Marmara Medical Journal 2018; 31: 76-80
DOI: 10.5472/marumj.430795

ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA

Relationship between obesity and thyroid function in adults

Erişkinlerde obezite ve tiroid fonksiyonu arasındaki ilişki

Ferhat EKİNCİ, Demet MERDER-COŞKUN, Bilge TUNCEL, Dinçer ATİLA, Hüseyin YILDIZ, Arzu UZUNER

ABSTRACT

Objectives: Obesity affects prognosis of many comorbid diseases negatively. This study was conducted to investigate the relationship between obesity and thyroid function.

Materials and Methods: This cross-sectional study was conducted between December 2011 and December 2012. Consecutively selected adults who applied to the outpatient clinics of Family Medicine and Internal Medicine, at Marmara University Hospital were recruited in the study. Height and weight were measured and body mass index (BMI) was calculated. Thyroid-stimulating hormone (TSH), free thyroxine (fT4), total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglyceride and glucose levels were measured for every participant. According to their BMI, participants were divided into three groups as normal weight (<25), overweight (25-30) and obese (≥30).

Results: Data of 618 participants (53% female/47% male) was analyzed. Mean age was 43±15. There were 175 (28.3%) participants in normal weight, 242 (39.2%) in overweight and 201 (32.5%) in obese groups. No statistically significant difference was found between groups in terms of TSH or fT4. Statistically significant difference was found in terms of lipid profiles and blood glucose between groups. Atherogenic lipid levels (total cholesterol, LDL and triglyceride) and blood glucose were higher and HLD levels were lower in overweight or obese groups (P<0.05) but there were no statistically significant differences between overweight and obese groups (P>0.05).

Conclusion: This study is one of the few studies in the literature showing that there is no relationship between obesity and thyroid function.

Keywords: Obesity, Adults, Thyroid function tests

ÖZ

Amaç: Obezite, pek çok komorbid hastalığın seyrini olumsuz etkilemektedir. Bu çalışmanın amacı obezite ve tiroid fonksiyonu arasındaki ilişkiyi ortaya koymaktır.

Gereç ve Yöntem: Bu çalışma kesitsel bir çalışmadır. 2011 Aralık ve 2012 Aralık yılları arasında Marmara Universite Hastahane'si Aile hekimliği ve Dahiliye polikliniklerine başvuran erişkin yaş hastalar bu çalışmaya dahil edilmiştir. Hastaların boy ve kiloları ölçülmüş, vücut kitle indeksi (VKİ) değerleri hesaplanmıştır. Kanları alınmış ve tiroid stimulant hormonu (TSH), serbest tşiroksin (fT4), total kolesterol, düşük dansitesli lipoprotein (LDL), yüksek dansiteli lipoprotein (HDL), trigliserid ve glukoz değerlerini ölçen tahliller yapılmıştır. Katılımcılar, VKİ değerlerine göre üç gruba ayrılmış ve grupların verileri karşılaştırılmıştır.

Bulgular: Çalışmaya 618 hasta dahil edilmiştir (%53 kadın/ %47 erkek). Ortalama yaş 43±15 ti. Normal kilolu grupta 175 (%28.3), fazla kilolu grupta 242 (%39.2) ve obez grupta 201 (%32.5) kişi yer almaktaydı. Gruplar arasında TSH ve fT4 değerleri açısından istatistiksel olarak anlamlı bir fark bulunmadı. Gruplar arasında lipid profili açısından istatistiksel olarak anlamlı fark bulundu.Fazla kilolu ve obez grubun aterojenik lipid değerleri (total kolesterol, LDL ve trigliserid) ve glukoz değerleri normal kilolu gruba kıyasla yüksek, HDL değerleri ise düşük bulundu (P<0.05), fazla kilolu ve obez grup arasında lipid değerleri ve glukoz değeri açısından istatistiksel olarak anlamlı bir fark bulunmamıştır (P>0.05).

Sonuç: Bu çalışma, obezite ve tiroid fonksiyonu arasında ilişki olmadığını gösteren literatürdeki ender çalışmalardan biridir.

