E-ISSN:3062-0961
International Journal Of Physical Activity, Nutrition and Health
URL: https://ijpanh.com/index.php/pub

Research Atricle **DOI: 10.5281/zenodo.14592125**

Investigation of the Relationship Between Type II Diabetes Risk Factors and Physical Activity Levels in Female University Students

Melis AKGİDENER[1] **Gizem AKARSU TAŞMAN**[2] **İrfan YILDIRIM**[3]

Abstract

The aim of this study is to examine the relationship between Type II diabetes risk factors and physical activity levels of female university students. Descriptive screening model and survey method were used in this study. Research data were obtained from the questionnaire form applied for demographic information, physical activity assessment questionnaire and Finnish Diabetes Risk Questionnaire. Height and weight values of the participants were obtained through the survey. A total of 200 students studying at Mersin University participated in the study. The obtained data were evaluated with an analysis program and descriptive statistics were used to evaluate the demographic characteristics of the participants. Shapiro-Wilk test was used for normality analysis of the data. Since the obtained data did not show normal distribution, the relationship between the variables was analyzed using Spearman correlation. As a result of the analysis, it was determined that there was a negative relationship between the physical activity levels of the students and diabetes risk factors. It was determined that there was a low level of relationship between type II diabetes risk factors and physical activity level ($r=-0.139$; $p<0.05$), a high level of relationship between type II diabetes risk factors and Body Mass Index ($r=0.724$; $p<0.01$), a high level of relationship between type II diabetes risk factors and waist circumference ($r=737$; $p<0.01$) and a low level of relationship between type II diabetes risk factors and sitting time ($r=-0.229$; $p<0.01$). According to the results of this study, it was determined that as the physical activity level decreased, the type II risk level increased, and as the body mass index, waist circumference and sitting time increased, the type II diabetes risk factors increased. As a result, it can be said that the type II diabetes risk factors decreased as the physical activity level of female students increased. In line with the results of this study, it is thought that it would be useful to examine healthy eating behaviors and physical activity level as diabetes risk factors. In order to increase awareness, comprehensive health education is needed to encourage type II DM prevention programs in universities and schools.

Keywords: Diabetes Risk Factors, Female University Student, Physical Activity, Type II Diabetes

INTRODUCTION

Diabetes mellitus (DM) is a disease that develops as a result of complete or relative insufficiency of pancreatic insulin production or insulin ineffectiveness or structural defects in the insulin molecule, characterized by hyperglycemia, causing impairment in carbohydrate, protein and fat metabolism and leading to acute metabolic and chronic impairing complications (Bölükbaş et al., 2023; Ministry of Health, 2014). Today, diabetes is an increasingly important health problem all over the world due to its frequency and the problems it creates.

With the rapid change in lifestyle, the prevalence of diabetes, especially type 2 diabetes, is increasing rapidly in all developed and developing societies. (Turkey Diabetes Program 2015-2020) The International Diabetes Federation (IDF) estimates that there are 425 million people with diabetes

[1] Mersin University, Mersin-Türkiye. melisakgidenerm@gmail.com
[2] Corresponding Author: Mersin University, Mersin-Türkiye. gizemakarsu88@gmail.com
[3] Mersin University, Mersin-Türkiye. yldrm76@gmail.com

worldwide as of 2017 and that this number will reach 628.6 million in 2045. The rate of people with diabetes worldwide is 8.8% and 9.9% of the world's population has impaired glucose tolerance (IDF 2017).The main reasons for this increase are population growth, aging and the increase in obesity and physical inactivity as a result of lifestyle changes brought about by urbanization. It has been reported that the prevalence of type 1 diabetes has also increased in many societies and this increase is more pronounced in preschool ages. (Green et al., 1996) Type 1 diabetes mellitus (DM) is a chronic metabolic disease characterized by insulopenia and hyperglycemia that develops as a result of the ongoing autoimmune or non-autoimmune destruction of pancreatic beta cells involved in insulin production mediated by Th cells, which is common in childhood (Behrman, Kliegman and Jenson,2004). Impaired insulin secretion or insulin resistance underlies the development of Type 2 DM. For this reason, Type I diabetes is more difficult to treat (Laakso, 1996).

The most important issue in the management of the disease is to ensure glycemic control. The most basic indicator in assessing glycemic control is the glycated hemoglobin (HbA1c) value. HbA1c, which reveals whether the disease is well managed, is measured as the last three-month indicator of the average glucose load in the blood. (Wong et al., 2010) With the introduction of insulin in the 1920s, physical activity has become an important method in managing Type I and Type II DM in addition to insulin therapy and diet (ACSM, 2014; Ministry of Health, 2014).

