JOURNAL OF ATHLETIC PERFORMANCE AND NUTRITION

e-ISSN:2148-7488

Original Article **Journal of Athletic Performance and Nutrition**
Volume: 4 Issue: 2 pp:1-10 2017

The Waist circumference in Turkish adults: 19 – 75 years age*

Muhammed Emin KAFKAS[1]; Fahri Safa ÇINARLI[1*]; Nurkan YILMAZ[2]; Özgür EKEN[2]; Fatma KIZILAY[1]; Murat KAYAPINAR[1]; Armağan KAFKAS[1]

Received Date: 24.10.2017
Accepted Date: 20.12.2017

Abstract

Objectives: Waist circumference reference values can vary among societies. Therefore, the purpose of this study was to determine the waist circumference values of Turkish adults people for 19-75 year.

Methods: A total of 25.866 (11484 females and 14382 males) adult participants were recruited, grouped into categories of waist circumference in accordance with the World Health Organization cut offs. Waist circumference was measured with a tape measure according to the recommendations of the World Health Organization.

Results: It was found that waist circumference values varied at certain age ranges. Furthermore, there was a statistically significant relationship between the age variable and waist circumference values for male (r=.441) and female (r=.444) adults. It was determined that 87.91% of the male adults participating were to have normal values and 12.08% of them were to have higher risks of obesity related to the diseases, and 65.86% of female participants were to have normal values and 34.14% of them were to have had higher risk of obesity related diseases.

Conclusion: The use of waist circumference for the prediction of risk factor clustering among adults has significant clinical utility. These analyses should be continued in future studies to examine both health and reference values between societies.

Keywords: *Waist circumference, Age factor, Obesity, Adults.*

[1]Inonu University, Faculty of Sports Science, Department of Movement and Training Science
[2]Inonu University, Faculty of Sports Science, Department of Physical Education and Sport
*This study was presented at "Europen Conference on Science, Art & Culture" Prague' Czech Rep. Ocotober 19-22, 2017

e-ISSN:2148-7488
Original Article Journal of Athletic Performance and Nutrition
Volume: 4 Issue: 2 pp:1-10 2017

INTRODUCTION

Obesity is closely related to many serious health problems (Jung, 1997; Bundak et al. 2006). It affects the cardiovascular system and causes problems such as hypertension, hypercholesterolemia, lipid disorder; it affects the endocrine system, causing problems such as type 2 diabetes and menstrual irregularities; it affects the respiratory system and causes psychological problems such as asthma, respiratory problems such as obstructive sleep apnea, and depression by affecting mental health (Yosmaoğlu et al., 2010; Tam and Çakır, 2012). Obesity is not only a problem for adults, also it threatens the health of children and adolescents. In several studies show that obese individuals are likely to be overweight throughout their lives. Therefore, identification and prevention of obesity as early as possible is of vital importance (Newby et al., 2003; Abbasi et al., 2004).

Various methods are used to determine obesity. To measure obesity in adults is used bioelectrical impedance analysis, dual X-ray absorptiometry, as well as systems that measure body fat in an objective manner; skinfold anthropometric measurements such as thickness measurement, waist circumference (WC), hip circumference, waist hip ratio are often use by researchers (Gray and Fujioka, 1991; He et al., 2001). The use WC in predicting health risk associated with obesity has been proven in many studies (Savva et al., 2000; Onat et al., 2006). Recent findings indicate that WC is a stronger marker of health risk than is body mass index (BMI) (Janssen et al., 2004; Katzmarzyk et al, 2004). It has been reported that measurement of waist circumference provides additional information on cardiovascular risk increase especially in patients with a body mass index of 25-35 kg / m^2 (Chan ve ark., 1994). The use of waist circumference measurement with these methods may provide additional information, as other methods do not provide sufficient information to assess abdominal obesity (Günay et al., 2003). Ketel et al. (2007) reported that the best method for determining body fat mass is waist circumference measurement and skinfold skin-fold thickness measurement.

