

Association Between Smoking Exposure and Obesity in Turkey

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ABSTRACT

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Introduction: Obesity and smoking, has become a public health concern and both of them are like a treated disease increasing every day. Tobacco smoke is the most important source of toxic and carcinogenic chemicals. The chemicals that cause obesity, called obesogen, are quite new and important research topic.

Objective: Past decade study results show that toxic chemical substance exposure increased obesity prevalence. This study aim to investigate smoking, obesity, and their relationship in Turkey.

Methods: Study designed as cross sectional analysis of a survey. The 25-question survey was administered to man. The 31-question survey was administered to female. Body Mass Index was calculated and subjects were classified as underweight, normal, overweight, or obese according to WHO criteria. Also smoking status in study group were also recorded. The datas were analyzed using SPSS.

Results: The research group consists of 406 (205 female, 201 male) (M_{age} 38,51±8.33) adult and between the ages of 18-65 years old (Male M_{age} =40.28±8.39; Female M_{age} =36.77±7.92). Results of this study 44.03% of adults were obese, 36.8% smoked, and 18.0% smoked and were obese. The relationship between cigarettes smoked and body-mass index was non-significant ($p>0.05$).

Conclusions and Recommendations: This is a seminal study to evaluate the possible risk of obesity in Turkish smokers. In the futue a new studies should be made in Turkey aimed to investigate the relationship passive smoking exposure and obesity.

Türkiye’de Sigara Maruziyeti ve Obezite İlişkinin İncelenmesi

Makale Bilgileri

ÖZ

Makale Geçmişi

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Anahtar Kelimeler:

Obezite,
Obezojenler,
Sigara,
Tütün ürünleri.

Giriş: Obezite ve sigara içimi önemli birer halk sağlığı sorunu olup etkilenen kişi sayısı her geçen gün artmaktadır. Sigara içimi toksik ve karsinojenik kimyasallara maruziyetin en önemli nedenlerinden biridir. Obezogen olarak adlandırılan obeziteye neden olan kimyasallar oldukça yeni ve önemli araştırma konuları arasındadır.

Amaç: Son on yılda yapılan araştırmalar toksik kimyasallara maruziyetin obezite yaygınlığını arttırdığını göstermiştir. Sunulan çalışma Türkiye’de sigara maruziyeti ve obezite ilişkisini incelemeyi amaçlamıştır.

Yöntem: Çalışma kesitsel anket çalışması olarak planlanmıştır. Erkek bireylere 25 soru kadınlara ise 31 soru içeren anketler uygulanmıştır. Çalışmaya katılan tüm gönüllülerin Beden Kitle İndeksi hesaplanarak Dünya Sağlık Örgütü kriterlerine göre zayıf, normal, aşırı kilolu ve obez şeklinde kategorilere ayrılmıştır. Ayrıca sigara alışkanlıkları da kayıt altına alınmıştır. Veriler SPSS programı kullanılarak analiz edilmiştir.

Bulgular: Çalışma grubu 18-65 yaş aralığında erkekler için 40.28±8.39, kadınlar için 36.77±7.92 ve tüm çalışma grubunda ise yaş ortalaması 38.51±8.33 olan 406 (205 kadın, 201 erkek) kişiden oluşmaktadır. Çalışma sonuçlarına göre yetişkinlerin %44.03’ü obez, %36.8’i sigara içen ve %18’i ise hem sigara içen hem de obeziteye sahip kişiler olarak belirlenmiştir. Sonuçlar, sigara içimi ve beden kitle indeksi arasındaki istatistiksel olarak anlamlı bir ilişki olmadığını göstermiştir ($p>0.05$). **Sonuç ve Öneriler:** Sunulan çalışma Türkiye’de yetişkinlerde sigara içimi ile obezite arasındaki ilişkinin değerlendirildiği ilk çalışma olma özelliğindedir. Çalışma sonuçlarımıza göre Türkiye’de yetişkinlerde sigara içimi ve obezite arasında istatistiksel olarak anlamlı bir ilişki saptanmamıştır. Sigaranın obezogenik etkisinin değerlendirilmesi için pasif maruziyetin etkilerini de araştıran yeni çalışmaların yapılmasına ihtiyaç duyulmaktadır.

