

The Effect of Moderate Intensity Aerobic Exercise on Breast Milk IgA Concentrations

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Abstract

Background: The immune properties of mothers' milk are well known. But the effects of physical activity on humeral immune properties of mothers' milk is still undetermined. Therefore, reports on the impact of exercise on IgA concentrations of mothers' milk is controversial. The purpose of the present study was the investigation of the effects of selected aerobic exercises in maximum intensity of 60-70% of heart rate reserve on IgA concentrations in breast milk as well as body composition. **Method:** In this research, 28 sedentary women (29 ± 5.7 years; VO_{2max} 36 ± 4 ml/Kg/min), divided into two exercise and control groups through random sampling, took part. The exercise group performed some particular exercises for 10 weeks whereas the control group did not do so. Milk samples were taken from both groups and measured by the ELISA method. Body composition was also measured in different stages of the study. **Results:** In the rest status, the two groups were identical in terms of IgA concentrations ($p= 0.549$) and body composition ($p=0.204$). IgA concentrations under exercise load of 60% ($p=0.060$) and 70% ($p= 0.001$) of the HRR respectively showed a significant increase as compared to the resting status mean values in the two groups. Body composition variables were only of significant values in terms of comparing the general effects, only in the factors of group ($p=0.003$) and reciprocal effect of the grouping - the duration of the exercises ($p=0.024$). **Conclusions:** The results of this research show that, under the effects of moderate intensity exercise, the mothers' secretory immune system experiences some changes. Therefore, IgA concentrations in the milk increase. In addition, with the reduction of fat weight, the decrease of fat mass percentage, and increase in the body density, the level of the mothers' aerobic fitness is increased, which is in no contradiction with their lactation performance. **Keywords:** mucosal immunity, breast milk, aerobic exercise

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INTRODUCTION

The existence of a particular immune system in the secretory mucosal is rather a new theory, and the present information about mucosal immunity is based on the research done on the digestive system. However, it is likely that, immune responses in mucosal and lymphatic tissues (the mother's mammary glands) are basically similar (Soltani, 2018). The mother's mammary glands are one of the areas that produce milk. A mother's milk is a suspension of fat and protein, a solution of lactose and minerals, which is isotonic with plasma. Most of the milk proteins are unique and are not found elsewhere in the body. Secretory IgA is one of the three proteins in a mother's milk, and its concentration is high and plays an important immunological role for the infant (Johnston, Landers, Noble, Szucs, & Viehmann, 2012). Immunoglobulin A in a mother's milk has the shape of S-IgA and is therefore very resistant to the proteolytic activity of the stomach-intestine track of the infant's digestive system (Lovelady, Hunter, & Geigerman, 2003). On the other hand, different factors affect a mother's secretory immune system. For example, the IgA present in a mother's milk as index of mucosal and humeral immunity may change during sport activities as the most important antibody in the infant's body. The results of the studies carried out on the type of sport, intensity and time of the exercise and its impact on IgA concentration in the milk are diverse and contradicting. This adds to the mother's uncertainty about the amount of milk taken by the infant and possible change of immunity composition (Lee & Kelleher, 2016). Ogawa et al. (2004) emphasized the varied results on the influence of other various bioactive factors and physical activity on the concentration of secretory IgA antibodies in the mother's milk and colostrum (Ogawa et al., 2004). Mackinnon (1994) related the different general responses of the immune system to the intensity and kind of exercise. Lovelady et al. (2003) and Klentrou, Cieslak, Macneil, Vintimner, & Pyley (2002) reported an increase in the milk's IgA concentration followed by middle intensity of physical activities, while Schouten, Verschuur, and Kemper (1998) and Lovelady et al. (2003) reported a drastic decrease in the milk's IgA concentration followed by physical activities. However Su, Zhao, Binns, Scott, and Oddy (2007) reported that exercise did not affect breast-feeding compositions and volume (outcomes) at the usual levels of activity undertaken by mothers.

Despite the various studies carried out, the importance and role of physical activities during a mother's breast feeding period from viewpoints of immunology and physiology have not been paid attention, and few researches have been carried out on this subject. In addition, the research performed on the IgA concentration during different physical activities in Iran has not been reported, and there are limited studies worldwide. On the other hand, mothers who breast feed their infants and are involved in sports use higher energy, which is likely to lead to changes in their body composition. The increase in the energy consumption may change the milk's volume and components such as IgA. This issue also needs more essential study. Moreover, because the mechanism responsible for suppression and enforcement of secretory immune system have not been known yet, more research for understanding the relationship between sport (exercise intensity) and this system during breast feeding is required. Therefore, the aim of the present study is the investigation of the effects of selected aerobic exercises with the intensity of 60% HRR (during the first five weeks) and 70% HRR (during the second five weeks) on the IgA concentration in the first year of breast feeding and the variables of the body composition. Furthermore, in this study, the plan of exercises has followed a certain pattern.

METHOD

Participants

In this research, 28 non-athletic healthy volunteer mothers with the following properties: they were 6-8 weeks after delivery; they breast fed their babies for the first year and were divided into two exercise and control groups through random sampling; took part (Table 1).

