Original Article

Association of Type 2 Diabetes Risk with Some Anthropometric Measurements in Obese Adults

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Abstract. *Background and Aims:* Type 2 diabetes can be defined as an insidious disease that can last for years without symptoms. Disease In type 2 diabetes, insulin resistance and insulin secretion deformation are predominant and account for about 90-95% of all diabetics (5). The major disadvantage of delayed diagnosis is the increased risk of complications. The management of risk factors and risk factors that can be considered as a finding can prevent the disease or keep it uncomplicated (6). *Methods:* A total of 95 obese women adults with a mean age of 33.65 ± 1.62 years were included in this study. All cases were women. The Finnish Type-2 DM Risk Scale (FINRISK) was used to determine the risk of type 2 diabetes. *Results:* FINDRISK (diabetes risks) scoring results of the participants are given in Table 2. According to this distribution, 15.8% of the participants were low risk, 26.3% were mild risk, 28.4% were medium risk, 13.7% were high risk and 15.8% were carries a very high risk. When body weight and risk scoring were evaluated, body weight was found to be statistically significant between the low-risk group and the high-risk group and the low-risk group and the medium-risk groups (<0.001). The difference between BMI values between low risk group and medium risk group, low risk group and mild risk group and between high risk and very high risk groups were found to be statistically significant (<0.001). *Conclusion:* No statistical significance was found between height and body fat percentage (%) values. The difference between waist circumference, hip circumference and waist/hip ratio values between low risk group and medium risk group, between low risk group and high risk group, and between mild risk and high risk groups were statistically significant (<0.001).

Keywords: Obesity, Type 2 Diabetes, FINDRISK

Introduction

Obesity; is a chronic disease which is characterized by the increase of body fat tissue due to the fact that the energy taken is more than the energy consumed. The most common anthropometric parameter used in the classification and definition of obesity is body mass index (BMI). BMI is obtained by dividing the body weight measured in kilograms by the square of the length measured in meters, and a value of 30 kg/m^2 above is considered as obesity (1).

Diabetes Mellitus (DM) is a chronic metabolic disease that requires continuous medical treatment due to insufficiency of insulin or deficiencies in insulin effect and develops with high blood glucose. Familiar susceptibility can develop due to many factors, depending on environmental factors and differences in daily life. There are three primary types, Type 1, Type 2 and gestational, but some other specific types are also available (2). Type 2 Diabetes Mellitus (T2DM) can be described as a public health problem and affects the whole world. Its worldwide prevalence is increasing much faster than expected. According to the International Diabetes Federation (IDF), by the end of 2017, it was estimated that approximately 425 million people suffered from diabetes and this number would increase by 48% to 630 million in 2045. In particular, more than half of the individuals with Type2 diabetes do not

realize that they have problems related to the disease and carry their findings (3). A study of epidemiology and diabetes that was carried in Turkey ,2010 (TURDEP-2) shows that the prevalence of diabetes in Turkey for 12 years (1998-2010) has reached from 7.2% to 13.7%; awareness level was determined as 45% (4).

Type 2 diabetes can be defined as an insidious disease that can last for years without symptoms. Disease In type 2 diabetes, insulin resistance and insulin secretion deformation are predominant and account for about 90-95% of all diabetics (5). The main disadvantage of delayed diagnosis is the increased risk of complications. The management of risk factors and risk factors that can be considered as a finding can prevent the disease or keep it uncomplicated (6). In the Diabetes Prevention Program (DPP) study, it was shown that type 2 diabetes can be prevented to a great extent by 58% in diabetic ethnic groups, especially by healthy nutrition, exercise and body weight control (7).

The aim of this study was to determine and correlate the anthropometric measurement distributions and diabetes risk levels of individuals who had not been diagnosed with diabetes before applying to a special diet clinic with the diagnosis of obesity and to refer the high-risk patients to the internal medicine physician for diagnosis and intervention.

Materials and Methods

This descriptive study was conducted between November 10 and December 2, 2019 with the participation of patients diagnosed with obesity. The study was conducted with the participation of 95 people who met the inclusion criteria. The inclusion criteria were; There were voluntary obese individuals between the ages of 20-64, not diagnosed with T2DM, no cognitive impairment, no communication difficulties and no problems in taking anthropometric measurements. Consent was obtained from the participants who were informed about the study and who accepted to participate in the study. Ethics committee approval was received from the Ethics Committee of Clinical Research of European University of Lefke on 07.11.2019 with the protocol code ÜEK/45/01/11/1920/06.