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INTRODUCTION

Obesity and smoking, has become a public health crisis and both of them are like a treated disease. Between 1975 and 2016 years obesity ratio has tripled in the world (World Health Organization, 2019). Researchers agree that too many caloric intake and too little exercise both of them important factors in obesity prevalence but the studies suggest that the toxic chemicals may also be factor in overweight or obesity (Grun and Blumberg, 2006; Grun and Blumberg, 2007; Newbold, Padilla-Banks and Jefferson, 2009; Göney, 2016). Obesity reasons are classify that diet, sedentary lifestyle, physical activity, psychological factors, genetic syndromes, some endocrine diseases and also smoking exposure (Amisola and Jacobson, 2003; Toschke, Koletzko, Slikker, Hermann and von Kries, 2002; Gao et al., 2005; Behl et al., 2013) that evaluating possible obesogenic effects of this paper.

Cigarette smoke is a source of toxic compounds that are over the 4000 and some of them are anti-obesogenic (chromium, cadmium) and some of them (Benzo[a]pyrene and PM_{2,5}) are obesogenic. Study results suggest that there may be a more general relationship between chromium levels and glucose and/or lipid metabolism. A lots of study show that chromium (Wilson and Gondy, 1995; Kaats, Blum, Fisher and Adelman, 1996; Kaats, Blum, Pullin, Keith and Wood, 1998; Onakpoya, Posadzki and Ernst, 2013) and cadmium (Johnson et al., 2003; Padilla, Elobeid, Ruden and Allison, 2010) supplementation showed decreases in body mass index and fat. Cigarette smoking caused polycyclic aromatic hydrocarbons (PAH's) and particulate matters (PM's) exposure and analysis put forward obesogenic effects of them. Experimental studies have shown that these substances may have an obesogenic effect (Grün and Blumberg, 2009). In experimental animals results indicate that PAH's exposure block lipolysis, resulting in increase body mass index (BMI). Also shown that early period in lifetime exposure to PM's causes mitochondrial damage and increased accumulation of white adipose tissue relative to metabolically active brown adipose tissue. PM's have an estrogenic effects, and according to result in utero exposure to environmental estrogens cause subsequent obesity in animal bioassays (Wenger et al., 2009) Importantly animal study result found that fetal and early neonatal exposure to nicotine resulted in accelerated postnatal weight gain and increased visceral adiposity, as well as increased adiposity (Irigaray et al., 2006, Newbold, Padilla-Banks, Snyder and Jefferson, 2007; Sun et al., 2009; Wenger et al., 2009; Xu X et al., 2011; Yan et al., 2014; McConnell et al., 2016). In addition, animal assays indicate that chronic nicotine withdrawal increases appetite and food intake. Nicotine directly activates the brain melanocortin system in animal bioassays via nicotinic receptors, and the BMI increase associated with cessation of smoking is due to decreased activity of melanocortin 4 receptors (Tomasi et al., 2009; Marrero et al., 2010). It is difficult to determine the precise mechanism through which maternal smoking may result in increased offspring obesity. Kieser, Groeneveld and Da Silva (1997) found that maternal obesity has a destabilizing effect on the developing fetus and that this effect appears to be enhanced in obese mothers who smoked. Infants of mothers who smoked in pregnancy were lighter at birth than infants of non-smokers, but from adolescence they had an increased risk of being in the fattest decile of BMI. The OR (Odds ratios) for obesity associated with maternal smoking increased with age, strengthening of the relationship over time (Power and Jefferis, 2002; Oken, Levitan and Gillman, 2008). Evaluating current epidemiological data support a positive association between maternal smoking and increased risk of obesity or overweight in offspring (Behl et al., 2013; Dare, Mackay and Pell, 2015; Watanabe et al., 2016; Ginawi et al., 2016; Göney, 2019). Over the past decade, there have been a large number of studies investigating the possible relationship between smoking and obesity (Dare, Mackay and Pell, 2015; Courtemanche, Tchernis and Ukert, 2018; Sun et al., 2019).