Physical activity is defined as all kinds of physical movements performed by the contraction of skeletal muscles that require energy expenditure above the basal level (Thompson et al. 2009; Ardıç, 2014). Physical activity is a concept that includes all kinds of muscle movements and covers a wide range from daily life activities such as housework, walking, exercise, sports, dance and leisure time activities to various sports activities (Caspersen et al. 1994; Howley, 2001). Otherwise, an inactive lifestyle will occur. An inactive (sedentary) lifestyle negatively affects human and public health. Decreasing physical activity and turning into an inactive lifestyle increases the risk of obesity, chronary heart disease, non-insulin-dependent diabetes, osteoporosis and some types of cancer (Baumgartner et al. 2003; Chasan-Taber et al. 2002).

Regular physical activity improves physiological, psychological and metabolic parameters and reduces the risk of chronic diseases and early mortality. It prevents bone, muscle and joint diseases and maintains a healthy life. Studies have shown that regular moderate physical activity can prevent the formation of cardiovascular diseases, prevent obesity, improve mood and increase life satisfaction (Akarsu et al. 2023; Hayden and Allen, 1984; Bulut, 2013; Hsing et al. 1994; Heyward, 2006; Long, 1983; Tekin et al. 2009). In addition to reducing the risk of developing diabetes, exercise is considered to be an important factor together with diet and pharmacologic treatment in patients with diabetes (ADA, 2015). It is known that exercise reduces insulin resistance, increases the effect of insulin and glucose tolerance, has positive effects on lipid profile and blood pressure, and also helps weight loss and preservation by reducing cardiovascular risk factors (Colberg et al., 2010). With these effects of exercise, it is an important component in both prevention and treatment of diabetes. People with impaired fasting glucose and impaired glucose tolerance have a high risk of developing Type 2 diabetes. It has been reported that regular exercise delays and even prevents the risk of developing Type 2 diabetes in individuals with prediabetes (Albright et al., 2000). The aim of this study is to examine the relationship between type II diabetes risk factors and physical activity levels of female university students. Studies examining type II diabetes risk factors on university students are limited in number and have generally been applied in health departments (medical, nursing etc.) (Bülbül et al., 2020; Özkan, Taylan ve Çiçek, 2022). The application of this study to students studying at the faculty of sports sciences and the association with physical activity levels reveal the original value of this study. It is assumed that there is a relationship between physical activity levels and type 2 diabetes risk factors.

In this study, it was aimed to examine the relationship between diabetes risk factors according to physical activity levels in female university students.

METHOD

Study Group: In this study, descriptive survey model and questionnaire method were used. Random sampling method was used in this study. The sample group of this study consisted of 200 female students studying at Mersin University Faculty of Sports Sciences.

Data Collection Tools: The research data were obtained with Demographic Information, Physical Activity and Diabetes Risk Assessment form. The height and weight information of the participants were obtained by questionnaire method.

Physical Activity Assessment Questionnaire

In our research, the short form FADA developed by Craig et al. (2003) and the Turkish validity and reliability (r=76) was used by Öztürk M. (2005). In FADA, it was taken as a criterion that physical activities should be performed for at least 10 minutes at a time. In the last 7 days with the questionnaire;

- Duration (min) of vigorous physical activity (soccer, basketball, aerobics, fast cycling, weight lifting, load carrying, etc.).
- Duration of moderate physical activity (light load carrying, cycling at normal speed, folk dances, dancing, bowling, table tennis, etc.) (min).
- Duration of walking and sitting for one day (min).

The total physical activity score (MET-min/week) was calculated by converting vigorous, moderate activity and walking times into METs corresponding to basal metabolic rate using the following calculations (Craig et al., 2003).

- Walking score (MET-min/hf) =3.3 *walking time*walking days
- Moderate vigorous activity score (MET-min/hf) = 4.0*duration of moderate vigorous activity*days of moderate vigorous activity
- Vigorous activity score (MET-min/hf) = 8.0 duration of vigorous activity*days of vigorous activity,

Total Physical Activity Score (METdk/hf) = Walking + Moderate activity + Vigorous activity scores.

According to the total physical activity score, participants' physical activity levels were classified as “low, moderate and high”;

Physical Activity Levels:

- Low level: less than 600 MET-min/week.
- Moderate level: between 600-3000 MET-min/week.
- High level: above 3000 MET-min/week.

