

Impact of exercise on affective responses in female adolescents with type I diabetes

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ABSTRACT

Background: Adolescent is a time of profound biologic, intellectual, psychological, and socioeconomic change that they will face a crisis. Therefore, compatibility may be exposed to many hazards, such as depression, anxiety, and other emotional problems. Nevertheless, a planned regular exercise enhances physical and mental health of adolescent female with diabetes. The aim of this study was to determine the effect of exercise on emotional reactions of female adolescents with type I diabetes.

Materials and Methods: This study was a quasi-experimental research conducted in Endocrine and Metabolism Research Centre. A total of 72 patients were randomly allocated in the two groups. The intervention group did aerobic exercise for 45 minutes, while the control group did not aerobic exercise. Data were collected using a Symptom Checklist (SCL)-90 questionnaire. Data were analyzed and using descriptive and inferential statistics methods and SPSS software.

Results: The results showed that the mean score for physical symptoms, depression, obsession–compulsion, interpersonal sensitivity, aggression, phobia, paranoid ideation, psychosis, and anxiety in the test group significantly decreased after intervention than before intervention. The average score in the control group did not differ. The average total score of emotional reactions in the test group after the intervention decreased before the intervention significantly ($P = 0.001$). However, in the control group, the mean scores did not differ ($P = 0.97$).

Conclusion: The findings showed that regular exercise is effective on affective responses of adolescent females with type I diabetes.

Key words: Aerobic exercise, affective symptoms, female adolescents, Iran, type I diabetes mellitus

INTRODUCTION

Adolescent is a transition stage from childhood to adulthood, which is marked by important intellectual, physical, social, and psychological development and growth, and also is the most difficult stage someone sees him/herself different from their peers.^[1] Chronic disease influences on physical, psychological, and emotional condition of adolescents, and can confine their ability to perform necessary activities.^[2] Therefore, an adolescent who has a chronic illness on one hand should be adapted with the developmental tasks, and on the other hand, should adapt him/herself with treatment and long-term pains and also the stresses resulting from it. Therefore, compatibility

is difficult for adolescents and may expose them to many risks such as depression, anxiety, and other issues.^[1]

It also should be noted that one of the most common and serious chronic diseases of childhood and adolescence is type I diabetes.^[3] According to recent statistics, more than 246 million people worldwide suffer from diabetes.^[4] The number of people with diabetes in the world in 2000 was between 151 and 171 million, and it will reach 366 million by 2030.^[5] Approximately 40% of people with diabetes are less than 20 years of age. The most common age of onset of diabetes is puberty.^[3] In Isfahan Province, almost 100,000–120,000 people suffer from diabetes, and the number in Isfahan City is between 22,000 and 25,000 people. Also, 1600–2000 people are added to this annually.^[6]

The complications of diabetes are: small vessel complications, large vessel complications, and effects on other body organs (somatically). In addition, diabetes influences on mental, social, and emotional conditions of patients, among which there are *affective responses* including depression, guilt, anxiety, aggression, chagrin, decreased self-confidence, impaired self-imagination, and also stress; meanwhile, the most common ones are anxiety and depression.^[2] Adolescent girls with type I diabetes are more susceptible

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to depression, anxiety, and decreased self-confidence.^[7] It has been reported that psychological problems and mental disorders in Iranian adolescent girls are higher than the Iranian boys of the same age.^[8] Therefore, the aim of managing diabetes in adolescent girls is to enable them to have a natural life without clinical, social, and psychological problems and complications.^[4] Long-term continuous treatment requires a lifestyle modification.^[9] Having a planned physical activity and regular exercise can promote physical and mental health of adolescent girls now and in the future, and also can develop their prosperity and growth of latent talents.^[10]

Exercise can reduce cardiovascular risk factors and improve blood sugar threshold, increase vitality and quality of life, and also strength spirit and life expectancy. Increasing the will power, exercise can cause diet tolerance and increase body insulin sensitivity and reduce the body's need to insulin. Furthermore, it enhances resistance against infectious diseases in diabetic patients.^[11] Perhaps, the most effective influence of exercise in psychological disorders is prevention from disorder incidence. Possessing a physical fitness following exercise activities is the best means to prevent from depression and other mental disorders, i.e. exercise has a role in mental health.^[12]

Exercise provides a sense of mastery over disorder and illness, which influences on other aspects, and increases self-confidence and reduces sense of illness in an individual. The impact of exercise is important in happiness and decreased depression. On the other hand, exercise causes an athlete to have an active role in controlling illness.^[13]