Exercise protocol

Breast-feeding mothers took part in the research for three time periods including rest period, aerobic exercises during the first five weeks, and second five weeks of aerobic exercises. To determine the primary level of the intensity of exercises, an introductory pretest was conducted, and the highest range of reserve heart rate of the exercises was computed (135-144 $\text{beat}/\text{min}^{-1}$ in the first five weeks and 142-153 $\text{beat}/\text{min}^{-1}$ in the second five weeks).

Table 1: Characteristics of lactating mothers

Group \ Variable	Age (year)	Height (cm)	Weight (kg)	Maximal estimated heart rate (beat/min)	Maximal oxygen consumption (ml/kg/min)
Experimental (n=14)	28.8±5	161±3.8	74±12	191±5.8	36.6±4.2
Control (n=14)	29.4±6	160±2.6	71.9±7.3	190±6.4	35±3.9

Values are expressed as mean ± standard deviation.

A certain questionnaire based on the previous research was provided and distributed in order to know about the primary health of the mothers (Yoneyama, Ikeda, & Nagata, 1990) and survey their physical activity (Pate et al., 1995). Control variables were also measured. The similarities of the variables during the rest of the control and experimental groups were determined. The experimental group performed aerobic exercises with the intensity of 60% reserve heart rate for three sessions per week in the first five weeks. The group continued the same exercises with the intensity of 70% reserve heart rate for three sessions per week for the second five weeks (Bopp, Lovelady, Hunter, & Kinsella, 2005; Lovelady et al., 2003). The control group was not involved in the exercises.

Measurement of body composition and maximal oxygen consumption

To figure out the percentage of the body fat, bioelectrical impedance analysis (Omron HBF-306C) was used. Fat weight and lean body mass (kg) were calculated from the percentage of fat and weight and body mass index measured by WHO method (2018) (27). In this study, the maximal oxygen consumption was computed using the method in George et al.'s (2007) study.

Measurement of the concentration of Immunoglobulin A

5^{cc} milk samples, using Ogawa et al. methods (2004), were obtained through a sterilized breast pump. The milk was kept in -20^c in a freezer in order to be analyzed. Then, the ELISA method was used to measure the amount of IgA in the mother's milk (Thiha & Ibrahim, 2015).

Statistical analysis

To analyze the data statistically, statistics' tests MANOVA, One-way ANOVA, independent sample T test, paired sample T test, and one sample T test were used.

RESULTS

The effect of chosen aerobic exercises with their intensity of 60% and 70% HRR on IgA concentrations and body composition variables were studied and the following results were obtained.

Comparison between experimental and control groups to find the similarity of average immunoglobulin A concentration during rest

This index was studied during rest to ensure IgA sameness to be measured in both groups, at the beginning of study. As the data in Table 2 shows, there was not a considerable change ($p=0.549$) in the milk's IgA in both groups during rest.

Table 2: Comparison between experimental group and control group regarding the average sameness of IgA concentrations in the mother's milk during rest

Group	Statistics*	Mean (mg/dl)	Standard deviation	Mean standard deviation	P**
Experimental (n=14)		25.6	7	1.9	0.549
Control (n=14)		24	6.6	1.8	

*Independent Sample T, P**: Significance level, Values are expressed as mean \pm standard deviation.

Comparing the milk's IgA mean concentration in both groups during first five weeks (60% HRR) and second five weeks (70% HRR) of aerobic exercises

Table 3 data shows that IgA mean concentration with the activity intensity of 60% ($p=0.001$) compared to IgA mean concentration during rest in both groups had a significant change (figure 1).

Table 3: Comparison between IgA average of mother's milk in aerobic exercises with the intensity of 60% and 70% reserve heart rate and mean amounts of rest

Statistics Stage	Average amounts of test = 24.8 mg/dl					
	IgA (exp*)	IgA (con**)	Mean difference	90% confidence range of difference		Two sided significant level***
				Minimum	Maximum	
70% reserve heart rate	40.4±11.6	24±6.6	15.56	10.05	21.06	0.001
60% reserve heart rate	29.9±9.3	24±6.6	5.13	.071	9.54	0.060

*Experimental Group, **Control Group, ***One-Sample T Test

The regression line fitted to the figure 1 shows that there is a considerable difference between IgA concentration during rest (baseline) and IgA concentration in exercises with the intensity of 60% HRR. Moreover, due to the impact of intense exercises, the amounts of antibody in the experimental group increased. In addition, there was a significant difference between IgA concentration in the activity intensity of 70% HRR and the former amounts, and IgA concentration increased. Furthermore, there is a significant difference between the two kinds of intensities of the exercises in the first five weeks and second five weeks, and IgA concentration in the mother's milk increased. On the other hand, MANOVA test showed that mean IgA concentration difference throughout the phases was generally significant ($p=0.004$). Therefore, One-Way ANOVA test and Post-Hoc test were used to interpret the data. Thus, the difference between mean pairs of rest-exercises in the first five weeks ($p=0.079$), rest-exercises in the second five weeks ($p=0.001$), and exercises in the first five weeks-second five weeks ($p=0.008$) was different.