Although the large number of studies on the subject in the world (Kim, Jeong, Yoo, Oh and Kang, 2016; Dare et al., 2017; Pérez-Ferrer et al., 2018) in Turkey there is no study conducted to analyzing the possible obesogenic effects of cigarette exposure. The present study aims to fill the lack of scientific data on this subject.

MATERIALS AND METHODS

Type of Study

Study designed cross sectional analysis of a survey. A web-based survey was applied in Turkey over the Internet.

Sampling

This study was carried out from January to September 2019 with participants (n= 406) 205 female ($M_{age}=36,77\pm7.92$) and 201 man ($M_{age}=40,28\pm8.39$) who were 18 or older.

Data Collection

Present study designed cross sectional analysis of a survey. The 25-question survey was administered to man and the 31-question survey was administered to female to learn specific information about cigarette smoke such as active or passive smoking, smoking status (never/former/current,), smoking intensity (pack/day). In addition, age, sex, nutrition habits, physical activity in study group were also recorded. Current smokers were divided into 3 categories according to daily consumption; 1 to 9 cigarettes/day, 10 to 19 cigarettes/day, and ≥ 20 cigarettes/day. In addition, information of disease (Hypertension/Diabetes), body weight and height were recorded. BMI, defined as the weight in kilograms divided by the square of the height in meters, was calculated and subjects were classified as underweight, normal, overweight, or obese according to WHO criteria (WHO, 2019).

Data Analysis

BMI of participants exposed to smoking was calculated and compared with BMI results of the healthy, non-smokers controls who were not exposed to any tobacco products passively. The datas were analyzed using Statistical Package for the Social Sciences, the statistical program. Frequency and percentage analyses have been used for analyzing participants' demographic characteristics and mean scores from the measurement tools. T-test analyses have been performed to compare of two related groups to determine whether there is a statistically significant difference. Analysis of variance (ANOVA) is used to check if the means of two or more groups are significantly different from each other. A Chi-square test is used to analyze categorical datas. A *p* value less than 0.05 was considered as statistical significant.

Ethic

The collection of the questionnaires were based on a formal consent form approved by the Ethical Committee of the Afyon Kocatepe University Scientific Research (document number 2019/35). Consent form was received from all participants.

RESULTS

Baseline characteristics from participants was shown Table 1 about a 59.67% of the male and a 21.76 % of the female were current smokers. Characteristics of BMI from 406 participants (205 female and 201 male) are shown in Table 2 BMI was calculated as kg/m^2 by sex for each group. Male were more frequently obese or overweight (46.6%) than female (41.6%). According to t-test results with a

95% confidence interval duration of gender and BMI relationship was statistically significant in female ($p=0.048$) and non-significant male ($p=0.438$).

Table 1. Characteristics from Participants

Gender	n	Age (Mean±Std)	Smoker	Nonsmoker
Female	205	36.77±7.92	21.76%	78.24%
Male	201	40.28±8.39	59.67%	40.33%

Table 2. Characteristics of Body Mass Index (BMI) from Participants (n=406)

Gender	Study group	Underweight (n=) n=(%)	Normal (n=) n=(%)	Overweight (n=) n=(%)	Obesity		Missing	p Value
					Class 1 (n=) n=(%)	Class 2 (n=) n=(%)		
Female	205	8 %3.9	101 %48.8	53 %25.6	25 %12.1	8 %3.9	12 %5.8	$p=0.048$
Male	201	9 %4.4	63 %30.9	63 %30.9	29 %14.2	3 %1.5	37 %18.1	$p=0.438$