Since the study sample will constitute obese individuals, BMI was calculated as the first test and then the person was included in the study if she was obese (≥30 kg/m^2) and volunteer. The sociodemographic questionnaire form prepared by the researcher; by scanning the current literature and was filled with face to face interview method. The age, sex, marital status, education level, occupation, smoking habits and exercise status of the individuals were recorded in this questionnaire. Type 2 Diabetes Risk Assessment Questionnaire was used. Body fat and lean mass, body fat and lean tissue percentage and body weight were taken with TANITA BC-418 device at least 2 hours after the food and water intake and waist/hip measurements were taken with the help of non-flexing tape measure. Lengths were measured with a portable height meter.

The Finnish Type-2 DM Risk Scale (FINRISK) was used to determine the risk of type 2 diabetes. It consists of eight questions (age, BMI, waist circumference, exercise status, vegetable and fruit consumption status, hypertension status, whether your blood sugar level was high or limit before, diabetes status in the family) and it is considered an advantage that no biochemical data is needed. FINDRISK; was developed by Professor Jaakko Tuomilehto and Jaana Lindström in 1987 (to identify persons at risk for Type-2 DM without laboratory tests) and its validity-reliability was established in 1992. A minimum of 0 and a maximum of 26 points can be obtained from the FINDRISK questionnaire for age, body mass index, waist circumference, physical activity status, nutritional habits, history of high blood pressure, high blood glucose and family history of diabetes.

The FINDRISK scores were 10-year risk of type-2 diabetes according to Lindström's study, which validated the reliability of the scale.

1. 7, low risk
2. 7-11, slight risk
3. 12-14, moderate risk
4. 15-20, high risk
5. 20 was evaluated as very high and according to the result of the said score, the individuals scored minimum score "0" and maximum score maksimum 26 (8). Numerous studies have been conducted in which the validity of the FINDRISK score was tested and at the same time determined the risk of Type-2 diabetes (5,9,10,11,12). The cut-off point of the score was determined as 15 and above. In this

study, FINDRISK was evaluated according to the Lindstörm scoring.

SPSS (Statistical Package for Social Sciences) for Windows 20.0 was used for statistical analysis. Descriptive statistics of continuous variables are summarized in terms of mean and standard deviation, and descriptive statistics of categorical data are summarized in terms of frequency and percentage. Compliance with normal distribution was evaluated by Kolmogorov-Smirnov test. Accordingly, One-Way ANOVA was used to compare quantitative data showing normal distribution. Post-hoc test was performed when there was a significant difference between the groups. Chi-square test was used to compare categorical data. Pearson correlation analysis was used for correlations between parameters. Correlation coefficient (r); Between 0.00–0.24 weak, medium between 0.25–0.49, between 0.50–0.74 strong, between 0.75– 1.00 was evaluated as a very strong relationship (). Regression determinant coefficient was calculated by linear regression analysis between two variables. The results were evaluated at 95% confidence interval and p <0.05 significance level (14).

Results

A total of 95 obese adults with a mean age of 33.65 ± 1.62 years were included in this study. All cases were women. In addition, 63% were married, 50.5% had high school education and above, 59% had income.

Table 1 shows the distribution of anthropometric measurements of the participants. According to these data, mean body weight, height, BMI, body fat percentage, waist circumference and waist/hip ratio of the participants were 81.6 ± 1.56 kg, 163.1 ± 1.17 cm, 31.7 ± 1.12 kg/m^2, 35.8 ± 2.54, 84.8 ± 2.18 cm, 118.6 ± 3.42 cm and 1.29 ± 0.27.

FINDRISK (diabetes risks) scoring results of the participants are given in Table 2. According to this distribution, 15.8% of the participants were low risk, 26.3% were mild risk, 28.4% were medium risk, 13.7% were high risk and 15.8% were carries a very high risk. The mean FINDRISK scoring value of the low-risk group was 5.21 ± 3.51, 8.75 ± 3.49 for the low risk group, 12.23 ± 3.67 for the medium risk group, 15.91 ± 4.72 for the high risk group, and 20.11 ± 4.59 for the very high group. The mean FINDRISK value of the whole group was 11.95 ± 3.89.

Table 3 shows the distribution and relationship of anthropometric measurements according to the FINDRISK scores of the participants. When body weight and risk scoring were evaluated, body weight was found to be statistically significant between the low-risk group-the high-risk group and the low-risk group -the medium-risk groups (<0.001). The difference between BMI values between low risk group - medium risk group, low risk group - mild risk group and high risk -very high risk groups were found to be statistically significant (<0.001). No statistical significance was found between height and body fat percentage (%) values. The difference between waist circumference, hip circumference and waist/hip ratio values between low risk group-medium risk group, low risk group - high risk group, and mild risk - high risk groups were statistically significant (<0.001).