It appears that aerobic exercises can be taken into account in some aspects for adolescent the girls with type I diabetes: being aerobic desirable impacts on diseases, recreation, high eagerness of the girls to do, easy access and cost efficacy, melting away the sense of being diseased, and the possibility of compatibility of exercise with the special needs of patients. Although many current studies indicate positive impacts of applying exercise intervention in adolescent girls with type I diabetes and there is enough knowledge about it, no study has ever been done in Iran as an exercise intervention as a part of usual process of care and treatment in adolescent girls with diabetes. So, many studies have reported contradictory results. For example, a study was conducted in 2010 aiming to determine the correlation of exercise with sleep pattern and mental functioning of adolescents. In this study, adolescents reported lower depressive and anxiety symptoms with exercise.^[14] While in Iran, in 2009, a study conducted on type II diabetic patients reported exercise had no impact on social functioning and depression.^[15] Scientific sports community services to Iranian adolescent girls with

type I diabetes are limited to a few qualitative and review studies. However, positive impacts of regular exercise and physical activity have long been considered on controlling chronic diseases such as type I diabetes; but no particular exercise program has been designed for adolescents with diabetes. On the other hand, in order to plan an exercise, it is necessary to set type, pressure, intensity, duration, and frequency of exercises for each individual patient so that it has the highest consequence with less complication, and adolescents with diabetes benefit from exercise as much as healthy people do.^[16] On the other hand, even by proving its helpfulness, a planed exercise program needs adaptation to cultural, economic, and social conditions of the patient, and the facilities available.

Therefore, we decided to conduct a study to review the impact of exercise on affective responses of female adolescents with type I diabetes. It is hoped that obtained results pave a way to explore and solve these problems and prevent probable complications.

MATERIALS AND METHODS

This was a quasi-experimental study and the study population included adolescent females with type I diabetes referred to Endocrine and Metabolism Research Center (Sedigheh Tahereh Research Center). Sampling was conducted through convenient sampling method. Thus, 72 records of adolescent girls aged 14–20 years were selected based on their medical record of other diseases that resulted from diabetes. Thereafter, they were randomly divided into test and control groups ($n = 35$ in each group). Due to 10% sample loss, 32 patients were enrolled in each group.

First, during a session, the samples of the test group were invited, and during a briefing meeting in the presence of their parents, the study objectives and method were explained orally and in written form. Symptom Checklist (SCL)-90 questionnaire was distributed among the adolescents, and the questionnaires were completed.

The inclusion criteria were: being female, aged 14–20 years, initial diagnosis and treatment for diabetes for at least 1 year, blood sugar over 70 mg/dL or less than 250 mg/dL at the beginning of each exercise session expect diabetes, and lack of any previous illness that needed to be treated over 2 months, in addition to ensuring about full physical health of the subjects and lack of any complication due to diabetes by the center's physician (using full examinations and required check-ups).

Data collection in this study was conducted through SCL-90-r (90-item Symptom Checklist Questionnaire) which is used for affective responses. It is one of the most

common psychiatric diagnostic tools in the US, which was made by Dragutin *et al.* in 1976 for the age group over 13 years. It consists of two parts; the first part includes demographic characteristics such as age, education, marital status, occupation of parents, family status, and the number of years suffering from diabetes. The second and main part of the SCL-90 consists of 90 dimensions of physical complaints, depression, obsession–compulsion, interpersonal sensitivity, hostility, phobic anxiety, paranoid ideation, psychosis, and anxiety. Each of the questions was composed of a 5-degree scale range indicating discomfort, from zero (no discomfort) to 4 (intense).

This questionnaire has been investigated in Iran in different cities and on different patients, and it has been reported to have a high level of reliability coefficient (over 0.7) in most of the studies. Therefore, for example, in standardization of the questionnaire among 4015 high school students in Gilan in 2010, the reliability coefficient obtained was 0.93. Furthermore, the reliability coefficient obtained through test re-test method was 0.93, with Cronbach's alpha 0.85 among 260 patients with acute coronary syndrome in Hamadan City in 2010. In standardization of the questionnaire among 300 high school students in Zarrin Shahr, Isfahan, its reliability coefficient was higher than 0.7.

Therefore, according to the above-mentioned reports, it can be concluded that this tool has an appropriate reliability and validity.

The intervention included a designed exercise activity for 6 weeks and three sessions each week for an hour only for the intervention group. Glycemic control before and after the exercise, carbohydrate intake if necessary, and controlling the hypoglycemia symptoms of or possible dehydration during exercise were carefully examined.

The exercise was conducted through three stages of warm-up, exercise activity, and cool down. After the warm-up, according to their weight, if necessary, they consumed 15–30 g fat-free simple carbohydrates such as date or candy. Then, aerobic exercise activity was implemented with music for 40–45 min with 50–70% intensity. Finally, the cool-down stage was conducted for 5–10 min. After the exercise, their blood sugar was calculated again with the same device and they took carbohydrates if necessary. In terms of any hypoglycemia symptoms reported during the intervention, the procedure was stopped for that individual, her blood sugar was controlled, and she was given sugar if necessary.