Baseline characteristics of participants was shown in Table 3. The association between physical activity and BMI was non-significant ($p=0.078$). In addition, the association between alcohol consumption and BMI was significant ($p=0.013$). The participants were also responded about do they think overweight/obese and do they think weight gain despite their regular/balanced diet. We assessed the association between thinking overweight/obese or weight gain despite their regular/balanced diet and BMI. We evaluate that both of them was statistically significant ($p=0.000$). In addition, when we ask do you think you are obese or overweight majority of participants (Female: 40.6%; Male: 49.5%) answered no. The majority of those who do not think they are obese are 34.1% normal weight. Also we assessed the association between hypertension/diabetes and overweight/obesity ($p=0.013$).

Associations between BMI and smoking habits among study group (n=406) was shown Table 4. We evaluated the association between cigarette smoking and BMI. The most valuable result of this study is that there were no statistical differences found between duration of smoking and BMI ($p=0.152$). The association between cigarettes smoked per day and BMI was non-significant ($p=0.286$). Also the association between passive exposure (home/workplace) and BMI was non-significant (respectively $p=0.082$, $p=0.954$). Among study group, we found that no significant association between the duration of cigarettes or number of cigarettes smoked daily and obesity was found.

Table 3. Baseline Characteristics of Study Group (n=406)

	Study group	Female	Male	Underweight (n=) n=(%)	Normal (n=) n=(%)	Overweight (n=) n=(%)	Obesity Class 1	Obesity Class 2
Physical activity*								
Per day walks <1 hours	123 %29.9	63 %30.4	60 %29.4	4 %1.6	40 %16.1	37 %14.9	19 %7.6	4 %1.6
Per day walks 1-2 hours	77 %18.7	34 %16.4	43 %21.1	3 %1.2	29 %11.6	16 %6.4	13 %5.2	0
Per day walks 2-4 hours	30 %7.3	15 %7.2	15 %7.4	0	9 %3.6	8 %3.2	4 %1.6	2 %0.8
Per week walks a few hours	43 %10.5	24 %11.6	19 %9.3	3 %1.2	15 %6.0	13 %5.2	8 %3.2	1 %0.4
Per month walks a few hours	24 %5.8	13 %6.3	11 %5.4	1 %0.4	8 %3.2	8 %3.2	2 %0.8	2 %0.8
Missing	114 %27.7	58 %28.0	56 %27.5					
Alcohol consumption **								
Never	237 %57.7	132 %63.8	105 %51.5	7 %2.8	83 %33.5	65 %26.2	38 %15.3	9 %3.6
Occasionally	19 %4.6	5 %2.4	14 %6.9	3 %1.2	5 %2.0	10 %4.0	0	0
Daily	39 %9.5	12 %5.8	27 %13.2	1 %0.4	12 %4.8	6 %2.4	9 %3.6	0
Missing	116 28.2	58 %28.0	58 %28.4					
Do you think overweight/obese? *								
No	79 %40.6	101 %49.5	10 %4.1		84 %34.1	47 %19.1	8 %3.3	1 %0.4
Yes	63 %30.4	46 %22.5	1 %0.4		13 %5.3	35 %14.2	39 15.9	8 %3.3
Missing	60 %29.0	57 %27.9						
Do you think weight gain despite your regular/balanced diet? **								
No	99 %47.8	118 %57.8	10 %4.0		86 %34.7	56 %22.6	21 %8.5	4 %1.6
Yes	50 %24.2	30 %14.7	1 %0.4		15 %6	24 %9.7	26 %10.5	5 %2.0
Missing	58 %28	56 %27.5						
Hypertension ***								
No								
Yes	3 %1.4	3 %1.5	0		1 %0.9	1 %0.9	3 %2.6	0
Diabetes ***								
No								
Yes	6 %2.9	2 %1	0		1 %0.9	2 %1.7	1 %0.9	2 %1.7
Healthy	58 %28	58 %28.4	7 %6.0		35 %30.2	47 %40.5	11 %9.5	5 4.3
Missing	140 %67.6	141 %69.1						

*p=0.000, **p=0.000, ***p=0.013

Table 4. Relationship between Smoking and Body Mass Index (BMI) from Study Group (n=406).