It was evaluated as.

Finnish Diabetes Risk Questionnaire (FINDRISK):

Nowadays, there are many tools available to assess diabetes risk in adults. FINDRISK, developed by the Finnish Diabetes Association within the scope of the Finnish Type 2 Diabetes Prevention Program, is a tool that can be easily used in daily practice for this purpose (Finland2003-2010). There are studies showing that the FINDRISK questionnaire, which is widely used in our country and recommended by the Turkish Society of Endocrinology and Metabolism, is useful in determining the risk of Type 2 diabetes in the early period.

In the evaluation made with this questionnaire, the risk of diabetes in the next 10 years is determined (TEMD2015). In our study; Age (0, 2, 3 and 4 points), Body mass index (0, 1 and 3 points), Waist circumference (0, 1 and 3 points), Physical activity status (0 and 2 points), Frequency of vegetable and fruit consumption (0 and 2 points), History of antihypertensive treatment (0 and 2 points), History of

hyperglycemia (0 and 5 points), Family history of diabetes (0, 3 and 5 points). The scores corresponding to the participants' answers between 0 and 26 were summed and calculated.

Analysis of Data: The data analysis of this study was carried out through a statistical program. For all the data obtained, the normality test of quantitative variables was first analyzed with the Shapiro-Wilk test. The distribution of the data was examined and it was determined that it did not show a normal distribution. Descriptive statistics were used for the demographic data of the participants. The relationships between variables were analyzed with Spearman correlation coefficient. Statistical significance was used as $p<0.05$. As a result of the correlation analysis, 0.0- 0.2=Very low level relationship, 0.2- 0.4=Low level relationship, 0.4- 0.6=Medium level relationship, 0.6- 0.8=High level relationship, 0.8- 1.0=Very high level relationship.

RESULTS

Table 1. Anthropometric Characteristics of Participants

Variables	N	Minimum	Maximum	$\bar{X}$±SS
Age (Year)	200	18	25	20,73±1,80
Body Weight (kg)	200	44	101	70,22±13,36
Height Length (cm)	200	151	180	163,49±6,09

Table 2. Participants Physical Activity Averages

Variables	N	Minimum	Maximum	$\bar{X}$±SS
Physical Activity (MET)	200	148,50	15768,00	2681,68±2013,00

It was determined that the participants had a mean physical activity of 2681.68±2013.00 (Table 2).

Table 3. Physical Activity Levels of Participants

Variables	Physical Activity Levels	N	Percent (%)
<600	Inactive	11	5,5
600-3000	Minimal Active	120	60
>3000-	Very Active	69	34,5

It was determined that 34.5% of the participants had an adequate level of physical activity (Table 3).

Table 4. Body Mass Index Distribution of Participants

Variables	Physical Activity Levels	N	Percent (%)
<18,5	Weak	8	4,0
18,5-24,9	Normal	73	36,5
25-29,9	Overweight	76	38
30-34,9	I.Obese	31	15,5
35-39,9	II. Obese	12	6,0

It was found that 59.5% of the participants were overweight and obese (Table 4).

Table 5. Waist Circumference Measurements Of The Participants

Variables	Physical Activity Levels	N	Percent (%)
<80	Normal	74	37
80-87,99	Low Risk	70	35
≥88	High Risk	56	28

It was determined that 37% of the participants had normal waist circumference measurements, 35% were in the low risk group and 28% were in the high risk group (Table 5).

Table 6. Diabetes Risk Distribution of Participants

Risk Scores	N	Percent (%)	Risk Categorization	Probability of Type II Diabetes in 10 years (%)
<7	99	49,5	Low	1
7-11	64	32	Lightweight	4
12-14	18	9	Middle	16
15-20	15	7,5	High	33
>20	4	2	Very High	50

It was determined that 49.5% of the participants had low, 32% mild, 9% moderate, 7.5% high and 2% very high TIP II diabetes risk values (Table 6).

Table 7. Relationship between Type 2 Diabetes Risk Factors and Physical Activity, Body Mass Index and Sitting Hours

Independent Variables		TIP II Diabetes Risk
Physical Activity	r	-0,139*
	p	0,049
	N	200
Body Mass Index	r	0,724**
	p	0,001
	N	200
Waist Circumference	r	0,737**
	p	0,001
	N	200
Residence Duration	r	0,238**
	p	0,001
	N	200

It was determined that there was a low level relationship between Type II diabetes risk factors and physical activity levels ($r=-0.139$; $p<0.05$), a high level relationship with Body Mass Index ($r=0.724$; $p<0.01$), a high level relationship with waist circumference ($r=737$; $p<0.01$) and a low level relationship with sitting times ($r=-0.229$; $p<0.01$). According to these results, it was determined that Type II risk level increased as physical activity level decreased, and Type II diabetes risk factors increased as Body Mass Index, waist circumference and sitting times increased (Table 7).

