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KLİNİK ÇALIŞMA
RESEARCH ARTICLE

The effects of smoking on body composition, pulmonary function, physical activity and health-related quality of life among healthy women

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SUMMARY

The effects of smoking on body composition, pulmonary function, physical activity and health-related quality of life among healthy women

Introduction: *Smoking leads to more respiratory symptoms and negative effects on the health-related quality of life (HRQOL) in women than men for the same smoking burden. However, the relationship between smoking and body composition and its influencing factors remains unclear. In this study, we aim to investigate the effects of smoking on body composition, pulmonary function, physical activity and health-related quality of life (HRQOL) among healthy women.*

Materials and Methods: *A total of 73 young healthy women, current cigarette smokers and who had never smoked were included. The level of physical activity was assessed using the International Physical Activity Questionnaire; body mass index, circumference measurements, waist-to-hip ratio, skinfold measurements and body fat percentage were used to determine the body composition; HRQOL was assessed through the World Health Organization Quality of Life Instrument; level of depression and anxiety were evaluated using the Hospital Anxiety and Depression Scale; pulmonary functions were evaluated with spirometry.*

Results: *We found higher incidence of respiratory symptoms and lower physical activity levels in smokers than those of non-smokers ($p< 0.05$). There was no significant difference between smokers and non-smokers in respect of HRQOL, depression and anxiety ($p> 0.05$). In smokers whom cigarette consumption more than 150 p-years, we observed positive correlations between cigarette consumption and arm circumference, waist circumference, waist-to-hip ratio ($p< 0.05$).*

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Conclusion: *Our results show that the smoking causes an increase in the incidence of respiratory symptoms and reduces the level of physical activity in healthy women. Additionally it leads to abdominal obesity depending on cigarette consumption.*

Key words: *Body composition; health-related quality of life; physical activity; pulmonary function; smoking*

ÖZET

Sağlıklı kadınlarda sigaranın vücut kompozisyonu, pulmoner fonksiyonlar, fiziksel aktivite ve sağlıkla ilişkili yaşam kalitesi üzerine etkisi

Giriş: *Sigara içiciliği kadınlarda aynı miktarda sigara içen erkeklere oranla daha fazla solunumsal semptoma ve sağlıkla ilişkili yaşam kalitesi üzerinde negatif etkiye sebep olmaktadır. Sigara içiciliği ile vücut kompozisyonu arasındaki ilişki ve etkileyen faktörler ise net değildir. Bu çalışmada amacımız sağlıklı kadınlarda sigaranın vücut kompozisyonuna, pulmoner fonksiyonlara, fiziksel aktivite ve sağlıkla ilişkili yaşam kalitesi üzerine etkisini incelemektir.*

Materyal ve Metod: *Çalışmaya düzenli sigara içen ve hiç sigara içmemiş toplam 73 sağlıklı kadın dahil edildi. Fiziksel aktivite seviyesi Uluslar Arası Fiziksel Aktivite Anketi, vücut kompozisyonu; vücut kitle indeksi, çevre ölçümleri, bel-kalça oranı, skinfold ölçümleri ve vücut yağ oranı ölçümü, yaşam kalitesi World Health Organization Quality of Life Instrument, depresyon ve kaygı düzeyi Hastane Anksiyete ve Depresyon Skalası, akciğer volüm ve kapasiteleri solunum fonksiyon testi ile değerlendirildi.*

Bulgular: *Sigara içen grupta fiziksel aktivite seviyesi daha düşük, solunumsal semptom sıklığı daha fazla bulundu ($p< 0.05$). Gruplar arasında sağlıkla ilişkili yaşam kalitesi, anksiyete ve depresyon skorları benzerdi ($p< 0.05$). Sigara tüketimi 150 p-yıl dan fazla olan grupta sigara tüketim miktarı ile kol çevresi, bel çevresi, bel-kalça oranı arasında pozitif ilişki saptandı ($p< 0.05$)*

Sonuç: *Çalışmamızda sağlıklı kadınlarda sigaranın solunumsal semptom sıklığını arttırdığını ve fiziksel aktivite seviyesini azalttığı görülmüştür. Buna ek olarak sigara, tüketim miktarına bağlı olarak abdominal obeziteye yol açmaktadır.*

Anahtar kelimeler: *Fiziksel aktivite; sağlıkla ilgili yaşam kalitesi; sigara; pulmoner fonksiyonlar; vücut kompozisyonu*

INTRODUCTION

The prevalence of smoking in developing countries has been on the increase, even though there has been an increase in awareness about the health risks associated with smoking among the general public (1). With regard to the current smoking patterns, the annual number of tobacco-related deaths is expected to increase to 10 million by 2030. The 21st century is likely to see 1 billion tobacco-related deaths, most of them in low-income countries (2).

