for MS patients.

Keywords: Multiple sclerosis, Aquatic exercise, Speed of walking

Introduction

Multiple Sclerosis (MS) is a progressive autoimmune disease afflicting the central nervous system including brain and spinal cord. The complications of MS include destroying the myelin sheath and the formation of scar, which disturb the nervous and electric currents [1, 2]. Ranked beneath trauma, MS is the second major cause of nervous disability during young age and adulthood. Yet the true causes of this disease is still unknown [3, 4]. Currently, the disease has also come to afflict people under 20 with women twice as much afflicted as men [5]. MS may impose severe numerous impacts on the lives of patients. Indeed, people may be afflicted in their prime when they are prone to get married and start a new life and course of activity. The most common causes of MS include: losing the performance or senses in the limbs, fatigue, muscle or physical weakness, muscle cramps, squint, and gait disorder [6, 7, 8]. Fatigue is the most common indicator of MS [9]. For long, therapists used to advise the MS patients not to participate in sports activities because some patients would report inconsistencies in the Disease symptoms during physical activities due to body temperature increase. The other reason as to this ban was the misconception that refraining from sports activity would save the energy for daily routines. However, over the last decade, exercise has been confirmed as having positive effects on MS patients. Recently, it has been demonstrated that the deterioration or intensification of sensory symptoms in over 40 percent of the patients after taking exercise would be temporary and would become normal up to 30 minutes after exercise in almost 80 percent of the patients [10]. Also, controlling symptoms during physical activity programs may increase the patients' participation in

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exercise programs [11].

Nowadays, MS, causing physical disability and motion disorders, is dramatically increasing throughout the world, to the extent that it has been called the century disease. Physical education, obtaining an outstanding position among the bodies of knowledge, has come to be an undeniable, necessary knowledge which can be used as a supplementary treatment with diabetic, cardiovascular, MS and arthritis patients. The complications of MS may appear during 20 to 40 years of age. Tarraghi et al. (2007) reported the mean age of affliction to be 27.12±8.03- [12].

There is a population of 3.5 million MS patients in the world. In the United States, the prevalence of MS has reached 90 per 100,000 people, which requires a fund of over 10 million dollars to look after the patients. The prevalence of MS in Iran is estimated to be 57 in 100,000 people [13]. According to the report by the society for MS patients, there are almost 40,000 MS patients in Iran, the number of whom has been increasing. Khorasan Razavi society for MS has already identified 1400 MS patients 900 of whom benefit from the society supports. As there is no certain cure for MS, patients have to rely on the treatments which solely repress the symptoms [14].

It is necessary for MS patients to maintain their muscles' tenacity and the motion in their joints through taking exercises. Exercise is also useful for the patients as improving their health and performance [15]. Taking regular aerobic exercise may have certain benefits to the MS patients including: improving abilities, good temper (psychological status) and the ability to cope with routines [16]. Sport activity is one of the ways by which to help MS patients. Concerning the physical disability, imbalance and poor motion in MS patients, therapists are recommended to use selective aerobic training for these patients. In this connection, hydrotherapic exercises are particularly beneficial to MS patients. Since MS patients suffer from inactivity and its complications, strengthening muscles and water exercises can prevent muscle atrophy in these patients and result in positive effects on motion disability. It may even lead in a decrease in their muscles' spasticity. For many, taking exercise is equivalent to pressurizing the body to the threshold of pain. However, this is not an appropriate definition since it has been demonstrated that taking exercise to the threshold of pain may increase fatigue and weakness in MS patients. Affected by this view, some MS patients refuse to take any exercises.

