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Original Article

Comparison of the Effects of the Somatotype on the Physical Activity, Kinesiophobia, and Fatigue Levels of Obstructive Sleep Apnea Syndrome Patients and Healthy Individuals

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Abstract

Background: We aimed to compare the physical activity, kinesiophobia, and fatigue levels of obstructive sleep apnea syndrome (OSAS) patients and healthy individuals in terms their somatotypes.

Methods: A total of 165 individuals were enrolled referred to the Department of Chest Diseases Sleep Disorders Center Outpatient Clinic of Inonu University, Malatya, Turkey in 2018. The somatotype analysis was conducted using the Heath-Carter method, the fatigue level was assessed using the Functional Assessment of Chronic Illness Therapy (FACIT) fatigue scale, the kinesiophobia level was assessed using the Tampa Scale for Kinesiophobia (TSK), and the physical activity level was assessed using the International Physical Activity Questionnaire (IPAQ).

Results: The results of the somatotype analysis revealed 3 different somatotypes in the healthy individuals and the OSAS patients' mesomorph endomorph, endomorphic mesomorph, and mesomorphic endomorph. When comparing the somatotypes of the healthy individuals and the OSAS patients, statistically significant differences were found in the FACIT scores of the mesomorph endomorphs, the IPAQ and FACIT scores of the endomorphic mesomorphs, and the TSK and FACIT scores of the mesomorphic endomorphs ($P<0.05$).

Conclusion: In all three somatotypes of the OSAS patients, the fatigue index scores were higher when compared to those of the healthy individuals. Moreover, when compared with the healthy individuals, the physical activity levels of the endomorphic mesomorphs with OSAS were low, while the kinesiophobia scores of the mesomorphic endomorphs with OSAS were high. Based on the results of this study, in OSAS patients, the endomorphic mesomorph somatotype could be a risk factor for reduced physical activity, while the mesomorphic endomorph somatotype could be a risk factor for increased kinesiophobia.

Keywords: Sleep apnea syndrome; Somatotype; Fatigue; Kinesiophobia; Physical activity

Introduction

Obstructive sleep apnea syndrome (OSAS), which develops as a result of changes in the breathing pattern while sleeping, can be assessed pathologically, and it can cause increases in the morbidity and mortality rates of these patients. OSAS affects at least 3–7% of the general population; however, it has been reported that 80–90% of these cases remain undiagnosed (1,2). OSAS patients present with complaints about snoring, fatigue daytime sleepiness, shortness of breath during sleep, headaches in the morning, distractibility, and anxiety (2). Previous study has reported comorbid obesity in two thirds of the middle-aged male OSAS patients and hypertension in one third (3).

Because OSAS patients experience problems falling asleep, their sleep quality is low. An insufficient or poor quality of sleep and hypoxemia during the night can cause an increase in fatigue and an inclination toward sleep during the day. Fatigue is an important problem that can influence an individual's social life and lead to physical and psychological problems that limit physical activity (4). While fatigue and limited physical activity are the major risk factors that can predispose an individual to obesity, which lowers the quality of life of OSAS patients, few studies have determined their association with OSAS (4, 5). OSAS has been reported in 70% of overweight individuals, and being overweight can cause joint pain and excessive effort during physical activity. These, in turn, can cause an increase in kinesiophobia, which is defined as avoiding physical activity or an unwillingness to move (6). It would be a great contribution to the literature if more studies focused on the associations between OSAS and kinesiophobia in order to break this vicious cycle.

The association between obesity and OSAS is well-documented; however, the number of studies assessing the associations between OSAS and the somatotype are limited (7). A somatotype analysis, which is a more detailed body composition assessment based on anthropometric measurements, can provide critical information about an individual's fatigue, physical activity, and kinesiophobia levels due to OSAS.

Exercise training has a statistically significant effect on apnea/hypopnea index that seems to be independent of changes in body mass index (BMI). OSAS severity was achieved without a significant reduction in body weight. This suggests a possible role of exercise in the treatment of OSAS (8). Physical activity was important for decreasing OSAS symptoms (9). In addition individuals with insufficient physical activity levels had a higher probability of increased OSAS symptoms (10).

For these reasons, the purpose of this study was to assess the effects of the somatotypes of individuals with OSAS on their physical activity, kinesiophobia, and fatigue levels and compare these with the data obtained from healthy individuals.