Abdominal obesity is on the rise and is associated with increased risk for metabolic syndrome (Despres, 1993; Atabek ve ark., 2006). Maffeis et al. (2000) examined the children who were prepubertal age and found a correlation between WC values and plasma protein levels that cause cardiovascular risk ($p<0.05$). Wahrenberg et al. (2005) concluded that WC can be used for predicting insulin resistance. Additionally, Eroğlu et al. (2009) found a significant correlation between coronary flow reserve and WC in their study (r=-.316).

e-ISSN:2148-7488
Original Article Journal of Athletic Performance and Nutrition
Volume: 4 Issue: 2 pp:1-10 2017

Hatipoğlu et al. (2008) stated that it is important for the countries to set their own scales because the values of the waist circumference are related to many diseases. In this context, the WC values of different age groups have been examined in many countries (McCarthy et al., 2003; Lee et al., 2007; Khadilkar et al., 2014). Within our knowledge, there is a need to examine WC values for Turkish adults in relation to gender and age. Therefore, the purpose of this study was to examine reference values for WC of Turkish adults aged 19-75 years.

MATERIAL AND METHOD

Participants:

A total 26.200 subjects (11600 females and 14600 males) were participated in the study. However, the data of a total of 334 (116 females and 218 males) volunteers participating in the study were not included in the analyses because they did not comply with the research criteria (measurement or data entry error). This study was approved by University of Inonu Ethics Committee for Research on Human Participants. All of the participants were previously informed about the testing procedures and any known risks, and provided their own written informed consent. All of the procedures were in accordance with the Helsinki Declaration of 2008.

Waist circumference measurements:

Trained staff performed anthropometric measurements. Waist circumference was measured with a tape measure at midway between the lowest portion of the rib cage and iliac crest, and anteriorly midway between the xiphoid process of the sternum and the umbilicus in the standing position at the end of gentle expiration and was recorded at the nearest millimeter, as described by the World Health Organization (WHO, 2011).

Statistical analyses:

SPSS Version 23.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. The subjects were classified as having a “50-88, 89-102, 103-120, 121-150” in the WC and age parameters were divided into 11 groups from 18 to 76 years. Descriptive statistics were calculated for all experimental data. All data were examined by the test of normal distribution (Kolmogorov Smirnow) before any further analysis. As the data showed normal distribution, the Pearson product moment correlation coefficient was used to determine the relationship

e-ISSN:2148-7488
Original Article
Journal of Athletic Performance and Nutrition
Volume: 4 Issue: 2 pp:1-10 2017

between age and waist circumference values. The level of significance was set at $p<0.01$ and all data were reported as mean ± SD.

RESULTS

The WC values of the 14638 males were shown in Table 1. Males (≤102 cm) with WC values were considered to have a normal WC, whereas males (>102 cm) with WC values were considered to have a high WC. According to the findings in the research, it was found that 6806 (50-88 cm) and 5849 (89-102 cm) of male adults were determined to have normal values, 1628 (103-120 cm) of male adults were identified to have increased risk, and also 98 (121-150 cm) of male adults were seen to have overweight.

Table 1. The waist circumference values of male participants in terms of age

Age Classification	Waist Circumference Classification (cm)				
	50-88	**89-102**	**103-120**	**121-150**	**TOTAL**
19-24	1903	306	38	3	2250
25-30	1081	503	81	3	1668
31-35	947	677	117	8	1749
36-40	753	896	165	7	1821
41-45	601	851	179	13	1644
46-50	377	754	222	22	1375
51-55	356	728	315	15	1414
56-60	293	504	236	14	1047
61-65	241	345	134	4	725
66-70	185	185	107	9	486
71-75	69	100	34	0	203
TOTAL	**6806**	**5849**	**1628**	**98**	**14382**

The WC values of the 11484 females were shown in Table 2. Females (≤88 cm) with WC values were considered to have a normal WC, whereas females (>88 cm) with WC values were considered to have a high WC. According to the findings in the research, 7574 of the female adults (50-88 cm) were found to have normal values. In addition, 2922 of female

e-ISSN:2148-7488
Original Article
Journal of Athletic Performance and Nutrition
Volume: 4 Issue: 2 pp:1-10 2017

adults (89-102 cm) were found to have increased risk and 930 of female adults (103-120 cm) to have overweight and finally 58 of female adults (121-150 cm) were detected to have obese.

Table 2. The waist circumference values of female participants in terms of age

Age Classification	Waist Circumference Classification (cm)				
	50-88	**89-102**	**103-120**	**121-150**	**TOTAL**
19-24	1892	97	7	4	2000
25-30	1143	144	34	0	1321
31-35	1202	232	40	2	1476
36-40	1193	395	73	7	1668
41-45	796	427	83	4	1310
46-50	610	455	131	7	1203
51-55	35	479	191	13	718
56-60	308	259	176	9	752
61-65	225	246	109	6	586
66-70	122	127	65	4	318
71-75	48	61	21	2	132
TOTAL	**7574**	**2922**	**930**	**58**	**11484**

Pearson's product-movement correlation values between the age and WC were presented in Table 3. The WC values increased with age in both males and females. There was a significantly low correlation between age and WC in male (r=.441) and female (r=.444) adults.