DISCUSSION and CONCLUSION

Type II diabetes is recognized as a general health problem worldwide. Although the positive effects of regular physical activity on health have been demonstrated by studies, sedentary living habits are increasing day by day and becoming an important public health problem.

This study was conducted to examine the risk factors for Type II diabetes and physical activity levels of female university students. When Type II diabetes risk and physical activity level were examined, it was found that Type II diabetes risk level decreased as physical activity scores increased. The results of this study prove the positive effects of physical activity on health.

According to the results of the study, the mean weekly energy consumption of female university students' physical activity levels calculated according to the International Physical Activity Questionnaire was found to be 2681.68±2013.00 MET-min/week. According to the survey results, 5.5% (n=11) of the subjects were inactive, 60% (n=120) were minimally active and 34.50% (n=69) were very active. In Göktan's study, 19.6% (n=59) of the subjects were inactive, 53.2% (n=162) were minimally active and 26.58% (n=80) were very active. Similar to our study results, 43% were minimally active and 36.6% were very active in Öztürk's study (Öztürk, 2005). In a study conducted by Vural et al. on desk workers, 2249.62±2253 MET-min/week, 25.2% were found to be physically inactive, 48.9% had low physical activity level and 25.9% had sufficient physical activity level to protect their health (Vural et al., 2010).

Many studies have shown that the risk of diabetes increases as body mass index increases (Tankova et al., 2001; Costa et al., 2013). In our study, it was found that the risk of diabetes increased significantly as body mass index increased. In addition, it was found that there was a relationship between TIP 2 diabetes risk factors and physical activity levels, waist circumference and sitting time.

Various national and international studies have shown that FINDRISK is valid, reliable and useful in determining the risk of prediabetes and diabetes mellitus (Lindström et al., 2003). The diabetes risk levels of the participants were evaluated with the FINDRISK scale and the mean age was 20.73±1.80 years. In our study, 49.5% of the 200 participants had low risk, 32% had mild risk, 9% had moderate risk, 7.5% had high risk and 2% had very high risk. Similar to our study, in a study conducted by Arpacı et al. with 204 participants, 45.6% had low risk, 33.8% had mild risk, 11.3% had moderate risk, and 7.8% had high risk (Arpacı et al., 2019).

In a study conducted on university students, it was determined that although the majority of students had a family history of diabetes, their perception of diabetes risk was low (Khan et al., 2020). These findings indicate the need for health education that increases university students' awareness of the prevalence of type II diabetes, risk factors, and that it is a disease that can be prevented with healthy lifestyle behaviors. In their study conducted on nursing students, Özkan, Taylan, and Çiçek (2022) found that as the physical activity level of students increased, their type II diabetes risk scores decreased, parallel to our study findings. Physical activity is a critical factor in the prevention of type II diabetes. In a meta-analysis study examining 81 studies, it was shown that there was an inverse relationship between physical activity and the risk of type II diabetes, and that high levels of physical activity reduced the risk of type II diabetes by 35% (Aune et al., 2015). Similar to our study findings, in a study comparing the physical activity level and type II diabetes risk scores of 1093 students in Turkey, it was determined that the risk of diabetes decreased as the physical activity level increased (Çolak, 2015). There are some limitations to our study. First, the assessment of students' type II diabetes risk factors is based on subjective data. Therefore, it is possible that students' negatively perceived habits were not sufficiently reported. Second, since the fasting blood sugar levels of the participants could not be measured, the full sensitivity of the Finnish Diabetes Risk Score could not be estimated. It has been observed that the studies conducted on university students in Turkey were mostly conducted in health departments (nursing, medicine, etc.) and were associated with nutrition/healthy lifestyle behaviors. The strength of our study is that type II diabetes risk factors were examined in students with high physical activity levels at the faculty of sports sciences and were associated with physical activity. In addition, it is thought that this study will be useful in increasing students' awareness of type II diabetes risk factors.