Anahtar Kelimeler: Obezite, Erişkin, Tiroid Fonksiyon Testleri

Demet Merder-Coşkun (✉)
Family Medicine Clinic, Gevas State Hospital, Van, Turkey
e-mail: demetmerder@gmail.com

Ferhat Ekinci
Family Medicine, Yıldırım Public Health Center, Bursa, Turkey

Bilge Tuncel
Family Medicine Clinic, İliç State Hospital, Erzincan, Turkey

Dinçer Atila
Family Medicine,Izmir Public Health Directorate, Izmir, Turkey

Hüseyin Yıldız
Internal Medicine Clinic, Malatya State Hospital, Malatya, Turkey

Arzu Uzuner
Department of Family Medicine, School of Medicine, Marmara University, Istanbul, Turkey

Submitted / Gönderilme: 15.02.2018 **Accepted/Kabul:** 17.04.2018

Introduction

The prevalence of overweight and obesity has been increasing significantly in recent decades. According to World Health Organisation (WHO), over 50% of the people are overweight and over 20% of the people are obese in the European region [1]. According to the Organization for Economic Co-operation and Development (OECD), obesity rate among adults is in overall 18.4% and 22.3% in Turkey [2].

Overweight and obesity are found to be risk factors for some diseases like hypertension, type 2 diabetes, cardiovascular and pulmonary diseases [3,4]. As a chronic condition thyroid abnormalities affect a considerable portion of the population [5]. Thyroid dysfunction affects resting energy expenditure (REE), thus leads to changes in body weight. However, effect of obesity on thyroid function is not clear [6,7]. In the literature, some studies have shown relationship between obesity and thyroid function [8-11]. However, some other studies have not found an association between obesity and thyroid function [8,9].

This study was conducted to investigate the relationship between obesity and thyroid function.

Materials and Methods

Participants

This cross-sectional study was conducted in internal medicine and family medicine outpatient clinics of Marmara University Pendik Education and Research Hospital in Istanbul, between 2011-2012. Study was clinically approved by the Ethical Committee of Marmara University (No: B.30.2.MAR.0.1.02/AEK/120187198). Randomly selected adults (>18 years of age) were recruited in the study. Oral informed consent was obtained. Patients with known altered thyroidal function and/or using medication affecting thyroid metabolism and patients who were pregnant were excluded from the study.

Data Collection

Medical history and epidemiologic data were collected by a self-administered questionnaire.

Height and weight of the participants were measured by the same trained personnel using the same instruments. Body mass index (BMI) was calculated as weight / height^2 (kg/m^2). Blood samples were collected from the patients. Levels of thyroid-stimulating hormone (TSH), free thyroxine (fT4), total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglyceride and glucose were measured for every participant. TSH and fT4 reference-ranges for adults were considered as 0.27–4.2 mU/liter and 12–22 pmol/liter respectively.

Statistical Analysis

According to their BMI, participants were divided into three groups as normal weight (<25), overweight (25-30) and obese (≥30). Data was analyzed with SPSS 16 Programme, variables were compared with ANOVA test and Chi square test, correlation between variables was tested by Pearson correlation method. P<0.05 was accepted as statistically significant between variables.

Results

Six hundred fifty patients were included in this study. Thirty-two patients who were previously diagnosed as having thyroid diseases were excluded from the study. Data of 618 participants was analyzed. Three hundred twenty-seven participants (53%) were female and 291 participants (47%) were male. Mean age value was 43 ± 15. There were 175 (28.3%) participants in normal weight group, 242 (39.2%) in overweight group and 201 (32.5%) in obese group (Table I). In terms of age and sex there was no statistically significant difference between groups (P>0.05).

Table I. Demographic characteristics of participants

		n	%
Age (Mean±SD)	43±15		
Sex	Female	327	53
	Male	291	47
Weight	Normal Weight	175	28.3
	Overweight	242	39.2
	Obese	201	32.5

Five hundred seventy-eight participants (93.5%) had normal TSH levels and 40 participants (6.5%) had high TSH levels. Distribution of high TSH levels in BMI groups (normal weight, overweight and obese) was 6.3%, 5.8% and 7.5% respectively. In terms of having high TSH levels, no statistically significant difference was found between groups (P=0.76). Furthermore, BMI was not found to be correlated with TSH levels.

