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The Effects of Summer on Body Composition, Perceived Stress Level and Body Awareness of Young Women and Men: A University Example

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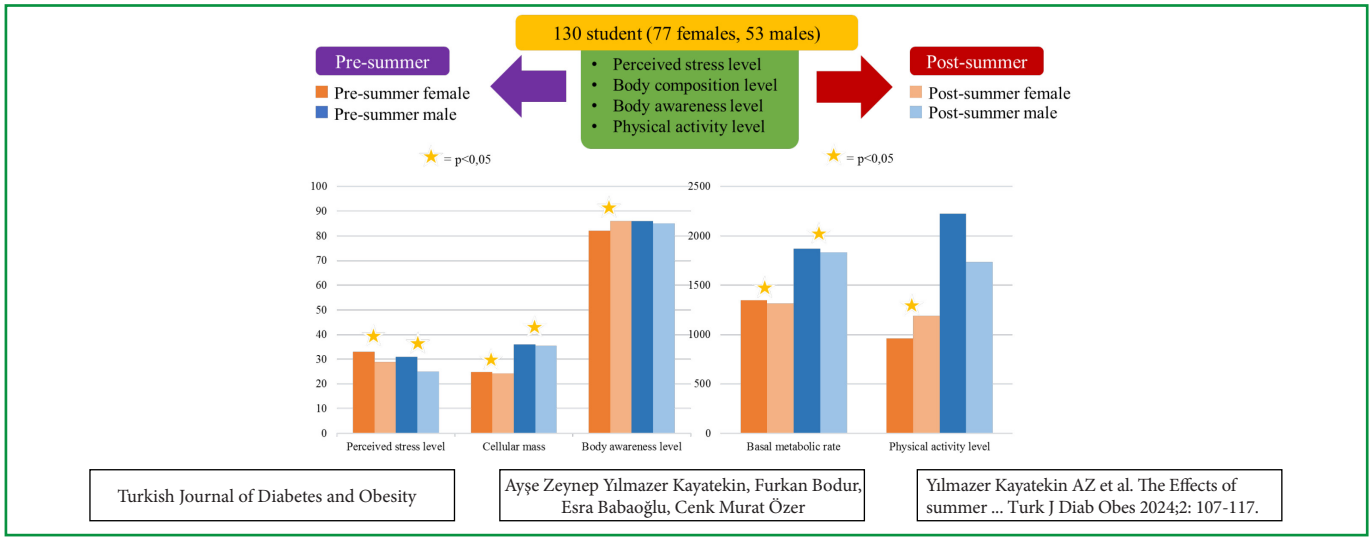
GRAPHICAL ABSTRACT



ABSTRACT

Aim: To investigate the effect of summer on body composition, perceived stress and body awareness in young male and female university students.

Material and Methods: A total of 130 students (77 females, 53 males) aged between 18 and 26 years without any health complaints participated in the study. Body composition, stress level, body awareness and physical activity level of the participants were evaluated before the summer season in May-June and after the summer season in September-October. Bioelectrical impedance analysis, perceived stress scale, body awareness questionnaire and international physical activity scale were used for these assessments, respectively. To analyse the data in the study, the Wilcoxon test, the Mann-Whitney U test and the Spearman correlation test were used.

Results: Statistical analysis revealed a statistically significant decrease in perceived stress (<0.001; <0.001), basal metabolic rate (<0.001; 0.005) and cellular mass analyses (<0.001; 0.004) in women and men, respectively, when the values before and after the summer season were compared. Body awareness level (0.031) and physical activity level (0.034) were also statistically significantly increased in women.

Conclusion: The results showed that body composition parameters, perceived stress, body awareness and physical activity levels may change after the summer season, especially in women.