As a result, it was found that there was a negative relationship between type 2 diabetes and physical activity levels of female university students, type II diabetes level decreased as physical activity levels scores increased, and students with high physical activity levels scores had a lower risk of type II diabetes. In line with the results of this study, it would be useful to examine healthy eating behaviors and physical activity level as diabetes risk factors. To increase awareness, comprehensive health education is needed to promote type II DM prevention programs in universities and schools. Education programs should cover areas such as general information about type II DM, family risk factors, behavioral risk factors, management and treatment.

Authors' Statement of Contribution to the Article: Article Design: MA, İY; Data Collection and Processing: MA; Statistical Analysis/Comment: İY; Literature Review: MA, GAT, İY; Article Writing: GAT, İY, MA; Consulting:İY

Conflict of Interest: The authors have no conflict of interest to declare.

Financial support: No financial support was received for the completion of this study**.**

Ethics Committee Approval: This study is in line with the Declaration of Helsinki. Ethical approval was obtained from Mersin University Sports Sciences Ethics Committee with the date and decision number 18/11/2024-068.

Peer Review: After the blind review process, it was found suitable for publication and accepted.

REFERENCES

Akarsu, G., Bayrakdar, A., Yıldırım, Y., Aygüney, Y., Meriçeri, S. (2023).Yaşam Boyu Form Kampı: Obezlerde Antropometrik Özellikler ve Obezite Farkındalığı Üzerine Etkisi. *IJPANH*, 1(1),46-55.

Albright, A., Franz, M., Hornsby, G., Kriska, A., Marrero, D., Ullrich, I. (2000). Exercise and type 2 diabetes. *Medicine and Science in Sports and Exercise,* 32, 1345-1360.

American Diabetes Association (ADA). (2015).Standards of medical care in diabetes, *Diabetes Care,* 38, p. 1-90.

Ardıç F. (2014). Egzersiz Reçetesi, *Turkish Journal of Physical Medicine and Rehabilitation,* 60, 1-8.

Arpacı, İ., Olgun, N., Arpacı Eren, İ. (2019). Hastane çalışanlarında diyabet riskinin değerlendirilmesi. *Diyabet, Obezite ve Hipertansiyonda Hemşirelik Forumu Dergisi*, 11 (1), 7-11.

Aune, D., Norat, T., Leitzmann, M., Tonstad, S., & Vatten, L.J. (2015). Physical activity and the risk of type 2 diabetes: a systematic review and dose–response meta-analysis. *European Journal of Epidemiology*, 30(7), 529-542.

Baumgartner, T, A., Jackson, A, S., Mahar, M, T. & Rowe, D, A.(2003). *Measurement for Evaluation in Physical Education and Exercise Science,* Boston: McGraw Hill.

Behrman, R.E, Kliegman, R.M., Jenson, H.B. (2004). *Diabetes Mellitus, Nelson Textbook of Pediatrics*. 17 edition. Pennsylvania: Elsevier Saunders, p.1947-72.

Bülbül, E., Çelik, S., Alçiçek, H., Dindar, A., Furtana, M., Günal, M., Öztunç, B., Karga, S., & Yılmaz, A. (2020). Hemşirelik Öğrencilerinde Diyabet Riski ve Sağlıklı Yaşam Biçimi Davranışlarının Belirlenmesi, *Türkiye Diyabet ve Obezite Dergisi,* 4(3), 230-238.

Caspersen, C, J., Kriska, A, M., Dearwater, S, R. (1994). Physical activity epidemiology as applied to elderly populations, *Bailliere's Clinical Rheumatology.* 8,7-27.

Chasan-Taber, L., Erickson, J,B., Mc-Bridge, J,W., Nasca, P,C., Chasan-Taber S., & Freedson, P,S. (2002). Reproducibility of a self administered lifetime physical activity questionnaire among female college alumnae, *American Journal of Epidemiology,* 155, 282-289.

Çolak, M. (2015). Physical activity levels and type 2 diabetes risk scores of university students. *Studies on Ethno Medicine*, 9(3), 401-409.

Colberg, S.R., Albright, A.L., Blissmer, B.J., Braun, B., Chasan-Taber, L., Fernhall, B. (2010). Exercise and type 2 diabetes: American College of Sports Medicine and the American Diabetes Association: joint position statement. Exercise and Type 2 diabetes, *Med Sci Sports Exerc,* 2282- 2303.