Recent studies have shown that women are more susceptible to carcinogens present in tobacco than men and have a higher risk of developing lung cancer from smoking (3). Further, women report more respiratory symptoms than men for the same smoking burden (4). Apart from respiratory disease, smoking leads to physical and psychological changes that affect the health-related quality of life (HRQOL). However, the relationship between smoking and body composition remains unclear, with studies reporting inconsistent results (5,6). Nonetheless, the negative effects of smoking on physical activity, HRQOL, anxiety, and depression have been highlighted in some studies (7-9).

To the best of our knowledge, no study has investigated the relationship of smoking with body composition, pulmonary function, physical activity level and HRQOL. Therefore, we aimed to determine and interpret the possible effects of smoking on body composition, pulmonary function, physical activity and HRQOL by comparing smokers and non-smokers in healthy women.

MATERIALS and METHODS

We conducted this cross-sectional study at Dokuz Eylul University School of Physiotherapy and Rehabilitation, in İzmir, Turkey. The study was approved by the local institutional review board. All patients provided their informed consent for participation.

Participants

We recruited 73 healthy women (37 current cigarette smokers and 36 non-smokers who had never smoked before) who live in Izmir where is one of the most modern and has high education rate cities of Turkey. We included women, working actively, between the ages of 25 and 40 years who had no neurological, musculoskeletal, psychological, or metabolic disease that directly affected the level of physical activity and volunteered to participate in the study and answer the questionnaire. We excluded women who had uncontrolled lung or heart disease, diagnosed with psychological illness, ex-smokers, and professional athletes.

Table 1. Demographic and clinical characteristics of smokers and non-smokers women

	Smokers (n= 37)	Non-smokers (n= 36)	p
Age (year)	33.03 ± 4.67	33.08 ± 4.36	0.96
Weight (kg)	62.08 ± 9.29	60.02 ± 7.55	0.30
Height (m)	1.63 ± 0.05	1.63 ± 0.07	0.70
Body Mass Index (kg/m²)	23.40 ± 3.43	22.46 ± 2.67	0.20
Smoking duration (year)	12.89 ± 5.03	0.00 ± 0.00	< 0.001
Cigarette consption (px/year)	177.95 ± 140.80	0.00 ± 0.00	< 0.001
Education, %, (n)			
Secondary School	40.5 (15)	36.1 (13)	
University	59.5 (22)	63.9 (23)	0.56
Medical history, %, (n)			
Respiratory disease	2.7 (1)	5.6 (2)	
Cardiovascular disease	8.1 (3)	5.6 (2)	0.59
Muskulo-Skeletal disease	2.7 (1)	11.1 (4)	
Metabolic disease	8.1 (3)	5.6 (2)	
Alcohol consumption %, (n)	35.1 (13)	11.1 (4)	0.02
Duration of using alcohol (year)	4.11 ± 6.85	0.57 ± 2.21	0.01
Alcohol consumption (glass/week)	0.74 ± 1.30	0.13 ± 0.40	0.01
Exercise habit , %, (n)	29.7 (11)	38.9 (14)	0.42
Exercise frequency (day/week)	1.68 ± 3.29	1.75 ± 2.59	0.92
Exercise duration (year)	1.69 ± 3.88	1.98 ± 3.75	0.75
Exercise type, %, (n)			
Walking	21.6 (8)	27.8 (10)	
Aerobic and dance	8.1 (3)	8.3 (3)	0.56
Swimming	-	2.8 (1)	
Respiratory Symptoms Ratio, %, (n)			
Cough	27.0 (10)	2.8 (1)	< 0.001
Dyspnea	45.9 (17)	16.7 (6)	0.01
Sputum	40.5 (15)	5.6 (2)	< 0.001
Chest tightness	10.8 (4)	5.6 (2)	0.04

Data were presented mean ± standard deviation (X ± SD) and categorical variables were presented as percentage (%) and Count (n).

Measurements

We recorded the demographic data [age, gender, education, profession, height, weight and body mass index (BMI)], cigarette and alcohol consumption, respiratory symptoms (cough, sputum, and dyspnea), and exercise habits of the participants.