	Underweight (n=) n=(%)	Normal (n=) n=(%)	Overweight (n=) n=(%)	Obesity Class 1 (n=) n=(%)	Obesity Class 2 (n=) n=(%)
Duration of smoking (years) ¶					
Never	7 %2.1	75 %27.7	49 %14.8	25 %7.6	7 %2.1
Former	1 %0.3	20 %6.1	12 %3.6	6 %1.8	0
3 month	0	5 %1.5	0	0	0
6-1 years	0	2 %0.6	0	0	0
1-5 years	0	6 %1.8	4 %1.2	3 %0.9	0
5-10 years	0	8 %2.4	14 %4.2	1 %0.3	0
10-15 years	0	9 %2.7	6 %1.8	3 %0.9	0
15-20 years	1 0.3	6 1.8	7 %2.1	8 %2.4	1 %0.3
>20	5 %1.5	12 %3.6	12 3.6	6 1.8	3 %0.9
Number of cigarettes (per day) ϕ					
<10	0	31 %10.1	20 %6.5	7 %2.3	1 %0.3
10-20	1 %0.3	12 %3.9	10 %3.3	8 %2.6	1 %0.3
>20	3 %1	9 %2.9	11 3.6	9 %2.9	2 0.7
Passive exposure					
Home †					
No	4 %1.4	67 %24.2	53 %19.1	35 %12.6	4 %1.4
Yes	9 %3.2	47 %17	39 14.1	14 %5.1	5 1.8
Workplace λ					
No	5 %2.1	55 23.2	39 %16.5	22 %9.3	4 %1.7
Yes	7 %3	48 %20.3	35 14.8	19 %8	3 %1.3

¶ p=0.152, ϕ p=0.286, † p=0.082, λ p=0.954

DISCUSSIONS

Recent years remarkable number of studies investigate that relationship between smoking exposure and prevalence of overweight or obesity (Lv et al. 2015; Watanabe et al. 2016; Sun et al. 2019). In this study, we present the first comprehensive study regarding the impact of cigarette smoking on BMI result, compared with healthy nonsmokers. In an adult Turkish population, we found that among smokers BMI not increased with number of cigarettes smoked. While these findings are concordant with

previous studies that analyzed a relationship between cigarette smoking and BMI (Dare et al., 2015; Courtemanche, Tchernis and Ukert, 2018; Sun et al. 2019). Also Winsløw, Rode and Nordestgaard (2015) study result show that tobacco smoking causes lower BMI among current smokers. According to the national health interview survey datas Healton, Vallone, McCausland, Xiao and Green (2006) indicate that adult people in the United States who smoke and are obese is relatively low. However, Lv et al. (2015) reported that tobacco smoking could be an important risk factor for obesity. In addition, epidemiological and experimental researches related to smoking or nicotine exposure and obesity or metabolic disorders at any age. According to the Behl et al. (2013) analyse 83 in humans and 18 in animals a totally 101 studies were a positive association between smoking exposure and overweight or obesity (Behl et al., 2013).

CONCLUSION

Finally, evaluating current epidemiological datas support a positive association between maternal smoking and increased risk of obesity or overweight in offspring. Active or passive exposure to tobacco smoke is also a significant source of toxic chemicals exposure. People to be encouraged to never take up smoking. In this study, in an adult Turkish population, we found that BMI not increased with smoking. In future taking into consideration the health of mother and child, a new studies should be made in Turkey aimed to investigate the relationship maternal or paternal smoking exposure and childhood overweight or obesity.

Conflicts of interest

The authors declare no conflict of interest.

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