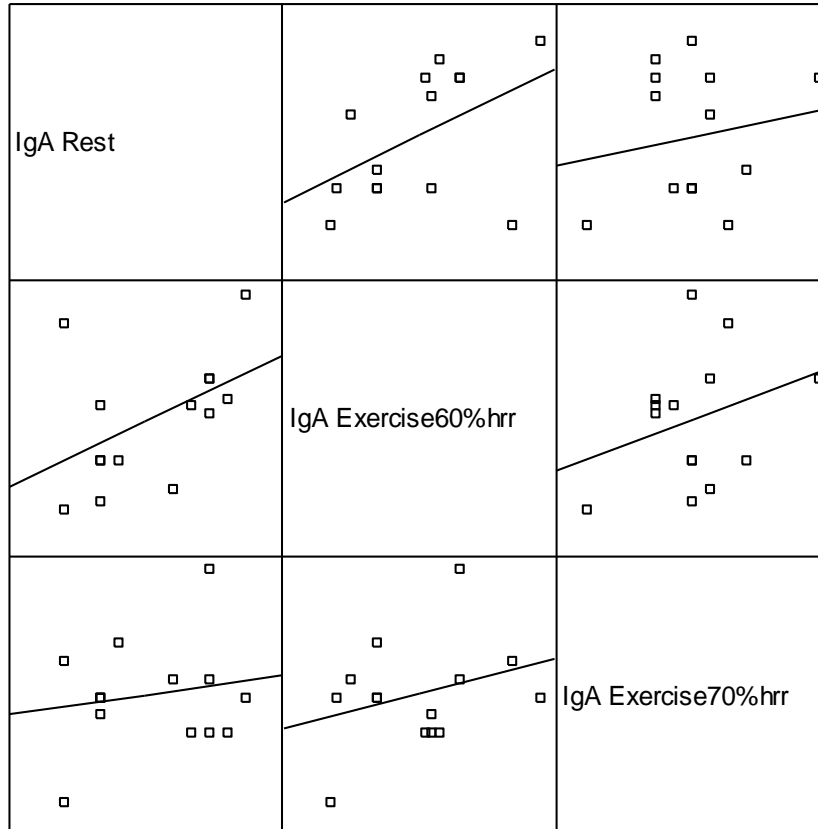


Figure 1: Comparison between mothers' milk IgA concentrations in rest, first five weeks, and second five weeks exercises

Comparison between experimental and control group to find the sameness between mean indexes of body composition in rest

To find out the general difference, through the MANOVA test, body composition indexes in rest were studied and no considerable difference ($p=0.204$) was noticed. Detailed analysis of body composition variables through One-way ANOVA test also showed the sameness between average body composition indexes between the two groups.

Comparison of mean indexes of breast-feeding mothers' body composition in experimental and control groups in rest, first five weeks and second five weeks of aerobic exercises

The general impact of body composition variables in rest, first five weeks, and second five weeks of aerobic exercises in both groups was studied (Table 4 and Table 5).

Table 4: Mean body composition indexes in control and experimental groups in rest, first five weeks, and second weeks of aerobic exercises

Stages Groups	Rest		First five Second five weeks of exercises weeks of exercises	
	Variables	IgA (M±SD)	IgA (M±SD)	IgA (M±SD)
Experimental (n=14)	Weight (kg)	74.4±12	72.9±11.6	70.6±10.9
	Fat weight (kg)	22±5.6	20.7±5	18±4.8
	Lean body weight (kg)	52±6.7	53±7.5	53.6±7.7
	%Fat	29±3	28±2.9	25±2.7
	Body density (gr/cm3)	1.03199±0.9125	1.0346±0.636	1.0411±0.575
	Body mass index (weight/height ²)	28.5±4	27.7±4	27.2±4.6
Control (n=14)	Weight (kg)	71.9±7	72.3±7.3	72.9±7
	Fat weight (kg)	20.6±4.7	21±4.6	21.9±4.2
	Lean body weight (kg)	51±3	51.3±3	51±3
	%Fat	28±3.6	29±3.4	31±3.2
	Body density (gr/cm3)	1.0345±0.6171	1.0334±0.755	1.0317±0.678
	Body mass index (weight/height ²)	28±2.6	27.9±2.4	28.3±2.4

Table 5: The comparison of the general impact of the group, time-period of exercises, and the impact of group-time period of exercises on breast-feeding mothers' body composition index in the two groups

Statistics test	Statistics F	P*
Group (Wilk's Lambda)	3.682	0.003
Trend (Wilk's Lambda)	1.346	0.199
Group - trend (Wilk's Lambda)	2.044	0.024
<i>*Multivariate Tests (MANOVA)</i>		

According to Table 5, group (experimental - control) factor had a considerable effect ($p=0.003$) on body weight, fat weight, lean body mass, percentage of fat mass body density, and body mass index. The reciprocal (group - time period of exercises) impact on the six mentioned indexes were significant ($p=0.024$). However, the time period exercises factor alone did not have a significant impact ($p=0.199$) on the indexes. The test was conducted through a One-way ANOVA test. Every variable was studied separately, and the body density variables regarding group factor ($p=0.080$), and group-time period ($p=0.006$), and also mass percentage fat regarding group factor ($p=0.013$), and group-time period ($p=0.001$) were significant.