Gezen Bölükbaş, M., Vatansever, Ş., Tirkayi Sönmez, R.G. (2023). Tip 2 Diyabet Hastalarda Yüksek Şiddetli Aralıklı Antrenmanın Vücut Kompozisyonu, Kardiyorespiratuar Uygunluk ve Metabolik Parametreler Üzerindeki Etkileri: Sistematik Bir Derleme.*IJPANH*, 1(1),11-27

Göktan, N. (2020). Sağlıklı yaşam biçimi davranışlarının ve fiziksel aktivitenin diyabet riskine etkisi, Yüksek Lisans Tezi, Medipol Üniversitesi, İstanbul.

Green, A., Sjolie, A,.K, & Eshoj O. (1996). Trends in the epidemiology of IDDM during 1970-2020 in Fyn County, Denmark. *Diabetes Care.* 19, 801-806.

Hayden, R, M., & Allen GJ. (1984). Relationship between aerobic exercise, anxiety, and depression: Convergent validation by knowledgeable informants, *Journal of Sports Medicine,* 24, 69-74.

Heyward, V,H. (2006). Advanced Fitness Assessment and Exercise Prescription. 5th ed. USA: Human Kinetics, pp.1-5.

Howley, E, T. (2001). Type of activity: resistance, aerobic and leisure versus occupational physical activity, *Med. Sci. Sport. Exerc*, 33, 364-369.

Hsing, A,W., Mclaughlin, K,J., Zheng, W., Gao, T,Y., & Blot, W,J. (1994). Occupation, physical activity and risk of prostate canser in Shanghai, people's Republic of China, *Cancer Causes Control*, 5, 136-140.

International Diabetes Federation (IDF) (2017). Diabetes Atlas. 8th edition. Brussels Belgium.

Khan, R. K., Misra, R., Shawley-Brzoska, S., & Wen, S. (2020). Predictors of diabetes risk perception among college students. *Journal of American College Health*, 1-7.

Laakso, M. (1996). Insulin resistance and coronary heart disease. *Curr Opin Lipidol*, 7(4), 217-226.

Lindström, J., Louheranta, A., Mannelin, M., Rastas, M., Salminen, V., Eriksson, J. (2003). The Finnish Diabetes Prevention Study (DPS): Lifestyle intervention and 3-year results on diet and physical activity. *Diabetes Care*, 26, 3230–3236.

Long, B.C. (1983). Aerobic conditioning and stress reduction: participation or conditioning?, *Human Movement Science*. 2, 171-186.

Özkan, İ., Taylan, S., & Çiçek, S.N. (2022). Hemşirelik ve Çocuk Gelişimi Bölümü Öğrencilerinin Tip II Diyabet Risk Algılarının, Sağlıklı Yaşam Biçimi Davranışlarının ve Tip II Diyabet Risk Düzeylerinin Değerlendirilmesi. *Izmir Democracy University Health Sciences Journal,* 5(2), 495-510.

Öztürk, M. (2005). Üniversitede eğitim-öğretim gören öğrencilerde Uluslararası Fiziksel Aktivite Anketinin geçerliliği ve güvenirliği ve fiziksel aktivite düzeylerinin belirlenmesi. Ankara: Hacettepe Üniversitesi Sağlık Bilimleri Enstitüsü.

Sağlık Bakanlığı (2014). Halk Sağlığı Kurumu Türkiye Diyabet Programı 2015-2020, Ankara, pp.9-10.

T.C. Sağlık Bakanlığı, Türkiye Halk Sağlığı Kurumu. Türkiye Diyabet Programı (2014). Ankara, Yayın No:816.

Tekin G., Tayfun Amman M.T, & Tekin A. (2009). Serbest zamanlarda yapılan fiziksel egzersizin üniversite öğrencilerinin depresyon ve atılganlık düzeylerine etkis, *International Journal of Human Sciences*. 6, 148-159.

Thompson, W., Gordon, N., Pescatello, L, S.(2009). *ACSM's Guidelines for Exercise Testing and Prescription.* 8th ed. Baltimore, MD: Lippincott Williams& Wilkins; Pp. 253-255.

Vural, Ö., Eler, S., & Güzel, N. A. (2010). Masa başı çalışanlarda fiziksel aktivite düzeyi ve yaşam kalitesi ilişkisi, *SPORMETRE Beden Eğitimi Ve Spor Bilimleri Dergisi*, 8(2), 69-75.

Wong, C,H., Chiang, Y,C., Wai, J,P.M., Lo, F,S., Yeh, C,H., Chung, S,C., Chang, C,W. (2011). Effects of a home-based aerobic exercise programme in children with type 1 diabetes mellitus. *Journal of Clinical Nursing*, 20, 681-691.