A trained physiotherapist assessed body composition by measuring the circumference of the waist, the hip

and right upper arm with a tape and calculated the percentage of body fat by measuring the right biceps, triceps, subscapularis and suprailiac muscles with a skinfold caliper (Holtain Callipers, 0.2 spaces) by using the Durnin&Womersley equations (10,11). The pulmonary function test which done with spirometry (Sensormedia V_{max} Series 22) was used to determine the forced expiratory volume in one second (FEV_1), forced expiratory capacity (FVC), FEV_1/FVC and peak expiratory flow (PEF) (12).

We determined the physical activity levels of the participants by using the short form of the International Physical Activity Questionnaire (IPAQ), which is a self-administered questionnaire about physical activity in the last 7 days. The scores were calculated as MET-min/week, based on which the participants were classified as physically inactive, minimally active and sufficiently active. In addition, we recorded the sitting time as number of hours/day (13). We assessed HRQOL by using the World Health Organization Quality of Life Instrument (WHOQOL-BREF questionnaire), which is comprised of four dimensions (physical health, psychological, social relationships and environment). This questionnaire has no total score and every dimension can be assigned a maximum score between 21 and 100 points (14). We evaluated the psychological symptoms by using the Turkish version of Hospital Anxiety and Depression Questionnaire, which has been shown to have sufficient validity and reliability. The 14 questions in this questionnaire are scored on a Likert scale of. A high score of 10 is indicative of anxiety and 7 of depression (15).

Statistical Analysis

We performed statistical analyses using SPSS 15.0 (Statistical Package for the Social Sciences, Chicago, Illinois). Descriptive statistics were performed for all the recorded variables, and the data were expressed as mean ± standard deviation (SD) and percentage (%). We compared continuous data by using The Student t-test and categorical data by using The Chi-Square test, and determined the relationship between continuous variables by calculating Pearson's correlation coefficient. We considered $p< 0.05$ to indicate significance.

RESULTS

Seventy-three women (37 smokers and 36 non-smokers) participated in this study. The smokers and non-smokers groups were similar with regard to their demographic and clinical characteristics ($p< 0.05$). The prevalence and amount of alcohol consumption and its duration were significantly higher in smokers ($p< 0.05$). Exercise habits were similar between the two groups ($p= 0.42$). Walking and aerobic exercises were the most common forms of exercise in both groups. With regard to respiratory symptoms, the incidence of cough, dyspnea, sputum and chest tightness was found to be significantly higher among the smokers ($p< 0.05$), (Table 1).

When body compositions were compared, we found similar circumference and skinfold measurements between groups except right arm circumference that was greater significantly in smokers group ($p= 0.04$), (Table 2). The FEV_1, FVC, and PEF values and the FEV_1/FVC ratio were similar in both groups ($p> 0.05$).

Table 2. Comparison of body composition parameters of smokers and non-smokers women

	Smokers (n= 37) X ± SD	Non-smokers (n= 36) X ± SD	p
Arm circumference (cm)	28.76 ± 3.63	27.15 ± 2.70	0.04
Waist circumference (cm)	76.53 ± 8.66	74.59 ± 6.84	0.29
Hip circumference (cm)	100.80 ± 6.20	98.67 ± 4.71	0.10
Waist/hip ratio	0.76 ± 0.06	0.76 ± 0.05	0.84
Biceps (mm)	10.26 ± 4.84	10.00 ± 5.04	0.82
Triceps (mm)	23.43 ± 8.26	21.00 ± 5.90	0.15
Subscapularis (mm)	18.30 ± 7.11	17.09 ± 6.49	0.45
Suprailiac (mm)	20.74 ± 8.02	18.09 ± 6.51	0.13
Body density	-3.44 ± 1.62	-3.03 ± 1.30	0.24
Body fat ratio	-637.37 ± 111.45	-656.31 ± 123.43	0.49

Interestingly, the values of FEV_1% and FVC% were significantly higher among smokers ($p< 0.05$, (Table 3).

According to the IPAQ, physical activity scores were significantly higher in non-smokers, ($p< 0.05$). The percentage of inactive women was 22.2% among the non-smokers and 45.9% among the smokers ($p= 0.04$). There was no difference in HRQOL, anxiety and depression scores between smokers and non-smokers ($p> 0.05$), (Table 4).