DISCUSSION

Infanthood is a vulnerable period. In this period, the baby passes through different immunological and physiological adjustments to have life outside the womb. The mother's milk contains antibodies, some of which are absorbed by the intestine. Secretory IgA in the mother's milk is one of the most common immunoglobulins in a mother's milk in this connection. Thus, this study focused on the role of exercises with respect to the kind of activity, intensity, time-period activity, and time-period of the plan for the activity on the immunological responses of mother's milk, especially changes in IgA concentration and also body composition variables. In this research, the intensity of exercises at 60% and 70% reserve heart rate equaled 135-153 beat/min. The exercises lasted for 49-71 minutes per session, 3 sessions per week, for 10 weeks. New scientific observations were considered in this research, which have recently shown that body activity with the average intensity correspondent to

energy cost has psychological and mental advantages (Äijö, Kauppinen, Kujala, & Parkatti, 2016).

In the research done (such as ACSM), the intensity of the exercises, 60%-70% of the maximal heart rate (equals 50%-85% of the maximal aerobic power) and 20-60 minutes of time-period activity, was suggested (Pate et al., 1995). The present research has shown that during breast-feeding, exercises with the intensity of 60%-70% HRR, had significant impact on the IgA concentration of the mother's milk. In addition, IgA concentration was affected during aerobic exercises in such a way that during the first five weeks of exercises, the amount of baseline IgA increased significantly from 24.8 mg/dl to 29.9 ± 9.3 mg/dl. The increase was more noticeable during the second five weeks, so that the amount extended to 40.4 ± 11.6 mg/dl. Further, the antibody's concentration had significant changes between the two kinds of activity intensity. These results were in line with the results of Klentrou et al. (2002) and Larson-Meyer (2002). They emphasized the importance of aerobic fitness and exercises with medium intensity to keep or increase IgA concentration of the mothers' milk, and the efficiency of breast-feeding. But Fly, Uhlin, and Wallace (1998) and Lee and Kelleher (2016) reported no change in the compositions and the milk's protein as a result of exercises and short-term diet. O'Connor, Schmid, Carroll-Pankurst, and Olness (1998) reported no effect of relaxing exercises on the milk's IgA concentration, and Lovelady et al. (2003) reported no change in IgA concentration of the mother's milk following physical activity. In contrast, Gregory, Wallace, Gfell, Marks, and King (1997) reported that the IgA concentration of the mother's milk decreased following maximal graded activity. In the present research, the concentration of IgA changes during the starting period of exercises after delivery. The baseline average of the IgA concentration of the mother's milk equaled 25.6 ml/dl in the experimental group and 24 mg/dl in the control group. In addition, the participants were in their 6-8 weeks after delivery. Other researchers have reported that the average amount of baseline IgA concentration in mothers during 10-12 weeks after delivery equaled 0.7-2.0 gr/l in the milk (Lovelady et al., 2003).

The type of exercise, intensity and time-period of the activity are among the factors that stimulate the increase in the IgA concentration of the mother's milk. In the present study, due to certain intensity of aerobic

activities, which extended for 10 weeks, IgA concentration of the mother's milk increased significantly. Such an increase has specific importance in the primary immunological defense against topical infections in areas such as the digestive system, respiratory system, and mammary glands, and causes the maturity of secretory immunological system in the baby (Korhonen, Marnila, & Gill, 2000). The stimulation of IgA concentrations increase due to exercise and maintains a long time at high levels, it prevents the entrance of antigens into the intestine surface of the infant and stops the progress of food allergy (Järvinen et al., 2014). This in turn protects the baby against EPEC, which causes illness in the small intestine and causes acute diarrhea (Manjarrez-Hernandez, Gavilanes-Parra, Chavez-Berrocal, Navarro-Ocaña, & Cravioto, 2000) and makes improvements in microbial flora and activity against lister's antigen (Chen & Allen, 2001). On the other hand, stimulation of IgA concentrations increase due to exercise and the presence of IgA with high concentrations in the mother's milk has been effective in fighting Type 1 HIV virus (Duprat et al., 1994; Aparicio et al. 2018). It also decreases the risk of sudden infant death syndrome (Gordon et al., 1999) and protects the infant against stomach inflammation, middle ear's acute inflammation, urinary tract infection, flu, blood infections, and antrocolit necrosis (Hanson et al., 2002). Also, in this study, the intensity of activity was defined at maximal 70% reserve heart rate but intense activities (more than 70% HRR) were not included. Researchers reported the existence of stress hormones (cortisol, noradrenalin and adrenocorticothropic) and their effectiveness on suppression of the immune system (IgA concentration decrease) in intense activities (Hasiiec et al. 2017; Tartibian & Moazeni 2003). However, it is possible that low intensity physical activity may not increase the mentioned hormones (Lovelady et al., 2003). In the present research, analysis of body composition variables showed that, in general, among factors of group, time-period exercises, and group-time period exercises, the factors of group, and group-time period exercises were significant. Thus, control and experimental groups were different with respect to the relevant characteristics. This difference became more noticeable when mothers performed exercises with the intensity of 60% HRR (first five weeks) and 70% HRR (in the second five weeks). In other words, there were significant changes in weight, fat weight, lean body weight, body

density, percentage of fat, and body mass index variables due to the difference between both groups, and the impact of aerobic exercises and other external factors (time-period of the exercises) did not affect the aforementioned variables.