Table II. Distribution of variables according to groups

	Normal (Mean±SD)	**Overweight** (Mean±SD)	**Obese** (Mean±SD)	**P**
TSH	1.95±1.24	1.87±1.45	1.97±1.30	0.249
fT4	1.30±0.24	1.30±0.76	1.21±0.17	0.141
Total Cholesterol	171.21±35.47	188.83±44.72	191.02±38.10	**0.000***
LDL	98.95±31,76	114.25±38.28	115.05±32.98	**0.000***
HDL	52.69±14.81	46.32±11.86	45.73±11.42	**0.000***
Triglyceride	9830±53.29	141.60±83.55	148.08±66.49	**0.000***
Blood Glucose	88.22±53.28	102.68±39.94	104.53±30.63	**0.000***

**statistically significant at>0.05 level,* one-way ANOVA

TSH or fT4 levels did not differ statistically between groups. In contrast, a statistically significant difference was found in terms of blood glucose levels and lipid profiles (triglyceride, LDL, HDL and total cholesterol) between groups (Table II).

Atherogenic lipid levels (total cholesterol, LDL and triglyceride) and blood glucose were higher and HDL levels were lower in overweight and obese groups when compared with the levels of normal weight group. On the other hand, no statistically significant difference was found in terms of atherogenic lipid levels, blood glucose or HDL levels between overweight and obese groups.

A positive correlation was found between blood glucose and atherogenic lipid levels. A negative correlation was found between BMI and HDL levels.

Discussion

The aim of the present study was to investigate the relationship between thyroid function and obesity. We did not find any relationship between thyroid function and body weight in our study. This result was also supported by some other studies. Buscemi et al., suggested that body weight did not have any independent effect on thyroid hormone homeostasis, but rather influenced by nutritional factors [10]. Manji et al., found no association between TSH or fT4 and BMI among euthyroid subjects [8]. Altunoglu et al., found that thyroid function was normal in obese patients [11]. Shinkov et al., did not find any correlation between TSH and BMI in their study (P=0.17) [12].

Unlike our findings, Alkaç et al., suggested that thyroid dysfunctions especially hypothyroidism and Hashimoto thyroiditis were common in obese patients [13]. Two studies had different settings; Alkaç et al., recruited their sample from an obesity outpatient clinic and did not include overweight or normal weight patients in their study. But we recruited also overweight and normal weight patients and compared their thyroid function levels with the levels of obese patients. They found a rate of 18.8% hypothyroidism in obese patients and we found 7.5% in our study. Discordance between rates might also be due to differences in degree or type of obesity between samples. Biondi et al., reported that REE and changes in body weight were related with impaired thyroid functions [14]. We did not measure change in body weight in our study due to cross-sectional design of the study. TSH levels were found to be increased and positively correlated with BMI in patients with obesity in the study of Iacobellis et al. [15]. Contrary to ours, Iacobellis et al., recruited only women in their study. Knudsen et al., reported a positive association between BMI and TSH, in contrast a negative association between BMI and fT4. They suggested that high serum TSH levels were correlated with high obesity occurrence in a population [16]. Although, sample size was acceptable in our study, a much larger sample from general population was examined in the study of Knudsen et al. which could make a difference in statistical analysis. Bastemir et al., reported presence of elevated serum TSH levels in obese patients and a positive association between BMI and serum TSH [17]. Irrespective of insulin sensitivity, a positive association between BMI and both fT3 and serum TSH was reported in the study of De Pergola et al. [18]. Unlike our study, only euthyroid women were included in studies of Bastemir et al. and De Pergola et al. Makepeace et al., suggested that BMI and fT4 were negatively associated in patients who had never smoked and former smokers (adjusted for age and sex) [19]. In our study we did not take into account smoking status of our sample. Muscogiuri et al., reported that TSH level was higher in overweight and obese patients; TSH correlated with BMI, and visceral adipose tissue volume was the most powerful predictor of TSH [20]. Sample size is 10 times larger in our study. Discordance between findings might be

due to the difference of sample sizes of both studies. In the study of Mamtani et al., waist circumference was found to be associated with thyroid function index (TFI) independent of age, sex and BMI [21]. In our study we calculated BMI but we did not measure waist circumference of the patients that might affect our findings. Rahbar et al. suggested that BMI was significantly higher in the high-TSH group than in the low-TSH group and individuals with TSH levels at the upper limit of normality might be at risk of obesity [22]. We did not compare BMI of TSH subgroups in our study.