Despite medical advancements over the last years, there is still no certain cure for MS and most of the current treatments are to repress the symptoms or lower the rate of progression; therefore, the early diagnosis and timely control of MS may significantly help avoid severe complications and uncontrollable progression of the disease to a great extent [13]. MS is mostly prevalent in indo-European people while it is not considerably widespread in black and yellow races [17]. With regard to the fact that Iranian people are of indo-European origin, it is necessary to conduct more investigations in MS and to come up with procedures so as to control its complications [5]. According to the U.S National Center on Physical activity and Disability for Multiple Sclerosis, "although MS disturbs physical and psychological health, it has been confirmed that regular sport activities and stretch and flexibility exercises would improve physical and psychological health" (as cited in Atashzadeh et al., 2003, 18). Therefore, it is necessary to conduct studies to help develop knowledge and explore physical education along with introducing this field as a supplementary treatment besides medical treatments in order to improve the patients' physical health, the quality of life in dealing with multiple sclerosis, and to fight the inconsistent nature of MS and control its unfavorable complications including trembling, imbalance, dizziness and muscle cramps. Besides, it is essential to conduct studies to explore the adjustment of the immune system in order to help avoid the devastation of myelin and the central nervous system white matter before the nerve axons can be harmed. Following this line of research conducted in other parts of the world and doing further studies in Iran in order to help the MS patients benefit from exercise as a supplementary treatment would provide the patients with new hopes and help alleviate their physical and mental sufferings. With regard to the dramatic increase in the number of MS patients, treatment expense, and the severe complications of MS on the life quality of patients, exercise can play a significant role in controlling the MS complications such as fatigue as well as improving the life quality of patients. Sharcot (1868) was the first researcher who studied MS patients. Romberg et al. (2004) found that an aerobic training program for 23 weeks can relatively improve the speed of walking in MS patients [20]. Husted et al. (1999) also devised an 8-week course of exercise for 30 MS patients and observed a significant improvement in the patients' speed of walking [21]. Wiles et al. (2001) studied the effects of a 4-week aerobic training program on 42 MS patients and found a relative improvement in their speed of walking [22]. Lord et al. (1998) conducted a study to compare two types of sports

therapy for MS patients with gait difficulty to improve their walking. The participants in either of the groups improved significantly in their responsiveness. There was no significant difference between the two groups in time-limited 10 meter walking, the length of step, and balance. O'connell et al (2003) conducted a randomly-controlled program to investigate the effects of sports therapy on medium-degree MS patients and found no significant relationship between the MS intensity and the speed of walking.

With regard to research findings indicating the positive effects of physical activities on MS patients, we decided to conduct a study which, besides medical treatments, drew on an 8-week selective aquatic aerobic training program to help reduce the MS symptoms and improve the patients' speed of walking. The question is whether selective aquatic aerobic training has a significant effect on the patients' speed of walking.

Method

This was an applied, quasi-experimental research. From among a population of 100 patients (100 patients whose MS affliction was approved by a neurologist, and who were under medical treatment), we randomly chose a sample of 46 and assigned them into 4 groups. All of them had medical files in private clinics in which they were under treatment. There were two experimental groups, one with high EDSS (10 members) and the other with low EDSS (15 members). There were also two control groups with high and low EDSS (each with 10 members for whom the average affliction period was 4±1 years, and their age ranged from 20 to 50).

To carry out the study, one day before the program was started, the patients came together. Then the researchers informed them of the exercise types, the intensity of exercise, and the number of iterations per session. Next, the experimental and control groups participated in the pre-test in which their walking speed and Expanded Disability Status Scale (EDSS) were measured and recorded.

The training program for the experimental group consisted of an 8-week aerobic training program 3 sessions each week with 50 to 60 percent maximum heart beat rate. The heart beat was measured during the exercise activity using Polar watch. At the end of program, after each EDSS stage, all groups were given the walking speed test. Then the results were analyzed. Besides, all the group members were using medicines during the program.

To test the speed of walking*:* 10 and 14 meter tests were used. In these tests, the first and last two meters are not considered in measurements.