Keywords: *Body awareness, Body composition, Perceived stress, Physical activity level, Seasonal change*

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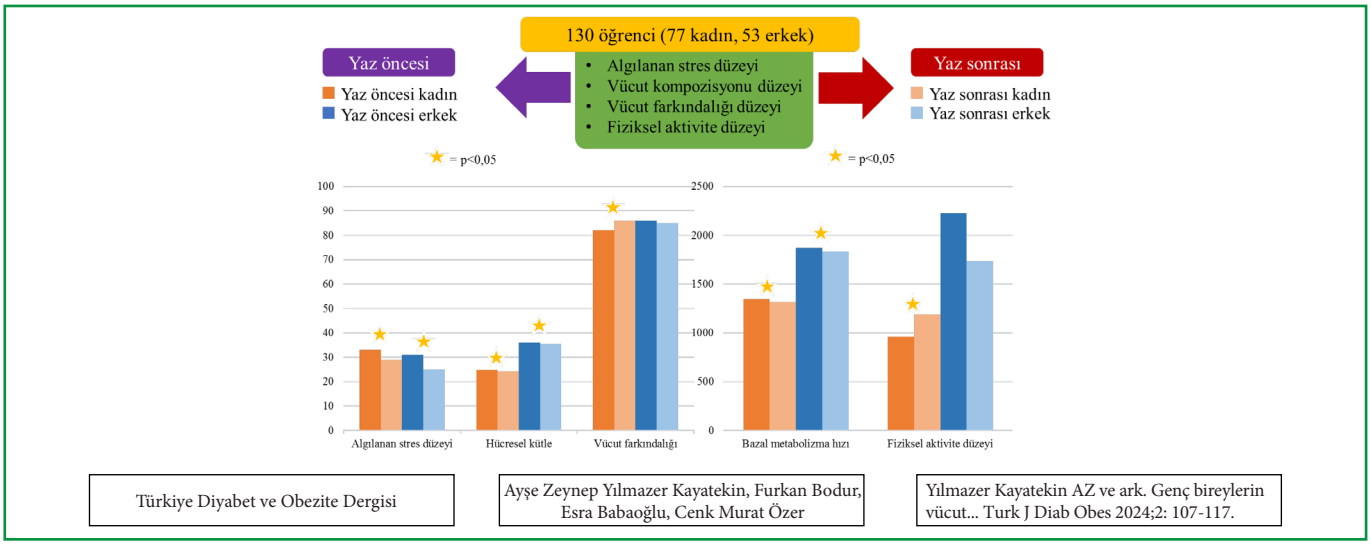
Genç Bireylerin Vücut Kompozisyonu, Algılanan Stres Düzeyi ve Vücut Farkındalığında Yaz Mevsiminin Etkisi: Bir Üniversite Örneği

GRAFİKSEL ÖZET



ÖZ

Amaç: Genç kadın ve erkek üniversite öğrencilerinde yaz mevsiminin vücut kompozisyonu, algılanan stres ve vücut farkındalığı üzerindeki etkisinin araştırılması amaçlandı.

Gereç ve Yöntemler: Çalışmaya herhangi bir sistemik hastalığı veya sağlık şikâyeti olmayan 77 kadın 53 erkek olmak üzere toplam 130 genç öğrenci (18-26 yaş) katıldı. Katılımcıların yaz mevsimi öncesi Mayıs-Haziran aylarında ve yaz mevsimi sonrası Eylül-Ekim aylarında vücut kompozisyonu, stres düzeyi, vücut farkındalığı ve fiziksel aktivite düzeyi değerlendirildi. Bu değerlendirmeler için sırasıyla biyoelektriksel impedans analizi, algılanan stres ölçeği, vücut farkındalık anketi ve uluslararası fiziksel aktivite ölçeği kullanıldı. Çalışmadaki verilerin analizi için Wilcoxon testi, Mann-Whitney U testi ve Spearman korelasyon testi kullanıldı.

Bulgular: İstatistiksel analiz sonucunda yaz mevsimi öncesi ve sonrası değerler karşılaştırıldığında, kadın ve erkeklerde sırasıyla, algılanan stres (<0,001; <0,001), bazal metabolizma hızı (<0,001; 0,005) ve hücresel kütlesel analizlerde (<0,001; 0,004) istatistiksel olarak anlamlı bir azalma saptandı. Kadınlarda vücut farkındalık düzeyi (0,031) ve fiziksel aktivite düzeyinin de (0,034) istatistiksel olarak anlamlı derecede arttığı görüldü.

Sonuç: Sonuç olarak yaz mevsimi sonrası kişilerin vücut kompozisyonu parametrelerinin, algılanan stres, vücut farkındalığı ve fiziksel aktivite düzeyinin özellikle kadınlarda daha fazla değişebileceği bulundu.