After the exercise intervention, the questionnaire was completed by the samples. In addition, the data were analyzed through Software SPSS version 16. Descriptive

and inferential statistics were used for data analysis.

Ethical considerations

Obtaining written permission from the university school and its presentation to the officials of Diabetes Research Center in Isfahan city, obtaining written consent from the adolescents and their parents, ensuring about freedom in completing questionnaires and participating in exercises, ensuring about confidentiality of the subjects and results, providing the study results to the subjects, and keeping the completed questionnaires with the researcher for a year.

RESULTS

In this study, totally 64 adolescent females with type I diabetes were evaluated in two stages. The mean age of samples in the test group was 17.43 (SD = 2.09) years and in the control group was 17.5 (SD = 2.24) years. 62.5% of the subjects in the test group and 53.1% of the subjects in the control group were high school students. Independent *t*-test showed that mean score of physical complaints, depression, obsession–compulsion, interpersonal sensitivity, hostility, phobic anxiety, paranoid ideation, psychosis, and anxiety had no significant difference before and after the intervention in test and control groups. However, after the intervention, the scores of such dimensions in the test group significantly were lower than those in the control group. As indicated in Table 1, paired *t*-test shows that mean of these dimensions in the test group significantly decreased after the intervention compared with before the intervention. However, in the control group, mean score of these dimensions had no difference. Total mean score of affective responses after the exercise in the test group was 82.93 (SD = 38.96) and in the control group was 140.7 (SD = 58.32). In addition, paired *t*-test showed that there was a significant difference in the test group before and after the test ($P = 0.001$). According to the independent *t*-test, there was a significant difference between the two groups after the exercise ($P < 0.001$).

The results of data analysis using paired *t*-test are summarized in Table 1.

DISCUSSION

The aim of the present study was to determine the impact of exercise on affective responses of female adolescents with type I diabetes, and the findings of this study showed that 6 weeks of aerobic exercise influenced on affective responses of adolescent girls with diabetes and had a significant impact on their affective responses. Moreover, the results showed that aerobic exercise could significantly reduce the occurrence of physical complaints, depression,

Table 1: Comparing the mean score of different dimensions of affective responses in the test and control groups before and after exercise physical complaints, depression, obsession–compulsion, interpersonal sensitivity, hostility, phobic anxiety, paranoid ideation, psychosis, and anxiety

	Test group			Control group		
	Pre-test Mean (SD)	Post-test Mean (SD)	<i>P</i> value; <i>t</i>	Pre-test Mean (SD)	Post-test Mean (SD)	<i>P</i> value; <i>t</i>
Physical complaints	18.6 (11.8)	2.06 (6.2)	0.004; 3.08	17.9 (9.35)	19.2 (9.13)	0.25; 1.17
Depression	25.8 (12.6)	13.8 (7.3)	0.001; 6.77	25.15 (12.6)	24.5 (10.96)	0.58; 0.56
Obsession–compulsion	19.46 (11.2)	11.03 (7.2)	0.001; 5.03	19.5 (9.02)	18.5 (8.3)	0.23; 1.2
Interpersonal sensitivity	16.9 (8.9)	9.4 (5.6)	0.001; 4.98	16.2 (8.1)	16.5 (7.7)	0.68; 0.412
Hostility	8.8 (5.6)	6.15 (4.3)	0.016; 2.54	8.9 (4.85)	9.15 (5.2)	0.68; 0.42
Phobic anxiety	9.9 (7.06)	5 (3.9)	0.001; 5.05	10.9 (4.5)	10.1 (4.4)	0.94; 0.75
Paranoid ideation	11.96 (5.2)	7.7 (5.2)	0.001; 4.57	12.06 (5.4)	11.5 (4.6)	0.37; 0.91
Psychosis	15.3 (9.2)	8.5 (4.9)	0.001; 4.57	14.7 (7.6)	14.6 (6.7)	0.001; 1
Anxiety	15.5 (8.9)	9.25 (5.5)	0.001; 4.11	15.93 (7.4)	16.4 (7.06)	0.53; 0.62
Total	142.21 (73.5)	82.93 (38.96)	0.001; 5.5	140.5 (63.19)	140.7 (58.32)	0.97; 0.037

obsession–compulsion, interpersonal sensitivity, hostility, phobic anxiety, paranoid ideation, psychosis, and anxiety in adolescent females with type I diabetes. In confirmation of the present study results, Sardar *et al.* in a study found that aerobic exercise could have a positive impact on dimensions of bodily symptoms ($P = 0.006$).^[15] The results of Shoundi *et al.* also were in accordance with these results and indicated that exercise could have a significant impact on the physical dimensions of patients with diabetes ($P = 0.008$).^[17]