In addition, when the variables were analyzed separately, it was noticed that among the six variables, only body fat percentage (with respect to factors such as group: $p=0.013$, and group-time period exercises: $p=0.001$) and body density (with respect to factors such as group: $p=0.080$, and group-time period exercises: $p=0.006$) were significant. The changes occurred merely because of the impact of aerobic exercises and without limited calorie and malnourishment in the mothers participating in the research. In this regard, Bopp et al. (2005) reported a decrease in the fat percentage of breast-feeding mothers in the experimental group (21%) compared to the control group (27.9%), followed by aerobic exercises with the intensity of 70% predicted heart rate (Bopp et al., 2005). Dusdieker, Hemingway, and Stumbo (1994) reported weight reduction of about 0.48 kg per week, which extended for 10 weeks of aerobic exercises in breast-feeding mothers. In contrast, Bopp et al. (2005) and Prentice (1987) emphasized the lack of change in body density, fat mass percentage, and body weight in breast-feeding mothers, which was conducted with limited calorie.

Moreover, the findings of this research correspond to the recommendations of Europe-America Medical Institute based on the reduction of up to 2 kg of body weight per month after the first month of delivery (Korhonen et al., 2000). It appears that reduction in fat mass percentage, weight, and body fat mass, and an increase in the body density of the breast-feeding mother have been attributed to the impact of the kind of activity (aerobic), intensity of activity (60%-70% HRR), and the duration of exercise periods (10 weeks). It is possible that during breast-feeding, medium intense activity stimulated the catabolism of the fat tissue (Lee & Kelleher, 2016), which makes fat mass lipolysis in areas of the abdomen and thighs more noticeable (Bopp et al., 2005). Besides, some hormones cause a decrease in fat tissue mass and fat percentage in breast-feeding mothers who are involved in athletics (in contrast to sedentary women) (Lee & Kelleher, 2016). In these conditions, synthesis of some hormones such as prolactin increase in the mother's milk (Lovelady et al., 2003). On the other hand, limited calorie activates

hormonal mechanisms and affects the variable changes, but in the present research, the changes were due to exercise.

Unfortunately, there has been no research history on this field in Iran, and the range of research and studies on this subject have been few worldwide.

However, this study is a step toward the clarification of the mother's milk's immunity responses to intensity and duration of exercises, and it is possible that studies on other exercise patterns give different results. In addition, the study of other IgA subclasses and other immune indexes in the mother's milk is one of the most important subjects for future researches, which will lead to other findings.

CONCLUSIONS

In conclusion, these original findings give evidences that mothers' secretory immune systems' response is affected by the medium intensity of exercise, and the IgA concentration of the mother's milk increases. Therefore, it provides adjustable resistance against potential pathogenic injuries. The increase of this antibody in the mother's milk neutralizes infectious organisms and prevents the organism's colonization in the infant's intestine during breast-feeding. This type of exercise intensity does not contradict the mothers' ability to successfully breast-feed her babies and causes an increase in the infant's and mother's mucosal immune performance and efficiency. Moreover, the findings of this research indicate that a decrease in fat weight, fat percentage, as well as an increase in lean body weight and body density, due to the exercises and without calorie limit, make a secure margin for mothers who breast-feed and cause an increase in their level of aerobic fitness.

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The Qualitative Survey of Effective Factors on Students' Participation in Extracurricular Sport Activities

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Abstract

Background: The purpose of this research was the qualitative survey of effective factors on students' participation in extracurricular sports activities. **Method:** The research methodology was qualitative, the kind of phenomenology with targeted sampling gathered through in-depth interviews with 16 students from Allameh Tabataba'i University of Tehran, Iran. The number of students in this university (research population) was about 18,000 in the academic year 2016-17. All interviews were carefully recorded, and then the analysis of the text of the interview was carried out by Smith's method. **Results:** Findings from the interviews with students was extracted in three main themes, including: Students' enthusiasm for sports activities, motivational factors of sports participation, and barriers to sports participation. 30 sub-themes are also included. **Conclusions:** Based on the results of this study, it is recommended that authorities and managers of extracurricular sports activities of universities pave the way for the development of extracurricular sports activities for students by removing barriers to sports participation and improving the factors of motivation and enthusiasm for sports.

Keywords: Extracurricular sports activities, Qualitative survey, Sports participation, Students

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INTRODUCTION

The issue of students' leisure time has always been one of the concerns of university authorities and students at all levels (Tondnevis, 2008). Inadequate motivation for students' participation in organized and regular sports activities and their doing different and sometimes destructive activities (including virtual entertainments) and their consequences can lead to physical and mental problems for the students. In addition, students' ignorance about the importance of leisure time in their everyday programs and its impact on their physical and mental health shows how important it is for university officials to present information about and make planning for leisure time with a focus on sports activities. Those involved in sports activities are engaged in social relationships and, as a result, get rid of isolation, which in turn can help reduce depression and increase mental health. Exercise also helps people to discover their mental talents, overcome social problems, if they have any, and improve certain human characteristics such as mood, self-confidence, self-esteem, socialization, and social adjustment (Pronk, Crouse, & Rohack, 1995; Shahiandi et al., 2014; Pooladi et al., 2011). In addition, sports participation can bring a higher level of happiness and satisfaction with life for individuals (Stubbe, De Moor, Boomsma, & De Geus, 2007).