Anahtar Sözcükler: *Algılanan stres, Fiziksel aktivite düzeyi, Mevsim değişimi, Vücut kompozisyonu, Vücut farkındalığı*

INTRODUCTION

Body composition, which is an important aspect of health related to nutritional status, refers to the combination of muscle, bone, fat cells, other organic substances and extracellular fluids that come together at a specific rate and collectively form the mass of an organism (1). Body composition classifies the body into meaningful units such as muscle, bone and adipose tissue ratio. This way, it basically provides significant benefits in the clinical follow-up of obesity, osteoporosis and metabolic diseases (2,3). Body composition is usually measured in humans in response to the need to identify the deficiency or excess of a component that is thought or known to be associated with a disease (4).

It has been widely shown that chronic exposure to stressors or stress hormones can lead to a number of metabolic imbalances. For example, exposure to social stressors may cause changes in body weight, body composition and weight distribution (5). Although there is no consensus on how stress affects body weight and body composition, it is a known fact that stress is a risk factor for many diseases including obesity and diabetes, which is a chronic disease (5). In addition, excessive secretion of cortisol, which is one of the

most important hormones activated by stress, can change the metabolic functioning of the body and lead to problems such as local weight gain, fatigue, tension and deterioration in skin-fat balance (6,7).

Body awareness is defined as the ability to define and experience the internal sensations, general physiological, emotional and psychological state of the body. Body awareness also includes paying attention to bodily information in daily life, noticing bodily changes/emotions and reactions to the environment (8). The main purpose of evaluating body awareness is to define body awareness with emotional components, to find out disorders in body functions, to evaluate the effectiveness of the treatment applied and to measure the change between different evaluation parameters. Traditionally, body awareness has been used to define anxiety and panic disorders and it has been stated that the dysfunctions in body awareness may be associated with many adverse health conditions such as anorexia, chronic pain and addiction (9,10).

With seasonal changes, many conditions such as social life, eating habits, appetite, sleep duration and energy level of individuals change. These changes are known to affect physical activity level, mental state and body composition in individuals (11). The holiday, which comes at the end of the busy academic calendar, coincides with the summer season in Türkiye with longer days and higher temperatures. The fact that students have more free time in the summer, away from the academic environment, increases their social interaction, participation in physical activities, and provides the opportunity to learn new skills or develop themselves in areas of interest. Thus, lifestyle changes associated with the summer season may also bring about psychophysiological changes, providing relaxation and stress reduction in young people and supporting their mental, physical and emotional health (11). Therefore, in order to develop more effective prevention strategies in the development of obesity and psychosocial disorders, it is necessary to better understand how seasonal changes, physical and psychosocial conditions affect body composition. Although body composition, perceived stress and body awareness are associated with many adverse health conditions such as obesity, metabolic dysregulation and mental health problems, it has been determined that there are limited number of studies evaluating these parameters together in the literature. Therefore, this study investigated how summer-related lifestyle changes affect body composition, perceived stress and body awareness in university students in a specific center. The study also investigated the impact of psychophysiological changes in perceived stress and body awareness on changes in body composition. Men and women often have different body structures and experience stress in different ways. Furthermore, gender differences were also taken into account, as hormonal differences between men and women can affect body composition, metabolism and stress responses.

MATERIAL and METHOD

This research was carried out at the Laboratory of the Department of Anatomy, Zonguldak Bülent Ecevit University Faculty of Medicine from May 1st to October 31st, 2022. A total of 130 volunteer students (77 female, 53 male), aged between 18-26 years, studying at Zonguldak Bülent Ecevit University Faculty of Medicine participated in the study. Prior to the study, the research was fully reviewed and approved (date 2022 and number 2022/11) by the Institutional Review Board (IRB) of Zonguldak Bülent Ecevit University Non-Interventional Clinical Research Ethics Committee. The students, who were selected on a voluntary basis, were informed about the purpose and procedures of the study and signed an informed consent form before participating in the study. The inclusion criteria were not having a diagnosed systemic or psychiatric disease, being in good health, having spent the summer vacation in Türkiye and not having worked during the summer months.