Materials and Methods

Research Groups

A total of 201 volunteers who meet inclusion criteria and between the ages of 30 and 65 year old were referred to the Department of Chest Diseases Sleep Disorders Center Outpatient Clinic of Inonu University, Malatya, Turkey. Sixteen of these volunteers were excluded because they did not meet the inclusion criteria. In addition, 20 volunteers were excluded from because they exhibited somatotypes that were different from the 3 somatotype groups found to be predominant in all of the subjects. Therefore, 99 healthy volunteers and 66 volunteers who were diagnosed with OSAS (apnea-hypopnea index (AHI, events/h) ≥ 15 in polysomnography) were included in this study. Ethical board's approval was obtained for this study (2018\124), and the clinical research was carried out between 10.09.2018-01.12.2018.

Study Inclusion and Exclusion Criteria

Those individuals without chronic chest diseases and disorders or cognitive problems, who were open to communication, and who could understand the instructions were included in this study. Those individuals with chronic diseases (other than OSAS), who were taking medication regularly, who had histories of cigarette and alcohol use, who had cognitive problems, and who were not open to communication were excluded from this study.

Data Collection Process

After the volunteers were provided with information about the study, they signed consent forms. Each patient's sociodemographic information was recorded on the patient information form.

Age, Height, Weight, and Body Mass Index Measurements

The patients' ages were calculated in years, and their heights were measured in cm while they stood barefooted using a steel stadiometer with a precision of 0.1 cm. Their weights were measured in kg while they stood barefooted without metal using a Tanita BC Segmental Body Analysis System (Tanita Corporation, Tokyo, Japan). BMIs were calculated using the following formula: weight (kg)/height (m^2) (11).

Physical Activity Level Determination

The International Physical Activity Questionnaire (IPAQ) was used to determine the physical activity levels of the study participants. The IPAQ short form was developed with the support of the WHO and American Centers for Disease Control and Prevention, and the validity and reliability of the Turkish version were determined according to Sağlam et al (12). This questionnaire provides information about the time individuals spend performing mild, moderate, and intense activities and their sedentary periods. While assessing these activities, the criterion for inclusion is performing each activity for at least 10 min at a time. For each activity level, the metabolic equivalent (MET) value was obtained by multiplying the minutes by the number of days to create a min/week score (12). The score was classified as either no physical activity (MET≤600) or an insufficient activity level (MET≥3,000) (13). When determining how much energy was spent for each physical activity, the weekly duration (min) of each activity and the MET values from the IPAQ were multiplied together. As a result, mild, moderate, and intense activity levels and the total energy spent at each activity level were calculated.

Kinesiophobia Level

The kinesiophobia level was assessed using the Tampa Scale for Kinesiophobia (TSK). The TSK is a checklist of 17 questions that is used in patients with acute and chronic backaches, fibromyalgia, and musculoskeletal system injuries. The TSK uses a 4-point Likert scale (1=totally disagree, 4=totally agree). The total score is calculated after items 4, 8, 12, and 16 are reversed, and each participant completing the questionnaire receives a score between 17 and 68. A high score shows that the study participant has a high degree of kinesiophobia (14). The total score was used for this study.

Fatigue Level

The participants' fatigue levels were assessed using the Functional Assessment of Chronic Illness Therapy (FACIT) fatigue scale, which is a 13-item short scale that measures the fatigue an individual has experienced during their daily activities over the previous week. The FACIT fatigue level is measured using a 4-point Likert scale (4=not tired at all, 0=very tired) (15). The FACIT fatigue scale is one of the many different fatigue scales that make up the health-related quality of life questionnaires for the management of chronic diseases.

Somatotype Determination

The subjects' somatotypes were determined based on the Heath-Carter method (16). The somatotype calculations were performed using the trial version of Somatotype for Windows (version 1.2.6; Sweat Technologies, San Diego, CA, USA).

Statistical Analysis

The data were analyzed by Kolmogorov Smirnov test for normal distribution and it was determined that the data did not conform to normal distribution. The difference between the IPAQ, TSK and FACIT parameters for different somatotypes in healthy and sleep apnea subjects, was analyzed by Kruskall Wallis Test. Mann-Whitney U analysis was performed to compare IPAQ, TSK and FACIT parameters in the same somatotypes of healthy and sleep apnea subjects. Mann-

Whitney U analysis was performed to compare IPAQ, TSK and FACIT parameters in the same somatotypes of healthy and sleep apnea subjects. $P<0.05$ value was considered significant. For statistical analysis, SPSS Statistics 22.0 (IBM Corp., Armonk, NY, USA) for Windows package program was used.