Wang et al., suggested that BMI mediated the effect of thyroid function on lipid profile [23]. We did not compare thyroid function with lipid profile in BMI subgroups. In our study a positive correlation between BMI and atherogenic lipid levels and blood glucose levels and a negative correlation between BMI and HDL levels were found. Ozsenel et al., supported our finding that triglyceride and glucose levels of obese hypothyroid patients were high and HDL-cholesterol levels were low when compared with the levels of non-obese hypothyroid patients [24]. On the contrary, Shinkov et al., did not find any association between serum lipid levels and serum TSH levels. Unlike our study, only euthyroid patients were included in the study of Shinkov et al [17]. In the study of Tagliaferri et al., they reported that thyroid function did not change lipid profile [25].

While our study supplied useful information about the relationship between obesity and thyroid function, it had several limitations. Cross-sectional design did not permit cause-effect relations in our study. We failed to find an association between BMI and thyroid function probably due to unaccounted confounders like age, sex, iodine intake and the other dietary conditions, smoking, degree or type of obesity and insulin sensitivity levels in the study population.

Conclusion

This study is one of the few studies in the literature showing that there is no relationship between obesity and thyroid function. There is need for further case-control or cohort studies to show any relation between thyroid function and obesity. This study, like previous studies, supports the notion that atherogenic lipid and blood glucose levels are higher in patients who are overweight or obese.

References

1. World Health Organization. Obesity and overweight. WHO Fact Sheet No. 311. Geneva: WHO; 2015. (http://www.wpro.who.int/mediacentre/factsheets/obesity/en/ Access date: 05/01/18)
2. OECD (2014). OECD Health statistics 2014, forthcoming. (http://www.oecd.org/els/health-systems/oecd-health-statistics-2014-frequently-requested-data.htm Access date: 07/01/18)
3. Adeboye B, Bermano G, Rolland C. Obesity and its health impact in Africa: a systematic review. Cardiovasc J Afr 2012;23: 512-1. doi:10.5830/CVJA-2012-040.
4. Torun E, Cakir E, Özgüç F, Özgen IT. The effect of obesity degree on childhood pulmonary function tests. Balkan Med J 2014;31:235-8. doi:10.5152/balkanmedj.2014.13101.
5. Bjoro T, Holmen J, Krüger O, et al. Prevalence of thyroid disease, thyroid dysfunction and thyroid peroxidase antibodies in a large, unselected population. The Health Study of Nord-Trondelag (HUNT). Europ J Endocrinol 2000;143.5: 639-47. doi: 10.1530/eje.0.1430639
6. Reinehr T. Obesity and thyroid function. Mol Cell Endocrinol 2010; 316.2: 165-71. doi: 10.1016/j.mce.2009.06.005.
7. Garnerone L, Iorio L, Zelaschi R, et al. Thyroid function and obesity. Minerva Medica 2010; 101: 363-70.
8. Manji N, Boelaert K, Sheppard MC, et al. Lack of association between serum TSH or free T4 and body mass index in euthyroid subjects. Clin Endocrinol 2006;64: 125-8. doi:10.1111/j.1365-2265.2006.02433.x
9. Fossati P, Fontaine P. Endocrine and metabolic consequences of massive obesity. Rev Praticien 1993;43: 1935-9.
10. Buscemi, S, Verga S, Maneri R, et al. Influences of obesity and weight loss on thyroid hormones. A 3–3.5-year follow-up study on obese subjects with surgical bilio-pancreatic by-pass. J Endocrinol Invest 1997;20: 276-81. doi: 10.1007/BF03350300
11. Altunoğlu E, Ülgen E, Müderrisoğlu C, Erdenen F, Boz M. Obezite ve tiroid fonksiyonları. İstanbul Tıp Dergisi 2009;1: 24-5.
12. Shinkov A, Borissova AM, Kovatcheva R, et al. The prevalence of the metabolic syndrome increases through the quartiles of thyroid stimulating hormone in a population-based sample of euthyroid subjects. Arq Bras Endocrinol Metabol 2014;58: 926-32. doi: 10.1590/0004-2730000003538.
13. Alkac C, Akbas F, Alkac B, Atmaca HU. Obezitede tiroid fonksiyonları. JAREM. 2014; 2: 74-6. doi: 10.5152/jarem.2014.466
14. Biondi B. Thyroid and obesity: an intriguing relationship. J Clin Endocrinol Metab 2010;95: 3614-7. doi: 10.1210/jc.2010-1245
15. Iacobellis G, Ribaudo MC, Zappaterreno A, et al. Relationship of thyroid function with body mass index, leptin, insulin sensitivity and adiponectin in euthyroid obese women. Clin Endocrinol 2005;62: 487-91. . doi: 10.1111/j.1365-2265.2005.02247.x
16. Knudsen N, Laurberg P, Rasmussen LB, et al. Small differences in thyroid function may be important for body mass index and the occurrence of obesity in the population. J Clin Endocrinol Metab 2005; 90: 4019-24. doi: 10.1210/jc.2004-2225