The G Power Version 3.1.9.2 software was utilised to determine the minimum number of participants needed prior to conducting the study. During the calculation of the required sample size, effect size of 0.50, test power of 80%, and 95% confidence level were taken into account. The power analysis revealed a sample size of at least 35 students was essential, separately for female and male students.

Data Collection

A Socio-demographic Information Form prepared by the researchers, Perceived Stress Scale (PSS), Body Awareness Questionnaire (BAQ) and International Physical Activity Questionnaire-Short Form (IPAQ-SF) were administered to the participants. The necessary usage permissions for the scales used in the study were obtained from the researchers who developed the Turkish version of the scale. After these forms were filled in, Tanita BC 418 (Tokyo, Japan, 2015), which was working with bioelectrical impedance analysis (BIA) method, was used to evaluate body composition. These evaluations were made twice, before summer in May-June as the first measurement and after summer in September-October as the second measurement. Participants whose second measurements of body awareness and stress values were higher than the first measurement were considered to have “increased stress” and “increased body awareness”. Participants who participated in the first measurement but could not participate in the second one were excluded from the study and the study was completed with individuals who completed both measurements.

In the sociodemographic information form, the participants' age, gender, smoking and alcohol use, where they spent their summer holidays, and whether they worked in any job during the summer were questioned and recorded.

The PSS, a stress measurement tool, was originally developed by Cohen et al. in 1983 (12) and was subsequently adapted into Turkish by Eskin et al. in 2013, where its validity and reliability were analysed (13). The tool comprises 8 items and is presented in a five-point Likert scale (ranging from 0 - never to 4 - very often). The total scale score ranges from 0 to 32, with higher scores indicating higher perceived stress levels (13).

The BAQ, which aims to determine the normal or abnormal sensitivity level of body composition, was developed by Stephanie A. Shields et al. in 1989 (14). In 2017, Karaca adapted the BAQ into Turkish and conducted a validity and reliability study (15). BAQ is an 18-item Likert type questionnaire consisting of four sub-groups as prediction of body reactions, sleep-awake cycle, changes in the body process and prediction of disease onset. Participants are asked to score each item between 1 and 7. Total score is calculated next and higher score means higher body awareness level (15).

Physical activity level of participants was evaluated with IPAQ-SF. The validity and reliability study of the questionnaire was conducted by Sağlam et al. in 2010 (16). The questionnaire has 7 questions and provides information about the time spent by the individual in the last 7 days for activities such as sitting, walking and moderate and intense activities. Of these activities, the ones that last for 10 minutes and longer are taken into account and metabolic equivalent (MET) method is used to determine the physical activity levels of participants. A 1-week time period is usually sufficient to reflect the diversity and regularity of physical activities in daily routines. International standardisation, coverage of different types of physical activity and living spaces, easy applicability, and frequent use in the fields of public health and epidemiology are the reasons for the preference of IPAQ-SF (16,17).

Body composition of the participants was evaluated with Tanita BC 418 (Tokyo, Japan, 2015) device working with BIA method. Before the measurement, participants were told that they should not have consumed alcohol in the last week, that they should come to the measurement at least 2 hours after eating and that female participants should have their measurements performed outside the menstrual phase of the menstrual cycle. During the measurement, participants got on the device with minimum number of light clothes and without metal objects. The students who got on the weighing device were asked to hold the probes of the device and look across in an upright position.

After the measurement was completed, the device reported the participants' cellular analysis weight, body mass index (BMI), basal metabolic rate (BMR); body fat ratio (BFR), lean mass ratio (LMR), arm, leg and torso fat ratio (AFR; LFR; TFR), fluid ratio (FR), muscle ratio (MR), bone ratio (BR), mineral ratio (MiR), protein ratio (PR), internal adiposity (IA), obesity rate (OR) and soft muscular tissue rate (SMTR), skeletal muscle ratio (SMR), extracellular fluid ratio (ECFR) and cell mass (CM). It should be noted that Tanita estimates BMR from fat-free mass values rather than measuring it directly (18).