Results

A total of 165 individuals (99 healthy individuals and 66 patients with OSAS) participated in this study. Based on the somatotype analysis, 3 different somatotypes were found in the healthy individuals and the OSAS patients - mesomorph endomorph, endomorphic mesomorph, and mesomorphic endomorph. The somatocard of OSAS patients is shown in Fig. 1.

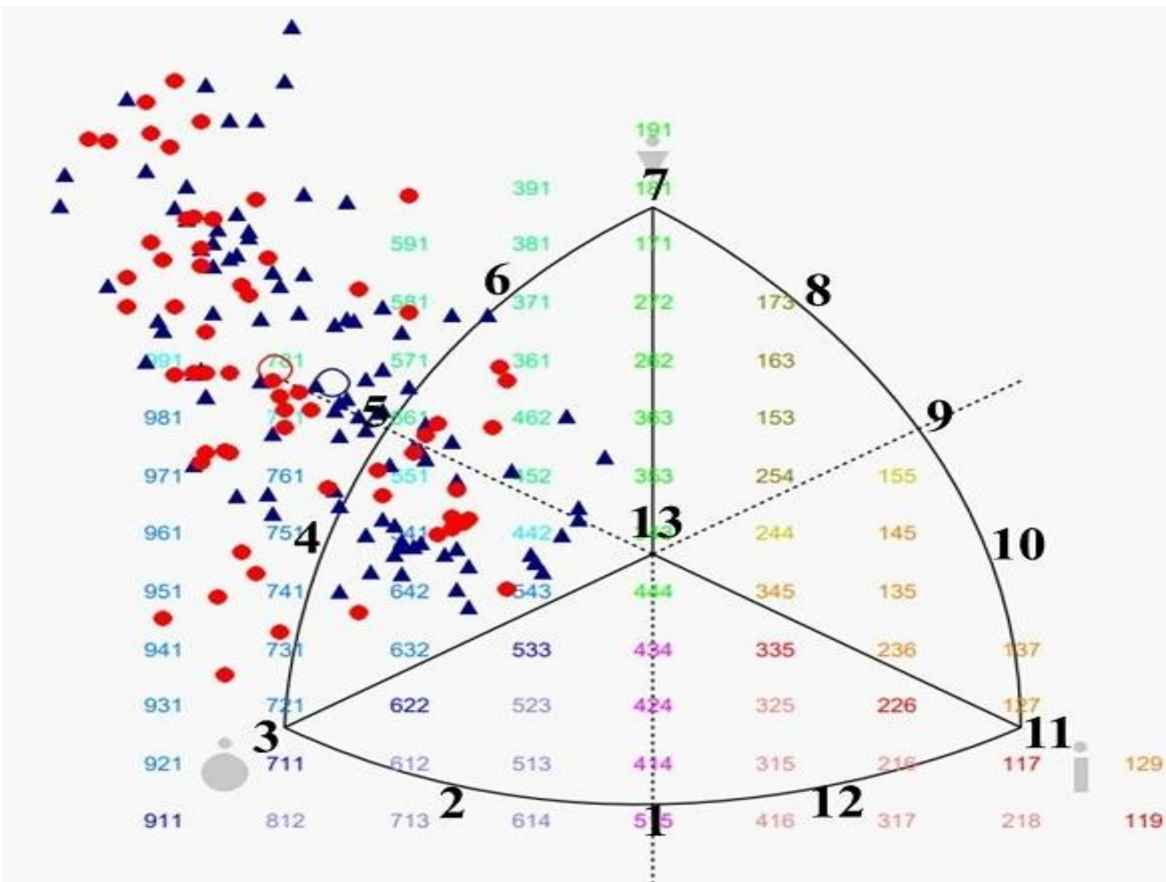

Fig. 1: Somatoplot representations of the somatotype characteristics. 1;endomorph ectomorph, 2;ectomorphic endomorph, 3;balanced endomorph, 4;mesomorphic endomorph, 5;mesomorph endomorph, 6;endomorphic mesomorph, 7;balanced mesomorph, 8;ectomophic mesomorph, 9;mesomorph ectomorph, 10;mesomorphic ectomorph, 11;balanced ectomorph, 12;endomorphic ectomorph, 13; central, O; mean somatotype, circle; somatotypes of patients with sleep apnea, triangle; somatotypes of healthy individuals

There were no statistically significant differences between the two groups with regard to the age, height, weight, and BMI ($P>0.05$).

The healthy group included 26 individuals with a median age of 52 yr old who were mesomorph endomorphs, 40 individuals with a median age of 43.5 yr old who were endomorphic mesomorphs, and 33 individuals with a median age of 45 yr old who were mesomorphic endomorphs (Table 1).