Tablo 3. Correlations between age and WC study population

Participants	Parameters	Age
Males (n: 14382)	**WC**	.411**
Females (n: 11484)	**WC**	.444**

(WC=Waist Circumference)
(p<.001)**

e-ISSN:2148-7488
Original Article **Journal of Athletic Performance and Nutrition**
Volume: 4 Issue: 2 pp:1-10 2017

DISCUSSION

When the findings were examined, it was found that waist circumference values varied at certain age ranges. Furthermore, there was a statistically significant relationship between the age and WC for both males and females ($p<.001$). One of most useful used in the evaluation of obesity are BMI and WC. However, the use of BMI does not work correctly in children, in pregnant women and in sportsmen with high muscle mass (Sarrai et al., 2001). The WC reflects visceral and subcutaneous fat, which accumulates in the abdominal region, and the tonus of the abdominal muscles in the best way (Ergün and Erten., 2004). WC alone seems to be a better predictor of cardiovascular risk factor than the waist-to-hip ratio previously used (Maffeis et al., 2001). Moreno et al. (2002) stated that a large waist circumference shows obesity and is also recognized as a good measure of abdominal fat, particularly the most metabolically active intra-abdominal fat in adults. Hence, WC should be used as a valuable predictive tool because it has great importance in determining many metabolic (Kitiş et al., 2010) and cardiovascular diseases (Meseri and Ünal, 2009).

It can be said that many nations have set their own reference values in terms of WC values used in the determination of obesity (Zhu et al., 2002; Katzmarzyk, 2004; Fernandez et al., 2004). Because the factors such as the characteristics of the environment, the structure of society, etc., may lead to the ideal values varying, WC reference values vary among societies. For example, for the waist circumference in China, the cut off score is assumed to be 85 cm in males and 80 cm in females, and it is emphasized that higher values pose a significant health risk (Bei-Fan, 2002). Moreover, it is stated that the sufficient and descriptive research has not been examined for Turkish adults people (Ergün ve Erten 2004).

According to the National Institutes of Health (NIH) guidelines, adult men and women with waist circumferences of ≤102 cm and ≤88 cm, respectively, are at higher risk of obesity-related disorders than are those with smaller measurements (National Institutes of Health, 1998). According to these results, it was determined that 87.91% of the male adults participating in the study had normal values and 12.08% of the other male participants had higher risks of obesity related to the diseases. Based on these reference values, 65.86% of female participants were found to have normal values and 34.14% of other female participants were found to have higher risk of obesity related diseases. The research has shown that a great number of women were at risk for increased obesity-related disease factors. The study conducted by He et al., (2001) reported the WC values 20-30 year as 75.9 cm, 31-40 year as

e-ISSN:2148-7488
Original Article **Journal of Athletic Performance and Nutrition**
Volume: 4 Issue: 2 pp:1-10 2017

83.7 cm, 41-50 year as 83.5 cm, 51-60 year as 81.7 cm, >60 year as 86.6 cm for male adults and 20-30 year as 66.2 cm, 31-40 year as 69.3. cm, 41-50 year as 76.2 cm, 51-60 year as 76.6 cm, >60 year as 82.1 cm for female adults in the Chinese population. When it is compared with Asian societies, it can be said that Turkish adults have more waist circumference values for both men and women. Zhou (2002) examined the waist circumference values of 53.103 men and 59.308 women in China and categorized the age ranges from 20 years to 70 years at intervals of 10 years. In the study, it was stated that a critical threshold was considered the 85 cm (for males) and 80 cm (for females) and the risk of disease could be prevented by 58% and by 47% if the waist circumference was below these values, respectively. Some researchers recommended using two cut values for men (WC >94 cm-overweight and >102 cm-obese) and women (WC >80 cm-overweight and >88 cm-obese) (Fredriks et al., 2005). While there are different waist circumference values among societies, the same community members can also change over time (Ko et al., 1999). Thus, it is recommended that anthropometric measurements of populations should be performed, and their time dependent changes should be analysed at regular intervals.