Statistical Analysis

Statistical analysis of the study was performed by using IBM SPSS 20.0 (Statistical Package for Social Science) program. Conformity of continuous variables to normal distribution was evaluated with Shapiro Wilk test. While the descriptive data of the continuous variables in the study were expressed as mean, standard deviation, median, minimum and maximum values, categorical variables were expressed as frequency and percentage. Wilcoxon test was used for the relationship between before and after in dependent variables, while Mann Whitney U test was used for the comparison of continuous variables between groups. Since the data were not normally distributed, correlation analysis was performed using Spearman correlation test. In addition, Cronbach's alpha coefficients were calculated for PSS and BAQ used in the study. As a result of the statistical analysis conducted, the values below 0.05 were considered to be statistically significant.

RESULTS

Our study was conducted between May 1, 2022 and October 31, 2022 with 130 individuals, 77 female and 53 male, who were attending Zonguldak Bülent Ecevit University. The mean age of the participants was 19.58±1.32 years, the rates of smoking and alcohol use were 13.1% (17 individuals) and 26.9% (35 individuals), respectively, and it was determined that all students spent the summer in Türkiye and did not work in any job. Table 1 shows the results of body composition, perceived stress and body awareness of the participants before and after the summer. According to the Mann Whitney U test results, the change in some parameters related to body composition and the change in perceived stress after summer compared to before summer were statistically significant ($p<0.05$). The change in body awareness after summer compared to before summer was statistically significant only in women ($p<0.05$).

Changes in body composition parameters according to the increase or decrease of stress levels in female and male participants are shown in Table 2. No statistically significant difference was found in male participants between groups with increased stress level and decreased stress level in terms of body composition parameters (p>0.05). In females, statistically significant difference was found between increased stress level and decreased stress level in terms of changes in weight, body mass index and obesity level (p<0.05).

Table 3 shows the changes in body composition parameters in female and male participants in terms of increased and decreased body awareness. In male individuals, statistically significant difference was found in terms of all body composition parameters except for metabolism age change between groups with increased body awareness and groups with decreased body awareness (p<0.05). In female individuals, statistically significant difference was found between group with increased body awareness and group with decreased body awareness only in terms of weight, body mass index, metabolic age and change in obesity level (p<0.05).

Table 4 shows the correlation between the changes in perceived stress and body awareness and the changes in other parameters in female and male participants.

Cronbach's alpha coefficients were calculated to determine the reliability of the scales used in this study. PSS showed a Cronbach's alpha of 0.85 before the summer season and 0.88 after the summer season. BAQ showed a Cronbach's alpha of 0.86 before the summer season and 0.89 after the summer season. These values indicate good internal consistency for both scales at both measurement points.

Table 1: Comparison of pre-summer and post-summer perceived stress, body awareness, physical activity level and body composition values of the participants.