Table 1: The median (min-max) values of the parameters of the healthy individuals with mesomorph endomorph, endomorphic mesomorph, and mesomorphic endomorph somatotypes

Parameters	*Mesomorph endomorph*	*Endomorphic mesomorph*	*Mesomorphic endomorph*
	Median (min-max)	Median (min-max)	Median (min-max)
Age (yr)	52 (35-58)	43.5 (32-58)	45 (29-58)
Height	167.5 (156-185)	165.1 (150-178)	170 (156-191)
Weight	76 (55-95)	82.5 (55-100)	75 (58-86)
BMI	27.4 (16.7-34.8)	29.3 (22.1-37.7)	25.8 (18.9-30.0)
IPAQ	5.598 (1.346-15.000)	5.661 (1.546-15.624)	3.012 (1.132-16.800)
TSK	35 (20-50)	37 (19-52)	36 (21-49)
FACIT	18.5 (6-36)	17.5 (7-45)	16 (7-37)

BMI: Body mass index, IPAQ: International Physical Activity Questionnaire, TSK: Tampa Scale of Kinesiophobia, FACIT: Functional Assessment of Chronic Illness Therapy

A Kruskal-Wallis analysis was conducted in order to determine whether there were statistically significant differences between the IPAQ, TSK, and FACIT scores of the healthy individuals with mesomorph endomorph, endomorphic mesomorph, and mesomorphic endomorph somatotypes. The results showed that there were no differences between the somatotypes of the healthy individuals in terms of the IPAQ, TSK, and FACIT scores (P>0.05) (Table 2).

Table 2: International Physical Activity Questionnaire (IPAQ), Tampa Scale of Kinesiophobia (TSK), and Functional Assessment of Chronic Illness Therapy (FACIT) scores of the healthy individuals with mesomorph endomorph, endomorphic mesomorph, and mesomorphic endomorph somatotypes

Somatotype	*IPAQ*		*TSK*		*FACIT*	
	Chi-Square	P	Chi-Square	P	Chi-Square	P
Mesomorph endomorph Endomorphic mesomorph Mesomorphic endomorph	2.148	.221	2.251	.560	.200	.700

The OSAS group included 15 individuals with a median age of 51 yr old who were mesomorph endomorphs, 25 individuals with a median age of 45 yr old who were endomorphic mesomorphs, and 26 individuals with a median age of 44 who were mesomorphic endomorphs (Table 3).

Table 3: Median (min-max) values of the parameters of the sleep apnea patients with mesomorph endomorph, endomorphic mesomorph, and mesomorphic endomorph somatotypes

Parameter	*Mesomorph endomorph*	*Endomorphic mesomorph*	*Mesomorphic endomorph*
	Median (min-max)	Median (min-max)	Median (min-max)
Age (yr)	51 (31-63)	45 (30-74)	44 (16-65)
Height	167 (150-182)	170 (149-190)	172 (150-187)
Weight	80 (65-97)	82 (68-137)	75.5 (49-112)
BMI	29.1 (20.5-35.5)	28.3 (24.3-44.7)	29.8 (27.8-35.9)
IPAQ	2.772 (693-9.500)	2.994 (396-11.544)	2.772 (350-9.276)
TKS	34 (32-54)	41 (31-51)	49 (17-51)
FACIT	37 (11-45)	36 (9-46)	34.5 (8-46)

BMI: Body mass index, IPAQ: International Physical Activity Questionnaire, TSK: Tampa Scale of Kinesiophobia, FACIT: Functional Assessment of Chronic Illness Therapy

A Kruskal-Wallis analysis was conducted to determine whether there were statistically significant differences between the IPAQ, TSK, and FACIT scores of the OSAS patients with mesomorph endomorph, endomorphic mesomorph, and mesomorphic endomorph somatotypes. There were no differences between the somatotypes of the OSAS patients with regard to the IPAQ, TSK and FACIT parameters (*P*>0.05) (Table 4).

Table 4: International Physical Activity Questionnaire (IPAQ), Tampa Scale of Kinesiophobia (TSK), and Functional Assessment of Chronic Illness Therapy (FACIT) scores of the sleep apnea patients with mesomorph endomorph, endomorphic mesomorph, and mesomorphic endomorph somatotypes

Somatotype	***IPAQ***		***TSK***		***FACIT***	
	Chi-Square	*P*	Chi-Square	*P*	Chi-Square	*P*
Mesomorph endomorph Endomorphic mesomorph Mesomorphic endomorph	2.766	.251	2.254	.324	.164	.921

A Mann-Whitney U analysis was conducted in order to compare the IPAQ, TSK, and FACIT scores of the healthy individuals and the OSAS patients with regard to the mesomorph endomorph, endomorphic mesomorph, and mesomorphic endomorph somatotypes. Based on the results, there were statistically significant differences in the FACIT scores of the mesomorph endomorphs, the IPAQ and FACIT scores of the endomorphic mesomorphs, and the TSK and FACIT scores of the mesomorphic endomorphs (*P*<0.05) (Table 5).