The results of the present study were also in accordance with study results of Brand *et al.* They stated that adolescents who on average did exercise 17.69 h/week had lower depressive symptoms than the control group with 4.69 h of exercise per week, and there was a significant difference between the mentioned groups.^[14]

In addition, in terms of obsessive–compulsive symptoms, Lancer in a study stated that obsessive–compulsive symptom in fact is an anxiety disorder and exercise can reduce this symptom following reduction of anxiety symptoms.^[18] The study results of Brown *et al.* were also in accordance with the results of the present study. They reported that aerobic exercise can reduce obsessive symptoms and improve this disorder.^[19]

In terms of interpersonal sensitivity, there was a significant difference between the two groups. In a study in which Shoundi and Yavari reviewed social functioning of patients with type II diabetes, there was a significant difference before and after the exercise.^[17,20] While in the study of Sardar *et al.*, which was also on patients with type II diabetes, social functioning of subjects had no significant difference with that of the control group.^[15] Perhaps, one of the contradictory reasons for the obtained results is that in the two studies that we observed, there was a significant difference between the groups and the study subjects were all women. While

in the study of Sardar *et al.*, gender has not been identified and the study subjects could be either males or belonging to both sexes.

In consonance with the results of the present study, Tkacz *et al.* in a study found a significant reduction in uncontrolled anger of children, while they found no significant correlation between exercise and controlled anger.^[21] The study of Brand *et al.* in line with the results of the present study found a significant difference in aggressive behavior of adolescents following exercise.^[14]

According to a study by Brazeau *et al.*, the major cause due to which patients with type I diabetes avoid to have an appropriate physical activity and exercise was the fear of hypoglycemia.^[22] However, during a 6-week exercise intervention, simultaneous with exercise activities, the adolescents learned preventive method and coping with hypoglycemia during different stages of exercise and after that. Therefore, such fear has been decreased and their tendency for implementing exercise activities has been enhanced so that thereafter they could easily manage their own blood sugar. However, in the control group, because no action was taken for their fear, their mean score had no change though. But fear from unknowns and unexpected things concerning health or any disorder in physical activity causes anxiety in individuals.

In this study, adolescents were familiar with their peers with diabetes and this caused reduction of gap between them and other peers. Taking part in such exercise sessions also had a positive impact on their mood and behavior and was associated with decreased amount of depression. Perhaps, these results have helped improve pessimistic thoughts toward themselves and others. Furthermore, diabetes in these ages can be associated with depression, and delusions associated with depression can also be exacerbated.

Psychological illnesses can be divided into neurotic and psychotic categories, and psychotic also can encompass various disorders. One of the other points in psychotic is existence of positive and negative emotions, delusions, and hallucinations; schizophrenia is also a part of psychotic disorders diagnosed with positive and negative symptoms. In confirmation of the results obtained from the present study, Acil *et al.* in a study found a significant difference between the group performing aerobic exercise with moderate intensity and the control group, and they stated that increase in positive symptoms and decrease in negative symptoms were obvious in the exercise group.^[23]

Furthermore, in most of the studies regarding mental health and affective response, anxiety is also assessed along with depression. In confirmation of the present study results, Sardar *et al.*, Shoundi *et al.*, and Yavari reviewed type II diabetes in Iran and also evaluated the amount of anxiety of the study subjects. In all the mentioned studies, anxiety decreased following exercise (both aerobic and endurance) in the intervention group.^[15,17,20] Moksnes *et al.* also confirmed the results and stated that there was a significant difference between the reduction of anxiety among the adolescents with physical activity and other individuals.^[24]

The obtained results of the present study were in accordance with the results of Reed and Henert. They stated that positive emotions increased following moderate aerobic exercise and there was no difference between aerobic exercise with riding bicycle or on treadmill, and both can have an effective role in the incidence of affective responses and mental health.^[25]

CONCLUSION

In this study, by designing and presenting an exercise program for adolescents with diabetes, nurses would be able to encourage and recommend adolescent females for implementing aerobic and even endurance exercises, and even they can participate with them so as to find out their problems clearly and monitor them closely for achieving better results. Concerns of parents about their adolescent children can be more organized and can help them in controlling diabetes and strengthen the sense of independence as a characteristic of this period. In general, diabetes can damage various mental and social dimensions of individuals, can influence on self-care behaviors, and finally can have adverse effects on long-term control of blood sugar, increased risk of long-term complications, and their quality of life. This is more prominent among adolescent females.

The limitations of the study included loss of some samples due to lack of an exercise culture in the people's environment

and also lack of adjustment in life condition of patients; however, belonging to a certain center means relative homogeneity and adjustment in social and cultural status. Ultimately, it is suggested to conduct similar studies on adolescent boys with type I diabetes and also to implement endurance exercises on girls and boys and do comparison between them. Larger sample size is recommended if it is possible.

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