CONCLUSION

Consequently, the findings of the current study show that many Turkish male adults had normal values according to the criteria defined by World Health Organization. But it was found that women had more risk factors associated with illness related obesity than men. Because it is known that the number of men who do not work is less than women as in all the world societies. One possible explanation for these findings may be the men's daily calorie expenditure in routine life. The current study can make an important contribution to the literature. Finally, kind of investigations should be continued with these analyses that will allow an examination of temporal trends in abdominal obesity.

REFERENCES

Abbasi, F., Chu, J. W., Lamendola, C., McLaughlin, T., Hayden, J., Reaven, G. M., & Reaven, P. D. (2004). Discrimination between obesity and insulin resistance in the relationship with adiponectin. *Diabetes*, *53*(3), 585-590.

Atabek, M. E., Pirgon, O., & Kurtoglu, S. (2006). Prevalence of metabolic syndrome in obese Turkish children and adolescents. *Diabetes research and clinical practice*, *72*(3), 315-321.

e-ISSN:2148-7488
Original Article **Journal of Athletic Performance and Nutrition**
Volume: 4 Issue: 2 pp:1-10 2017

Bei-Fan Z. Predictive values of body mass index and waist circumference for risk factors of certain related diseases in Chinese adults: study on optimal cut-off points of body mass index and waist circumference in Chinese adults. *Asia pacific journal clinical nutrition*. 2002 Dec;11 Suppl 8:S685-93.

Bundak, R., Furman, A., Gunoz, H., Darendeliler, F., Bas, F., & Neyzi, O. (2006). Body mass index references for Turkish children. *Acta paediatrica*, *95*(2), 194-198.

Chan, J. M., Rimm, E. B., Colditz, G. A., Stampfer, M. J., & Willett, W. C. (1994). Obesity, fat distribution, and weight gain as risk factors for clinical diabetes in men. *Diabetes care*, *17*(9), 961-969.

Ergün, A., & Erten, S. F. (2004). Body mass index and waist circumference in estimation of obesity in students. *Ankara university medical faculty*, *57*(02).

Eroğlu, S., Sade, L. E., Bozbaş, H., & Müderrisoğlu, H. (2009). Decreased coronary flow reserve in obese women. *Archives of the Turkish society of cardiology*, *37*, 391-6.

Fernández, J. R., Redden, D. T., Pietrobelli, A., & Allison, D. B. (2004). Waist circumference percentiles in nationally representative samples of African-American, European-American, and Mexican-American children and adolescents. *The Journal of pediatrics*, *145*(4), 439-444.

Fredriks, A. M., van Buuren, S., Fekkes, M., Verloove-Vanhorick, S. P., & Wit, J. M. (2005). Are age references for waist circumference, hip circumference and waist-hip ratio in Dutch children useful in clinical practice? *European journal of pediatrics*, *164*(4), 216-222.

Gray, D. S., & Fujioka, K. (1991). Use of relative weight and body mass index for the determination of adiposity. *Journal of clinical epidemiology*, *44*(6), 545-550.

Güney, E., Özgen, A. G., Saraç, F., Yılmaz, C., & Kabalak, T. (2003). Comparison Of Bioelectrical Impedance And The Other Methods Used For Diagnosis Of Obesity. *ADÜ Joruanl of medical faculty*, *2*(4), 15-18.

He, M., Tan, K. C. B., Li, E. T. S., & Kung, A. W. C. (2001). Body fat determination by dual energy X-ray absorptiometry and its relation to body mass index and waist circumference in Hong Kong Chinese. *International Journal of obesity & related metabolic disorders*, *25*(5).

Janssen, I., Katzmarzyk, P. T., & Ross, R. (2004). Waist circumference and not body mass index explains obesity-related health risk. *The American journal of clinical nutrition*, *79*(3), 379-384.

Jung, R. T. (1997). Obesity as a disease. *British medical bulletin*, *53*(2), 307-321.

Katzmarzyk, P.T. (2004). Waist circumference percentiles for Canadian youth 11–18 y of age. *European journal of clinical nutrition*, 58:1011–1015.

e-ISSN:2148-7488
Original Article **Journal of Athletic Performance and Nutrition**
Volume: 4 Issue: 2 pp:1-10 2017

Ketel, I. J., Volman, M. N., Seidell, J. C., Stehouwer, C. D., Twisk, J. W., & Lambalk, C. B. (2007). Superiority of skinfold measurements and waist over waist-to-hip ratio for determination of body fat distribution in a population-based cohort of Caucasian Dutch adults. *European Journal of Endocrinology*, *156*(6), 655-661.