Table 1. Anthropometric Measurement Distributions of Participants

Anthropometric Measurement	Avarage ±Standart Deviation
Body Weight (kg)	81.6 ± 1.56
Height (cm)	163.1 ± 1.17
BMI (kg/m^2)	31.7 ± 1.12
Body Fat Percentage (%)	35.8 ± 2.54
Waist Circumference (cm)	84.8 ± 2.18
Hip Circumference (cm)	118.6 ± 3.42
Waist/Hip Ratio	1.29 ± 0.27

Conclusion

In developed and developing countries, mortal-

Table 2. FINDRISK Score Distribution of Participants

FINDRISK Score	n=total number	% percentage	Avarage Score
<7 , low risk	15	15.8	5.21±3.51
7-11, slight risk	25	26.3	8.75±3.49
12-14, moderate risk	27	28.4	12.23±3.67
15-20, high risk	13	13.7	15.91±4.72
<20, very high risk	15	15.8	20.11±4.59

Table 3. Distribution of the Anthropometric Measurement Means of Participants According to FINDRISK Scoring

FINDRISK	<7, low risk (n=15)	7-11, slight risk (n=25)	12-14, moderate risk (n=27)	15-20, high risk (n=13)	>20, very high risk (n=13)	p
Measurement	a	b	c	d	e	
Body Weight (kg)	78.3 ± 1.16	79.6 ± 1.25	80.1 ± 1.27	83.9 ± 1.59	83.6 ± 1.51	**<0,001 ad,ac**
Height (cm)	162.1 ± 1.25	161.8 ± 1.21	162.4 ± 1.23	163.7 ± 1.25	162.7 ± 1.37	0.056
BMI (kg/m^2)	30.8 ± 0.88	30.9 ± 0.92	31.2 ± 1.02	31.9 ± 1.22	32.7 ± 1.16	**<0,001 ac,ab,cd**
Body Fat Percentage (%)	34.2 ± 2.44	34.3 ± 2.53	34.8 ± 2.18	36.2 ± 2.13	35.8 ± 2.89	0,051
Waist Circumference (cm)	83.1 ± 1.89	83.9 ± 2.08	84.8 ± 1.85	85.2 ± 2.06	86.9 ± 2.25	**<0,001 ac,ad,bd**
Hip Circumference (cm)	109.9 ± 2.56	111.8 ± 2.52	115.7 ± 2.62	117.9 ± 2.47	119.6 ± 2.51	**<0,001 ac,ad,bd**
Waist/Hip Ratio	1.17 ± 0.32	1.18 ± 0.21	1.21 ± 0.57	1.24 ± 0.77	1.31 ± 0.97	**<0,001 ac,ad,bd**

ity reports show that diabetes is the 4th or 5th place among the causes (15). In the process until 2030, it is thought that it will take the 2nd or 3rd place in this sequencing (16). DM is an important chronic disease due to its high prevalence in developed and developing countries, increasing mortality and morbidity rates with complications that occur in cases where it cannot be treated correctly and timely, and the economic burden on individuals and society. According to IDF 2014 data; Health expenditures for diabetes make up 11% of all health expenditures in the world. the cost per person for diabetes and its complications in Turkey in 2014, was determined to be 895 dollars (17).

According to ADA (2015) data, individuals aged 45 and over are reported to be at risk for type-2 DM. According to WHO (2013) data, type 2 DM is seen mostly in developing countries between the ages of 35-64. In the light of these data, the study was performed in adults and the average age was 33.65 ± 1.62 years (5).

According to ADA (2015) data, individuals aged 45 and over are reported to be at risk for type-2 DM. According to WHO (2013) data, type 2 DM is seen mostly in developing countries between the ages of 35-64. In the light of these data, the study was performed in adults and the average age was 33.65 ± 1.62 years (5). In this study, the mean BMI of the sample was 31.7 ± 1.12 kg/m^2. When the literature review was conducted in parallel with the study, mean body mass index (BMI) was 25.14 ± 0.11 kg/m^2 (19), 21.97 ± 2.87 kg/m^2 (13), 26.76 ± 4.05 (5), 30 ± 4 kg/m^2 (10). The reason for this study was higher because the sample consisted of obese adults and included values of 30 kg/m^2.

Waist circumference values considered as risk for Type-2 DM; > 88 cm for women and> 102 cm for men. In this study, the average waist circumference in women was 84.8 ± 2.18 cm. In the study of Makrilakis et al. (2011), the mean waist circumference of the participants was 98 ± 12.6 cm, in the study of Costa et al. It was reported to be 8.51 cm (20).

Obesity is the most important risk factor for type 2 diabetes. Recent studies have shown that corrected lifestyle and reduced body weight will be effective in preventing symptoms and delaying complications (21). Many studies also indicate that the risk of Type 2 DM decreases as the BMI level decreases (22,23). In this study, it was observed that the risk score of FINDRISK increased as the BMI level increased and the difference between the risk scores and BMI values was found to be significant for some values (Table 3).