Kurtzke's Extended Disability Status Scale questionnaire: this questionnaire measures different status and performances pertaining to the central nervous system. This questionnaire would mark the MS patient between 0 and 10 based on the damage inflicted upon the central nervous system. The greater the damage the bigger the obtained mark will be. In this study, the Kurtzke's EDSS mark was between 1 and 6. The validity of EDSS test has been approved by Kurtzke [19]. As to the analysis of the data, descriptive statistics was used to tabulate the data, calculate the means and standard deviations. To compare the means, dependent and independent t-tests were used. The level of significance used to show the statistically significant differences was set at 0.05. In the course of statistical analyses, SPSS software was utilized.

Results

According to the data presented in table 1 and table 2, selective aquatic aerobic training significantly improves the speed of walking in patients both with high and low-degree Multiple Sclerosis (p=0.003). The training program could successfully increase the speed of walking in low and high-degree MS patients as much as 0.711 and 13.805 seconds on average, respectively.

The results also indicated that the training program has been more beneficial to high-degree patients as their walking speed significantly exceeds that of the low-degree patients (p=0.017) - (table 3).

Table 1: Comparative test of walking speed in low-degree patients

The walking speed of low-degree Patients (seconds)	**Experimental group**		**Control group**		**The two groups' t values**	
	SD	**Mean**	**SD**	**Mean**	**Control group**	**Experimental group**
Pre-test	1.287	6.822	1.340	6.733	P=.496	P=0.003
Post-test	1.273	6.110	1.688	7.069	T=-0.757	T=3.673
The difference between Pre-test/post-test results	0.749	0.7111	1.448	-0.3463		

Table 2: Comparative test of walking speed in high-degree patients

The walking speed of high-degree Patients (seconds)	Experimental group		Control group		The two groups' t values	
	SD	Mean	SD	Mean	Control group	Experimental group
Pre-test	37.043	33.278	21.996	22.450	P=0.087	P=0.044
Post-test	18.634	19.474	23.369	23.866	T=-1.920	T=2.307
The difference between Pre-test/post-test results	19.844	13.805	2.363	-1.435		

Table 3: Covariance and the mean difference between the two experimental groups

The two groups' test of covariance			Independent t-test for comparing the means of the two groups			
t	**P value**	**Result**	**T**	**df**	**P value**	**Mean difference**
16.051	0.001	**The two groups covariance accepted**	2.573	24	0.017	13.0934

Discussion

Many researchers have conducted studies to investigate the effect of aquatic exercises on MS patients in different parts of the world. However, there have not yet been many studies to cover the issue in Iran, and so the reference materials for this study were all in English. As a limitation to this study, the Extended Disability Status Scale (EDSS) ranged from 1 to 6. There were also some limitations that restricted the sample to 46 people. These included: the impossibility to use male participants due to their small population, the participants' ages ranging from 20 to 50, and keeping the disease secret by some patients. The advantages of regular aerobic exercise for MS patients include: improving the patients' abilities, developing the temper (psychological status) and the ability to deal with daily routines [16].

MS patients are recommended to take stretch and yoga exercises. Motl et al. (2005) concluded that there was a relationship between the intensification of symptoms and less sports activities in MS patients. In their study, they examined the deterioration of symptoms in a period of 3 to 5 years and the reported physical activities by the patients in a sample of 51 MS patients. Accordingly, 31 patients reported the deterioration of their symptoms. Thus, the deterioration of symptoms significantly correlated with low physical activity. This provides a further evidence for the relationship between the deterioration of symptoms and low physical activity. Therefore, sports therapy can be used as a supplementary treatment besides medical treatments to reduce the MS symptoms [23]. In this regard, hydrotherapy plays a critical role because taking exercises in water improve body fitness. There are certain advantages of water exercises for these patients, the least of which is that the patients' weight considerably lowers in water and the water pressure from all around helps the patients keep their balance. Also one of the major problems of these patients while taking exercises is their temperature since as the body temperature increases, the nerve signals are disturbed and thus the disability prevails and the patient weakens. As the intensive exercise increases the internal body temperature, water would decrease the temperature in patients. Since under normal conditions, myelin sheath covers the nerves and protects them against the complications of increasing temperature, the lack of myelin sheath in MS patients may enhance the risk of neuronal short circuits in the central nervous system when the internal body temperature increases. As a result, the symptoms may intensify or new symptoms might arise. Taking exercise in water may also help the patients with maintaining and strengthening their muscles, providing oxygen for the brain, improving and maintaining the range of motion, a better control on muscles, improving the quality of life, keeping a better balance, energy and gaiety [24].