Physical activity and sport in students' leisure time during their studies has a great impact in the creation of student's personal identity and quality of life in the future (Ignatov, 2016). Extracurricular activities are defined as those that students undertake apart from those required to earn a degree. They may include hobbies and social, sport, cultural, or religious activities. They have some benefit and possess, and some structure/organization. Extracurricular activities are expected to enrich students' experience, develop students' soft skills, help them cope with stress, and provide them with added advantages to increase their employability (Veronesi & Gunderman, 2012; Thompson, Clark, Walker, & Duncan Whyatt, 2013).

The main goal of the extracurricular sports activities of universities is to enable students enhance their sense of responsibility and have effective participation in social activities as citizens. This can play an important role in general education and improvement of students'

physical, motor-activity, emotional, rational, moral, and social dimensions through voluntary healthy and amusing activities (Tejari, Esmaeili & Hojatkah, 2011). In general, attending university sports activities will make students benefit from the recreational sports programs and services. These activities, which take place in the leisure time of students only for entertainment and free from any material goals, play a major role in creating a sense of social participation and are considered a powerful tool for students' interaction with one another and with the university environment. Studies show that students who make use of these facilities are more self-confident and self-reliant than those who do not benefit from these services. Moreover, recreational sports have many benefits such as stress reduction, self-esteem creation, student progress, and social facilitation and integration (Jun, 2011).

Emami, Heidarinejad and Shafi Nia (2013) concluded in their research that the five priorities of students for participation in extracurricular sports activities include motivation for health, social interaction and recognition, sports competition, vitality and happiness, and progress in skills. Moreover, Nazarian Madavani and Ramazani (2013) conducted a study entitled *Evaluating the barriers and strategies for the development of the share of students' sports activities in their leisure time as prioritized by students*. They concluded that the barriers to the development of the share of sports activities in students' leisure include lack of equipment, space, attention to physical education courses in schools, and awareness about the benefits of regular physical activities.

Ignatov (2016) also examined the role of exercise and physical activity in the leisure time of students at the University of Sofia (166 people), 51% of whom expressed their own motivation regarding exercise to be rooted in health and well-being, and 36% of the students chose exercise for leisure as a personal choice, their alternatives including swimming, football, volleyball, aerobics and juggling. 56% of these students exercised outside college. Also, Sarraf, Mohammadsalehi, Kheirolahi, Rahimi, & Mohammadbeigi (2017), in their research, with the aim of assessing and prioritizing the activities of the students of Qom University of Medical Sciences in their leisure time, showed that most of the students of this university do not make effective use of cell phones, social networks, and computer games. Also, sport and studying activities

do not have a considerable place in their leisure activities, which necessitates providing accurate planning.

Physical education and sport to maintain the optimum development of the community depend on many factors, one of which is work force. As dormitory students spend most of their time indoors without a pre-designed leisure plan, and since the functions of social networks and virtual entertainment have developed while the level of physical activities and healthy recreation, based on motion, cheerfulness and group activity, has decreased, it is more important to plan students' leisure time with the workgroup approach in most physical activities. Nowadays, leisure time with a physical activity approach is no longer considered a peripheral phenomenon, but regarded as one aspect of the new civilization that has changed cultural and research products (Tondnevis, 2008).

Therefore, university officials at all levels seek to develop programs for students' leisure time, in general, and for their sports activities, in particular. In this regard, considering that students are the main focus of all cultural, social, economic and political development programs, one of the primary requirements for human development to achieve perfection is having physical health, physical and mental exhilaration, and moral virtues. Therefore, considering physical education and exercise during formal education can prove very constructive with positive outcomes.

Therefore, this important issue should be considered when organizing and planning for students' physical education and sports, because if it is not considered adequately, wasting students' energy and its immediate damage will cause future damage to the society and may lead to abnormalities within this society. It should also be noted that physical education and sports have a special place in students' lives and leisure time. Therefore, the main goal of this research is to determine the factors affecting students' participation in extracurricular sports activities.

METHOD

The research methodology was qualitative, the kind of phenomenology with targeted sampling gathered through in-depth interviews with 16 students from Allameh Tabataba'i University. The number of students in this university (research population) was about 18,000 in the academic

year 2016-17. Phenomenology is a philosophical category and research method developed to understand phenomena through human experiences. This research method seeks to clarify the structure and essence of phenomena by analyzing people's experiences meticulously. All interviews were carefully recorded, and interview transcripts analysis was done via Smith's method. Smith (2008) has proposed three steps for analyzing data in the phenomenological method: a. Data generation, b. data analysis (this phase includes the following steps: 1. Initial encounter; reading and revising the categories; 2. recognizing and labeling the categories; 3. listing and clustering the categories, and 4. creating a summary table); and c. combining the categories.

RESULTS

Findings from the interviews with students was extracted in three main themes, including: students' enthusiasm for sports activities, motivational factors of sports participation, and barriers to sports participation. Several subthemes described below were also included.

Students' enthusiasm for sports activities

Exercise is a priority in life about which there is no room for controversy and excuse. The problem is not whether we have or do not have time for exercise, but the problem is creating this time. If we are to wait for a free opportunity, we will never get it. We have to create this opportunity ourselves. People who exercise regularly on most days of the week are not necessarily sports lovers, but they understand that they need to exercise. Some have the good fortune to enjoy the sport they are doing, while some others do not have such a sense, but they try their best to keep exercising because they have a strong motive and a particular goal when they exercise.