We divided smoker participants into two groups according to cigarette consumption; those who smoked more than 150 packets-year and those who smoked less than 150 packets-year. Among the group who smoked less than 150 packets-year, none of the parameters were correlated with smoking. However,

Table 3. Comparison of pulmonary function test results of smokers and non-smokers women

	Smokers (n= 37) X ± SD	Non-smokers (n= 36) X ± SD	p
FVC (mL/s)	3.37 ± 0.42	3.27 ± 0.52	0.20
FVC %	98.05 ± 11.21	93.90 ± 8.87	0.04
FEV_1 (mL/s)	2.86 ± 0.33	2.79 ± 0.34	0.26
FEV_1 %	96.01 ± 10.63	92.39 ± 9.27	0.04
FEV_1/FVC	84.83 ± 5.95	85.71 ± 4.94	0.30
PEF (mL/s)	6.05 ± 0.73	6.09 ± 0.86	0.28
PEF %	88.85 ± 12.20	90.66 ± 9.93	0.31

FVC: Forced vital capacity, FEV_1: Forced expiratory volume in 1 second, PEF: Peak expiratory flow.

Table 4. Comparison of physical activity levels and anxiety-depression scores and health-related quality of life score of smokers and non-smokers women

	Smokers (n= 37) X ± SD	Non-smokers (n= 36) X ± SD	p
IPAQ Score	3546 ± 1131	9504 ± 1940	0.02
Sitting time (h/d)	6.54 ± 2.85	5.22 ± 2.57	0.05
IPAQ Classification, % (n)			
Inactive	45.9 (17)	22.2 (8)	
Minimally active	43.2 (16)	58.3 (21)	0.04
Sufficiently active	10.8 (4)	19.4 (7)	
HAD			
Anxiety	7.49 ± 3.69	6.42 ± 3.17	0.19
Depression	5.08 ± 3.54	5.44 ± 3.42	0.66
WHOQOL-BREF			
Physical (20)	16.42 ± 4.69	15.65 ± 2.39	0.38
Pscychological (20)	15.19 ± 2.20	15.02 ± 2.10	0.74
Social (20)	14.70 ± 2.54	14.48 ± 3.14	0.74
Environment (20)	13.80 ± 2.25	13.54 ± 2.27	0.63
Physical (100)	77.61 ± 29.29	72.81 ± 14.94	0.38
Pscychological (100)	69.93 ± 13.75	68.87 ± 13.12	0.74
Social (100)	66.89 ± 15.89	65.51 ± 19.63	0.74
Environment (100)	61.23 ± 14.04	59.64 ± 14.16	0.63

IPAQ: International physical activity questionnaire, HAD: Hospital anxiety and depression scale, WHOQOL-BREF: World health organization quality of life instrument.

Table 5. Correlations between cigarette consuption and other parameters in group that smoked more than 150 px/year

r	CC	BMI	AC	WC	HC	W/H	B	T	S	SI	BD	BFR	ST
BMI	.30	-											
AC	.55*	.77***	-										
WC	.60*	.75***	.85***	-									
HC	.04	.76***	.76***	.58*	-								
W/H	.77***	.41	.54*	.83***	.03	-							
B	.60**	.66**	.90***	.83***	.61**	.61**	-						
T	.13	.74***	.76***	.75***	.82***	.36	.81***	-					
S	.55*	.55*	.68**	.86***	.35	.82***	.74***	.66**	-				
SI	.33	.55*	.62**	.78***	.45	.65**	.63**	.56*	.75***	-			
BD	.40	-.71**	-.82***	-.91***	-.65**	-.68**	-.87***	-.87***	-.89***	-.86***	-		
BFR	.31	.74***	.75***	.86***	.70**	.58*	.79***	.87***	.72**	.75***	-.90***	-	
ST	-.50*	-.25	-.22	-.27	.07	-.38	-.15	-.02	-.38	.01	.14	-.07	-

* $0.01 < P \leq 0.05$.
** $0.001 < P \leq 0.01$.
*** $P \leq 0.001$.
CC: Cigarette consuption, BMI: Body mass index, AC: Arm circumference, WC: Waist circumference, HC: Hip circumference, W/H: Waist to hip ratio, B: Biceps, T: Triceps, S: Subscapularis, SI: Suprailiac, BD: Body density, BFR: Body fat ratio, ST: Sitting time.

in the group that smoked more than 150 packets-year smoking was correlated with arm and waist circumference, the waist-to-hip ratio, skinfold measurement of the biceps and subscapularis and sitting time ($0.50 \leq r < 0.78$), (Table 5).