Fatigue is one of the most common complications of MS affecting two-thirds of the patients. Besides, more than half of the patients have already reported that fatigue is the most important complication of MS which causes

disability. Fatigue directly affects the speed and duration of walking in MS patients. As there is a direct relationship between the distance walked and the muscles' oxygen expenditure, an improvement in the walking distance may be due to the improvement in muscles' capacity to use the oxygen or the cardiopulmonary function in transmitting oxygen through blood into the muscles. In the present study, the patients' improvement of walking speed can also be attributed to a decrease in the patients' fatigue since there is a close relationship between the two. No doubt, every program should be compatible with the needs of patients so that it might be efficient and effective. To be invaluable, training programs should fulfill the needs of MS patients. With regard to the nature and recurrence of MS symptoms, it often entails spasms and severe muscle cramps. Of course, if training programs do not take these complications into account, they may result in the deterioration of symptoms [25].

Thus, MS patients are not recommended to take intensive physical exercises because intensive exercises would increase the body temperature and intensify the symptoms. Extreme fatigue may also intensify the factors that increase symptoms. Therefore, different types of sports therapy including: aerobic exercises, yoga and swimming are recommended for MS patients in order to reduce fatigue, improve the quality of life, the speed and duration of walking, reduce the physical weakness and disability, improve balance and resisting the disease [26, 27]. With regard to the fact that MS patients frequently fall down due to imbalance, fatigue and spasticity, they usually fear walking; thus, the improvements they make during the training programs may be as a result of overcoming their fears. An increase in the speed of walking may be due to gaining strength, balance and even the flexibility as a result of selective aquatic or stretch exercises because all these factors can affect the speed of walking.

The most important point here is that there is no other study with the same procedure and exercise types as the present research to share the results with. The results of the present and past studies can be used to devise training programs, particularly with selective aquatic exercises, to increase the speed of walking in MS patients. The results of t-test showed that the speed of walking in the pre-test and post-test significantly changed in the experimental groups. The main reason for increasing the patients' speed of walking in this study was due to the effects of selective exercises on muscles strength, increasing the need for motor units and activation of new motor units. Since the selective aquatic exercises up to 8 weeks after the beginning of the program induce structural adaptations and partial hypertrophy, the increase in the patients' walking speed in this study may be the result of such factors. A further reason is that most of these patients had no history of sports training and took the exercises as their first serious sports experience.

Consistent with the findings in this study, Romberg et al (2004) found that an aerobic training program for 23 weeks can relatively improve the speed of walking in MS patients [20]. Husted et al (1999) conducted an 8-week aerobic training program on 30 MS patients and reported a significant improvement in the patients' walking speed [20]. Wiles et al. (2001) studied the effect of a 4-week aerobic training program on 42 MS patients and found relative improvement in their speed of walking [22]. Contrary to the findings of the present study, White et al [28], Lord et al [29] and O'connell et al [30] found no significant improvement in the patients' speed of walking.

One of the factors that may have contributed to the improvement in the patients' speed of walking in this study may be the implantation of selective aquatic aerobic exercises and deciding the duration of program to be 8 weeks. Therefore, it seems necessary for MS patients to take collective aquatic exercises while considering the overload factor and working under the supervision of experts because these exercises are compatible with their physical limitations, imbalance and gait disorders.

Conclusion

Taking selective aquatic exercises may improve the speed of walking in MS patients. Therefore, the therapists are recommended to use collective aquatic exercises as a supplementary treatment besides medical treatments for MS patients.

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References: Bibliographic references in the text appear like [1, 2 ...], using square brace. References should be numbered consecutively in the text.

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