Sport pleasure is an effective and positive response to participation in sports activities based on previous sport experiences, which reflects the generalized emotions and feelings based on pleasure, communication and entertainment. Shaver, Schwartz, Kirson, & O'Conner (1987) asserts that sport commitment depends on attractive experiences in sport and the motivating factors for continuing to do it among people.

Exercise commitment, as a psychological structure, reflects one's desire to continuously engage in sports activities. Exercise commitment reflects one's motivation to continue participating in exercise and indicates the importance of psychological infrastructure based on the insistence on continuing a certain behavior or activity. Exercise commitment can be related to a sports program, a sport field (for example, football), or commitment to continuous participation in a variety of sports activities (Johnson, 1982, cited by Parsamehr, 2011).

One of the main themes obtained in this study was the students' enthusiasm for sports activities. According to the students participating in the interviews, this main theme encompassed several sub-themes as follows: Habit, interest and commitment, recreation and entertainment, feeling and pleasure, healthy competition, inner satisfaction, promotion of fair play, promotion of sport ethics, manifestation of the championship sports, feeling of group ownership and consistence, tension reduction, and establishing communication.

Motivational factors for sports participation

The motivation to participate in sports activities depends on individual differences. Depending on the individual differences and various sports fields, the type of people's motivation to achieve the sports goals is of particular importance.

Enshel (1993) defines motivation as a factor for choosing and directing behavior and continuing it until one reaches the goal. Motivation comes from both sources of internal and external motivation, which are both important in sports and are employed by sports psychologists to improve performance (Sadat Emami, Heidarinejad & Shafi Nia, 2013).

Vroom (1964) views internal motivation as an activity for the sake of the activity itself. Intrinsic motivation in sports involves excitement, recreation, interest in practice, and an opportunity to prove one's abilities, improve one's skills and enjoy exercise. External motivation is shaped by the positive and negative reinforcements that a person receives from external sources, and the desire for exercise arises from the internal motivation that is reinforced by external motivation.

Several studies have shown that different motivations (social interaction, pleasure and vitality, prevention and treatment, reduction of psychological stress, weight control, occupational and life relationships, health and physical fitness, etc.) result in tendency towards exercise (Sadat Emami et al., 2013).

Most of the interviewees in this research also expressed motivational factors for participation in extracurricular sports activities in the following way, which we subcategorized into the following sub-themes: University authorities' understanding, fitness, physical health, mental health, identification of talents, vitality and happiness, social interaction and cognition, increased responsibility, development of athletic skills, and sports competition.

Barriers to sports participation

Researchers have mentioned several factors affecting the lack of physical activities and exercises, which can be classified into three categories:

1. Individual variables (such as age, sex, skill and knowledge, time, motivation, physical condition, self-esteem, awareness of the benefits of exercise, personal interest and desire, interest and attention to health, fitness),
2. social variables (such as sport sociability, social support, importance to others, gender stereotypes or social beliefs about the gender nature of sports activities, social class, educational level, leisure time, family economy, social incentives, lifestyle, cultural patterns corresponding to the place of sport in lifestyle, the way of doing sports activities, and male or female identity), and
3. environmental variables (such as the existence and fair distribution of facilities, and the facilities and infrastructure needed for sports activities) (Safania, 2001; Sadat Emami et al., 2013; Nazarian Madavani & Ramazani, 2013; Lopez & Gomez, 2010).

Some other studies have categorized the barriers to sports participation in three areas including:

1. Interpersonal barriers (such as reluctance, lack of awareness, physical and psychological problems, etc.),

2. interpersonal or social barriers (lack of a partner, non-belonging to group or environment, feeling of insecurity, negative experiences, etc.), and
3. structural barriers (lack of time, lack of facilities, financial problems, etc.) (Aghaei & Fatahian, 2012; Asadi, Moradi & Namazizadeh, 2011; Naghavi, 2016).

The students participating in the interviews in this research also mentioned the barriers to their participation in extracurricular sports activities in the following way: Lack of time, lack of facilities, lack of interest, lack of awareness and adequate information, lack of favorite sport, low economic status, physical and psychological problems, lack of access, lack of educational rewards, and inadequate sports awards.

DISCUSSION

At present, Allameh Tabataba'i University in Tehran, with ten faculties, is the largest specialized university in the field of humanities in Iran and the leading university in achieving the growth and development of knowledge in the field of humanities and social sciences of the country.

It annually accepts numerous students from all over the country in different fields of study (the number of students in this university was about 18,000 in the academic year 2016-17) (Allameh Tabataba'i University Website, 2017).

Many of these students are distant from their homes and are exposed to many mental problems and stresses caused by their dwelling in dormitories in addition to academic problems.

Reducing this stress and creating an environment in which students feel comfortable and relaxed requires extracurricular sports activities in the university. By participating in these recreational sports activities, students not only enjoy a physical and mental health, but also ensure active and energetic lives for themselves in the future thanks to their tendency to exercises and physical activities.

The purpose of this research was the qualitative survey of effective factors on students' participation in the extracurricular sports activities. By analyzing student experiences, 3 main themes and 30 sub-themes were extracted. The general context, main themes and sub-themes are presented in Table 1.