DISCUSSION

In this study that we investigated the potential effects of smoking in young and healthy women working actively, it was found that despite similar body composition, smoker women had lower physical activity and more respiratory symptoms than those of non-smokers.

The results related to body composition among smokers and non-smokers are conflicting (5-7,16-20). Many studies have shown that smokers have a lower BMI than non-smokers. For example, a cohort study performed on 14751 non-smokers and 7308 regular smokers aged between 25 and 84 reported that BMI was lower in smokers than in non-smokers; this study also found a positive correlation between cigarette consumption and BMI and waist-to-hip ratio in both female and male participants. Based on the findings, this study emphasized that personal and lifestyle characteristics might be more important than the direct effects of smoking (18).

In our study, no significant differences were found in the BMI scores of the groups. The participants had a similar work environment (which mostly involved sitting) and exercise habits, so energy intake and expenditure may have been homogeneous in the groups. However, we found a positive correlation between cigarette consumption and waist circumference and waist-to-hip ratio in women who smoked more than 150 packets-year. In a Denmark study on the relationship between smoking, lifestyle factors and body composition, it was found that smokers had a lower BMI and a higher waist-to-hip ratio than non-smokers. Moreover, they found a positive correlation between cigarette consumption and unhealthy diet, energy intake, sedentary lifestyle and alcohol consumption (7). Clairet al., showed that the daily cigarette consumption was related to waist circumference and body fat percentage but not BMI. Besides, they found a positive correlation between the cigarette consumption and abdominal fat percentage, especially in women (6). Thus, the results of our study are consistent with those of previous studies which showed that the relationship between smoking and abdominal obesity was dose dependent (6,7,16-19). So we consider that this is important to break down the wrong judgment that is smoking allowed weight control in the community.

The mechanism via which smoking affects body composition and fat distribution is very complex, as it is influenced by many factors such as genetic structure and sex hormones, which affect body weight (21-23). Testosterone levels are higher in female smokers, and the waist-to-hip ratio is higher in women with high testosterone levels (22,23). In addition, it was reported that female smokers had an unhealthy lifestyle and were prone to weight gain (7,16). Some studies have reported that smoking increases fat accumulation and increases insulin resistance (16,24). The lower BMI in smokers could be associated with the metabolic features of nicotine, as increased nicotine intake is known to result in an increase in fat oxidation and a decrease in fat accumulation (25,26).

We used the Turkish version of IPAQ which of the validity and reliability has been proven to assess physical activity in female smokers. Lower levels of physical activity were reported among smokers, and the results were comparable to those reported in the literature (7,16,17). Further, we also found that sitting time, waist circumference and the waist-to-hip ratio were positively correlated with increase in cigarette consumption. This result shows that smoker women had more sedantary lifestyle, depending on their cigarette consumption.

We assessed the effect of smoking on pulmonary function and we did not find any difference in the parameters of the lung function test, but the incidence of respiratory symptoms was found more among smokers. The lung function results may have been similar because our participants were young adults and therefore did not show any notable yearly decrease in FEV_1. But we consider that these patients will probably have a risk of reducing in lung functions because of smoking and obesity. Xu et al., found that the relative risk of chronic obstructive pulmonary disease was 12.8 times higher in female smokers than non-smokers who had never smoked before. Moreover, the mortality risk associated with tobacco use was higher in women than in men (27).

Previous studies have shown that higher anxiety-depression scores and lower HRQOL were more common in smokers than in non-smokers (8,9,28,29). Our results also show that the anxiety scores were higher in smokers, but the difference was not significant. Kenney et al., demonstrated a dose-dependent relationship between smoking and depression. Individuals who consumed more than two packs of cigarettes in a week had more depressive symptoms than those who consumed less than a pack of cigarettes a week (28). However, unlike the previous findings reported, we found similar results between the groups with regard to the effects of smoking on HRQOL (30). The range of age of the participants and their lifestyle as well as the sample size may explain this difference.

CONCLUSION

Smoking causes increase in respiratory symptoms and reduces the level of physical activity among women. It results in abdominal obesity and more sitting time depending on its consumption. According to our results we suggest that especially in women studies about the importance of smoking cessation and harm of smoking should be increased in our country. Women should be encouraged to increase their physical activity habits in working and social life. Additionally, contrary to the common belief that smoking helped to remain weak should be break down among women.

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