Khadilkar, A., Ekbote, V., Chiplonkar, S., Khadilkar, V., Kajale, N., Kulkarni, S., ... & Agarwal, S. (2014). Waist circumference percentiles in 2-18 year old Indian children. *The Journal of pediatrics*, *164*(6), 1358-1362.

Kitis, Y., Bilgili, N., Hisar, F., & Ayaz, S. (2010). Frequency and affecting factors of metabolic syndrome in women older than 20 years of age. *The Anatolian journal of cardiology*, *10*(2), 111-120.

Ko, G. T., Chan, J. C., Cockram, C. S., & Woo, J. (1999). Prediction of hypertension, diabetes, dyslipidaemia or albuminuria using simple anthropometric indexes in Hong Kong Chinese. *International Journal of obesity & related metabolic disorders*, *23*(11).

Lee, S. Y., Park, H. S., Kim, D. J., Han, J. H., Kim, S. M., Cho, G. J., ... & Oh, S. J. (2007). Appropriate waist circumference cutoff points for central obesity in Korean adults. *Diabetes research and clinical practice*, *75*(1), 72-80.

Maffeis, C., Pietrobelli, A., Grezzani, A., Provera, S., & Tatò, L. (2001). Waist circumference and cardiovascular risk factors in prepubertal children. *Obesity*, *9*(3), 179-187.

McCarthy, H. D., Ellis, S. M., & Cole, T. J. (2003). Central overweight and obesity in British youth aged 11–16 years: cross sectional surveys of waist circumference. *Bmj*, *326*(7390), 624.

Meseri, R., & Ünal, B. (2009). How to determine obesity to estimate cardiovascular risk and diabetes? *TAF Preventive medicine bulletin*, *8*(6).

Moreno, L. A., Pineda, I., Rodriguez, G., Fleta, J., Sarria, A., & Bueno, M. (2002). Waist circumference for the screening of the metabolic syndrome in children. *Acta paediatrica*, *91*(12), 1307-1312.

National Institutes of Health. (1998). Clinical Guidelines for the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults. Bethesda, MD: National Institutes of Health.

Newby, P. K., Muller, D., Hallfrisch, J., Qiao, N., Andres, R., & Tucker, K. L. (2003). Dietary patterns and changes in body mass index and waist circumference in adults. *The American journal of clinical nutrition*, *77*(6), 1417-1425.

Onat, A., Hergenç, G., Uyarel, H., Can, G., & Ozhan, H. (2006). Prevalence, incidence, predictors and outcome of type 2 diabetes in Turkey. *The Anatolian journal of cardiology*, *6*(4), 314-21.

e-ISSN:2148-7488
Original Article **Journal of Athletic Performance and Nutrition**
Volume: 4 Issue: 2 pp:1-10 2017

Sarria, A., Moreno, L. A., Garcí-LIop, L. A., Fleta, J., Morellon, M. P., & Bueno, M. (2001). Body mass index, triceps skinfold and waist circumference in screening for adiposity in male children and adolescents. *Acta paediatrica*, *90*(4), 387-392.

Savva, S. C., Tornaritis, M., Savva, M. E., Kourides, Y., Panagi, A., Silikiotou, N., ... & Kafatos, A. (2000). Waist circumference and waist-to-height ratio are better predictors of cardiovascular disease risk factors in children than body mass index. *International journal of obesity*, *24*(11), 1453.

Tam, A. A., & Çakır, B. (2012). Approach of obesity in primary health care. *Ankara Medical Journal*, *12*(1).

Wahrenberg, H., Hertel, K., Leijonhufvud, B. M., Persson, L. G., Toft, E., & Arner, P. (2005). Use of waist circumference to predict insulin resistance: retrospective study. *Bmj*, *330*(7504), 1363-1364.

World Health Organization. (2011). Waist circumference and waist-hip ratio: Report of a WHO expert consultation, Geneva, 8-11 December 2008.

Yosmaoğlu, H. B., Baltacı, G., & Derman, O. (2010). Effectiveness of body fat measurement methods in obese adolescents. *Physiotherapy rehabilitation*, *21*(3), 125-131.

Zhou, B. F. (2002). Predictive values of body mass index and waist circumference for risk factors of certain related diseases in Chinese adults--study on optimal cut-off points of body mass index and waist circumference in Chinese adults. *Biomedical and environmental sciences: BES*, *15*(1), 83-96.