Table 1: General context, main themes, and sub-themes of effective factors on students' participation in extracurricular sports activities

General context	Main themes	Sub-themes
Effective factors on students' participation in the extracurricular sports activities	Students' enthusiasm for sports activities	Habit, interest and commitment
		Recreation and entertainment
		Feeling and pleasure
		Healthy competition
		Inner satisfaction
		Promotion of fair play
		Promotion of sport ethics
		Manifestation of the championship sports
		Feeling of group ownership and consistence
		Tension reduction
		Establishing communication
	Motivational factors for sports participation	University authorities' understanding
		Fitness
		Physical health
		Mental health
		Identification of talents
		Vitality and happiness
		Social interaction and cognition
		Increased responsibility
		Development of athletic skills
	Sports competition	
	Barriers to sports participation	Lack of time
		Lack of facilities
		Lack of interest
		Lack of awareness and adequate information
		Lack of favorite sport
		Low economic status
		Physical and psychological problems
Lack of access		
Lack of educational rewards and inadequate sports awards.		

The first major theme extracted from student experiences was: Students' enthusiasm for sports activities. The interviewees in the present study expressed the following sub-themes for this subject: Habit, interest

and commitment, recreation and entertainment, feeling and pleasure, healthy competition, inner satisfaction, promotion of fair play, promotion of sport ethics, and manifestation of championship sports, feeling of group ownership and consistence, tension reduction, and establishing communication. These are consistent with the results of Sadat Emami et al. (2013), Jafari Siavashani, Ghadimi, Behaeen, and Same (2010), Pronk et al. (1995), Shahivandi, Masoud, Soltani, and Soltani (2014), Pouladi Reyshahri, Afsharpoor, and Bahramkhani (2011), Stubbe et al. (2007) and Ignatov (2016).

The second finding from the results of interviewing students was: Motivational factors for sports participation, for which the interviewees expressed the following sub-themes: University authorities' understanding, fitness, physical health, mental health, identification of talents, vitality and happiness, social interaction and cognition, increased responsibility, development of athletic skills, and sports competition. Parsamehr (2011), Ghodratnema and Heidarinejad (2013), Sadat Emami et al. (2013), Heerden (2014), Chen (2014), Gholipour, Anet, Rabieezadeh, & Karimi Dehkordi (2014), Sanaeifar, Abdi, Razavi, Ghamati, and Farzan (2015), Ignatov (2016) and Al-Ansari et al. (2016), in their research regarding sports participation factors, pointed out factors such as social interaction, pleasure and vitality, prevention and treatment, and reduction of the following factors: Psychological stress, weight control, occupational and lifestyle relationships, physical health, body health and body fitness, which in most cases were related to the results of this research considering motivational factors. Jafari Siavashani et al. (2010) also concluded that male and female students did sports activities with similar motives such as maintaining their health, fitness, sports interest and social interaction, consistent with the results obtained in this study.

The third main theme from the student's statements in the interview was: Barriers to sports participation, for which the interviewees in the present study expressed the following sub-themes: Lack of time, facilities, interest, awareness and adequate information, favorite sport, access, and educational or sports award, as well as low economic status, and physical and psychological problems. These are consistent with the results of Hazavehei, Asadi, Hassanzadeh, and Shekarchizadeh (2008),

Asadi et al. (2011), Aghaei and Fatahian (2012), Nazarian Madavani and Ramazani (2013), Naghavi (2016), and Gómez-López, Gallegos and Extremera (2010).

Hazavehei et al. (2008) showed in their research on female students' viewpoints about sports that students who do not participate in sports activities consider preventive factors such as lack of transport, social relationships, lack of awareness, skills, and health to be more effective than other factors. Gómez-López et al. (2010) concluded that the reasons for students' lack of participation in sports in the Almería University in Spain included external barriers such as time and internal barriers such as lack of interest in sport and lack of motivation. Nazarian Madavani and Ramazani (2013) also categorized the barriers negatively affecting the development of students' participation in sports activities in their leisure time, as prioritized by the students, in the following way: Lack of sports equipment, lack of sport space, lack of attention to the physical education course in schools, and lack of awareness about the benefits of doing regular physical activities.

CONCLUSIONS

Finally, it can be said that students, as the main source of national capital and the source of social and economic growth and development, are the main audience of universities. They are young people whose physical and spiritual needs need to be recognized and the way should be paved for the growth and realization of their talents. Recreational sports activities are part of the student's daily life plan, and academic sport is a complement to students' social and cultural lives in major universities of the world. Therefore, managers of extracurricular sports activities in universities should try their best to attract more credits in this field and provide sports spaces, facilities and equipment with appropriate planning so that students can take advantage of the physical, mental and social benefits of sports activities based on their interests, needs and motives. This research can have implications for physical education authorities of Allameh Tabataba'i University, as well as those of other universities, and researchers interested in this field, and provide a clear picture of the perceptions of participating students in this study. Based on the results of the research, it is recommended that the authorities and managers of extracurricular sports activities of universities pave the way for the development of such activities for students by removing preventive

factors (such as insufficient time, unsuitable facilities, lack of interest, lack of knowledge and information, low economic status, physical problems, etc.) and improving the motivation and enthusiasm for sports (such as proper planning, increased space, increasing the facilities and equipment for sports, visiting the sports activities of students, holding sports competitions and providing educational and material rewards, holding training courses, promoting sports ethics, providing bus services to and from sports venues, and other incentives).

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