As a result, the risk values of FINDRISK scores increase due to the increased anthropometric values due to obesity.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial of financial relationships that could be construed as a potenzial conflict of interest

References

1. World Health Organization, "Obesity: Preventing and Managing The Global Epidemic", Report of a WHO Conculcation, WHO Technical Report Series 894, Geneva,

2000.
2. Turkey Endocrinology and Metabolism Association (SEMT) Diagnosis of Diabetes Mellitus and its Complications, Treatment and Monitoring Guide-2017. Downloaded from http://temd.org.tr/admin/uploads/tbl_kilavuz/DI-YABET2017_web.pdf on 2/12/2019.
3. Satman I, Omer B, Tutuncu Y, et al. Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults. Eur J Epidemiol 2013; 28 (2): 169–80.
4. Coşansu G. Diabetes: A Global Epidemic. Okmeydanı Journal of Medicine 2015; 31 (Supplementary issue): 1-6.
5. American Diabetes Association. Prevention or delay of type 2 diabetes. Sec.5. Diabetes Care 2015; 38: 31-2.
6. The DPP Study Group. The Diabetes Prevention Program: baseline characteristics of the randomized cohort. Diabetes Care 2000; 23 (11): 1619-29.
7. Lindström J, Tuomilehto J. The diabetes risk score: a practical tool to predict type 2 diabetes risk. Diabetes Care 2003 Mar; 26 (3): 725-31.
8. Makrilakis K, Liatis S, Grammatikou S, et al. Validation of the Finnish diabetes risk score (FINDRISC) questionnaire for screening for undiagnosed type 2 diabetes, dysglycaemia and the metabolic syndrome in Greece. Diabetes Metab 2011; 37 (2): 144-151.
9. Hellgren MI, Petzold M, Björkelund C, et al. Feasibility of the FINDRISC questionnaire to identify individuals with impaired glucose tolerance in Swedish primary care. A cross-sectional population-based study. Diabetes Med 2012; 29 (12): 1501-5.
10. Costa B, Barrio F, Piol JL, et al. The HbA1c diagnosis reduces the ability of the Finnish Diabetes Risk Score (FINDRISC) to screen for glucose abnormalities within a real-life primary healthcare preventive strategy. BMC Medicine 2013; 11: 45.
11. Tarı Selçuk K, Determination of Type 2 Diabetes Risk in 45-74 Age Individuals in Bigadiç, PhD thesis, Şzmir: Dokuz Eylül University; 2013.
12. MemiŞS, Gökçe S, GündoŞmuŞEE, CoŞkunırmak D. Evaluation of diabetes risks of Health School students with type-2 diabetes in their families. Nursing forum journal of diabetes, obesity and hypertension; July-December (2014); Volume: 6, Issue: 2.
13. Aksakoglu G. Correlation and regression computation methods In: Aksakoglu G, eds. Research and analysis in health. 2. Printing. Şzmir: DEÜ Rectorate Printing House; 2006. p. 283-90.
14. International Diabetes Federation 2013. http://www.idf.org/signs-and-symptoms-diabetes. Accessed on 06.12.2019.
15. WHO, 10 facts about diabetes, November 2014. http://www.who.int/features/factfiles/diabetes/facts/en/ (Accessed 06.12.2019).
16. International Diabetes Federation 2013. http://www.idf.org/signs-and-symptoms-diabetes. Accessed on 19.11.2013.
17. Coşansu G, Çelik SG, Olgun N, Özcan , Demir HG. Determination of risk factors for Type-2 Diabetes in adults: an example of a community-based study. 49. National diabetes congress 1721 April 2013; 303. www.diabetes congress2013org. Access Date: 05.12.2019.
18. Taşlemir-Koçak HST, Öncel S, Zincir H, Sevig Ü. Determination of type 2 diabetes risk ratio and healthy lifestyle behaviors among classroom teachers. Public Health Activities - HASUDER, 16th National Public Health Congress 2013.
19. Makrilakis K, Liatis S, Grammatikou S, et al. Validation of the Finnish diabetes risk score (FINDRISC) questionnaire for screening for undiagnosed type 2 diabetes, dysglycaemia and the metabolic syndrome in Greece. Diabetes Metab 2011; 37 (2): 144-151.
20. Chiasson JL, Josse RG, Gomis R, et al. STOP-NIDDM Trail Research Group. Acarbose for prevention of type 2 diabetes mellitus: the STOP-NIDDM randomizedtrial. Lancet 2002; 359 (9323): 2072-7.
21. Tankova T, Chakarova N, Atanassova I et al. Evaluation of the Finnish Diabetes Risk Score as a screening tool for impaired fasting glucose, impaired glucosetolerance and undetected diabetes. Diabetes Res Clin Pract 2011; 92 (1): 46-52.
22. Costa B, Barrio F, Piñol JL, et al. The HbA1c diagnosis reduces the ability of the Finnish Diabetes Risk Score (FINDRISC) to screen for glucose abnormalities. BMC Med 2013; 11: 45.

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