Table 5: Results of the Mann-Whitney U analysis of the International Physical Activity Questionnaire (IPAQ), Tampa Scale of Kinesiophobia (TSK), and Functional Assessment of Chronic Illness Therapy (FACIT) scores of the mesomorph endomorph, endomorphic mesomorph and mesomorphic endomorph somatotypes of the healthy individuals and those with OSAS

Somatotype	***IPAQ***		***TSK***		***FACIT***	
	Z value	*P*	Z value	*P*	Z value	*P*
Mesomorph endomorph	-1.625	.104	-1.265	.206	-4.038	.000
Endomorphic mesomorph	-2.381	.017	-1.611	.107	-4.252	.000
Mesomorphic endomorph	-1.008	.313	-2.444	.015	-4.084	.000

*Boldface text indicates statistical significance at *P*<0.05

Discussion

We aimed to compare the differences between the effects of the somatotype on the physical activity, kinesiophobia, and fatigue levels of individuals with OSAS and those without them. In our study, the mesomorph endomorph, endomorphic mesomorph, and mesomorphic endomorph somatotypes were evaluated with regard to all of the parameters, and statistically significant differences were found in the FACIT scores of the mesomorph endomorphs, the IPAQ and FACIT scores of the endomorphic mesomorphs, and the TSK and FACIT scores of the mesomorphic endomorphs (*P*<0.05).

Daytime drowsiness and fatigue are the most common complaints of OSAS patients, and they can increase the sedentary lifestyle level by preventing individuals from participating in regular physical activity (17). FACIT scale is commonly used to assess the fatigue levels of OSAS patients (18). In our study, statistically significant differences were found in the FACIT scores of all 3 somatotypes when the OSAS patients and healthy individuals were compared. Fatigue can cause a decrease in the desire to participate in physical activity, and thus, increase the obesity rate in OSAS patients.

Physical activity was important for decreasing OSAS symptoms (9). Igelström et al assessed the physical activity capacity of OSAS patients using their IPAQ scores, and they reported that those individuals with insufficient physical activity levels had a higher probability of increased OSAS symptoms (17). In our study, no differences were found between the somatotypes in terms of the physical activity level. However, when the OSAS patients were compared with the healthy individuals, the individuals with the endomorphic mesomorph somatotypes had statistically lower physical activity levels. Individuals with the mesomorphic dominant somatotype were more severely affected by OSAS (17). The decreased physical activity levels of the endomorphic mesomorphs were associated with their OSAS symptom severities.

A weight increase or obesity can cause patients with mild OSAS to exhibit moderate to severe OSAS (18). Although there have been many studies examining the associations between OSAS and obesity (19, 20), a limited number of studies have examined the associations between OSAS and the patient's somatotype. Mecanti et al assessed individual somatotypes in order to evaluate the body compositions of patients with OSAS, and they reported that, in the mesomorphic dominant individuals, there were increases in the severe OSAS symptoms and OSAS dependent morbidity rate (17). In our study, no statistically significant differences were found in the kinesiophobia, physical activity, or fatigue levels with regard to the somatotypes of the OSAS patients. However, statistically significant differences were found in the fatigue levels of all of the somatotype groups, the IPAQ and FACIT scores of the endomorphic mesomorphs, and the TSK and FACIT scores of the mesomorphic endomorphs (P<0.05).

In a study (17), which assessed the kinesiophobia levels of OSAS patients using the TSK score, the average was 12.4 (3.1). A kinesiophobia increase would decrease the physical activity level, and this increase in sedentary behavior would increase the risks of obesity and OSAS symptoms (17). In our study, when the OSAS healthy mesomorphic endomorphs were compared, a statistically significant difference was found in the kinesiophobia score.

Conclusion

Greater fatigue, increased kinesiophobia, and decreased physical activity levels were found in the OSAS patients and the somatotypes when they were compared; however, no differences were found in the parameters that were evaluated. Additional studies with more varied somatotypes and larger sample groups will help to better determine the course of OSAS and its complications in the patients affected by this disease.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interest.

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