17. Bastemir M, Akin F, Alkis E, Kaptanoglu B. Obesity is associated with increased serum TSH level, independent of thyroid function. Swiss Medical Weekly 2007; 137: 431-4. doi: 2007/29/smw-11774
18. De Pergola G, Ciampolillo A, Paolotti S, Trerotoli P, Giorgino R. Free triiodothyronine and thyroid stimulating hormone are directly associated with waist circumference, independently of insulin resistance, metabolic parameters and blood pressure in overweight and obese women. Clin Endocrinol 2007; 67: 265-9. doi: 10.1111/j.1365-2265.2007.02874.x
19. Makepeace AE, Bremner AP, O'Leary P, et al. Significant inverse relationship between serum free T4 concentration and body mass index in euthyroid subjects: differences between smokers and nonsmokers. Clin Endocrinol 2008;69: 648-52. doi: 10.1111/j.1365-2265.2008.03239.x.
20. Muscogiuri G, Sorice GP, Mezza T, et al. High-normal tsh values in obesity: Is it insulin resistance or adipose tissue's guilt? Obesity 2013;21: 101-106. doi: 10.1002/oby.20240.
21. Mamtani M, Kulkarni H, Dyer TD, et al. Increased waist circumference is independently associated with hypothyroidism in Mexican Americans: replicative evidence from two large, population-based studies. BMC Endocrine Disorders 2014;14:46. doi:10.1186/1472-6823-14-46.
22. Rahbar AR, Kalantarhormozi M, Izadi F, et al. Relationship between Body Mass Index, waist-to-hip ratio, and serum lipid concentrations and thyroid-stimulating hormone in the euthyroid adult population. Iran J Med Sci 2017;42:301-5.
23. Wang Y, Yin Q, Xu M, Ni Q, Wang W, Wang Q. BMI modulates the effect of thyroid hormone on lipid profile in euthyroid adults. Int J Endocrinol 2017;2017:8591986. doi:10.1155/2017/8591986.
24. Ozsenel EB, Gurler MY, Karatemiz G, et al. Comparison of body mass index and lipid levels between obese and normal weighted hypothyroid patients. Şişli Etfal Hastanesi Tip Bülteni. 2015;49: 131-4. . doi: 10.5350/SEMB.20140808021149
25. Tagliaferri M, Berselli ME, Calo G, et al. Subclinical hypothyroidism in obese patients: relation to resting energy expenditure, serum leptin, body composition, and lipid profile. Obesity 2001;9: 196-201. doi: 10.1038/oby.2001.21