Parameters	Female (n=77)			Male (n=53)		
	Pre-summer	Post-summer	p	Pre-summer	Post-summer	p
Perceived stress	33.00 (22-42)	29.00 (15-45)	**<0.001**	31.00 (8-51)	25.00 (3-47)	**<0.001**
Body awareness	82.00 (52-120)	86.00 (42-117)	**0.031**	86.00 (30-126)	85.00 (53-120)	0.548
Metabolic equivalent	963 (90-4830)	1188 (330-3906)	**0.034**	2223 (198-4866)	1737 (231-5266)	0.694
Weight	56.5 (41.2-94.7)	55.8 (40.2-91.3)	**<0.001**	72.5 (47.4-112.5)	72.9 (49.3-109.4)	0.092
Body mass index	20.90 (15.7-32.3)	20.90 (15.3-32)	**<0.001**	23.20 (17.6-35.9)	22.80 (17.9-33.3)	0.115
Body fat ratio	25.60 (15.6-41.8)	25.60 (14.6-42.8)	0.814	16.70 (1.8-30.0)	16.30 (6.6-30.3)	0.457
Metabolic age	19.00 (15-30)	19.00 (14-30)	0.821	19.00 (14-31)	19.00 (14-30)	0.560
Basal metabolic rate	1348 (1110-1821)	1317 (1096-1720)	**<0.001**	1870 (1339-2514)	1834 (1382-2422)	**0.005**
Obesity level	-2.64 (-27.0-50.4)	-3.78 (-28.8-48.8)	**<0.001**	11.75 (-15.1-73.1)	9.68 (-13.8-60.3)	0.097
Fluid rate	54.49 (42.6-61.9)	54.49 (41.8-62.4)	0.766	60.98 (51.2-71.9)	61.25 (51.1-68.6)	0.389
Lean mass ratio	74.38 (58.2-84.5)	74.38 (57.2-85.3)	0.805	83.27 (70.0-98.3)	83.75 (69.8-93.5)	0.439
Mineral ratio	4.84 (3.03-6.17)	4.94 (2.97-6.23)	0.814	5.65 (3.64-7.17)	5.65 (3.63-6.83)	0.356
Protein ratio	15.06 (11.9-17.8)	14.95 (11.5-18.0)	0.933	16.98 (13.9-19.8)	17.17 (14.0-19.7)	0.636
Internal adiposity	1.00 (1-6)	1.00 (1-6)	0.166	2.00 (1-11)	2.00 (1-10)	0.452
Muscle ratio	70.74 (55.1-80.1)	70.56 (54.3-81.1)	0.873	79.54 (66.9-92.4)	80.18 (66.6-89.2)	0.418
Bone ratio	3.70 (3.09-6.18)	3.70 (2.91-4.26)	0.921	3.72 (3.11-5.90)	3.70 (2.88-4.25)	**0.040**
Soft muscular tissue ratio	40.20 (32.3-53.5)	39.44 (31.8-50.1)	**<0.001**	58.49 (41.3-75.8)	57.29 (42.7-73.1)	**0.005**
Skeletal muscle ratio	24.51 (19.7-32.7)	23.83 (19.2-30.6)	**<0.001**	35.49 (25.2-46.3)	34.86 (26.1-44.6)	**0.004**
Extracellular fat ratio	13.41 (10.8-17.8)	13.09 (10.5-16.7)	**<0.001**	19.42 (13.8-25.4)	19.08 (14.3-24.4)	**0.003**
Intracellular fat ratio	18.29 (14.7-24.4)	17.78 (14.4-22.8)	**<0.001**	26.48 (18.8-34.6)	26.02 (19.5-33.3)	**0.004**
Cellular mass	27.73 (22.2-36.9)	27.04 (21.8-34.4)	**<0.001**	40.48 (28.7-52.7)	39.76 (29.7-50.7)	**0.008**
Leg fat ratio	30.00 (20.6-41.5)	29.50 (22.3-43.3)	0.052	14.40 (2.7-32.2)	14.95 (5.1-32.3)	**0.033**
Arm fat ratio	28.50 (17.9-46.7)	27.20 (15.5-45.7)	**0.023**	19.45 (7.3-32.8)	18.10 (7.9-32.8)	0.353
Torso fat ratio	23.00 (8.8-41.1)	23.20 (7.3-42.0)	0.503	17.90 (3.0-31.1)	16.60 (6.5-32.2)	0.818

(min.; minimum, max.; maximum, p;0.05, * Wilcoxon test)

Table 2: Analysis of changes in body composition according to changes in stress levels in male and female participants.

Body composition change	Female (n=77)			Male (n=53)		
	Increased SL (n=23) Median (Min-Max)	Decreased SL (n=54) Median (Min-Max)	p	Increased SL (n=14) Median (Min-Max)	Decreased SL (n=39) Median (Min-Max)	p
Weight	-0.4 (-5.5-4.4)	-1.3 (-6.2-3.5)	**0.013**	-0.5 (-8.3-4.3)	-0.5 (-10.8-10.2)	0.455
Body mass index	-0.1 (-2.0-1.6)	-0.5 (-2.2-1.3)	**0.020**	<0.001 (-2.6-1.4)	-0.2 (-3.4-3.1)	0.492
Body fat ratio	0.6 (-5.8-4.1)	-0.05 (-5.3-7.4)	0.195	0.1 (-1.3-3.8)	0.3 (-9.2-5.3)	0.607
Metabolic age	<0.001 (-5.0-3.0)	<0.001 (-5.0-5.0)	0.070	<0.001 (-1.0-3.0)	<0.001 (-6.0-3.0)	0.575
Basal metabolic rate	-8.0 (-56-56)	-24.0 (-119-36)	0.058	-6.0 (-192-102)	-24.0 (-124-169)	0.519
Obesity level	-0.67 (-9.29-7.34)	-2.21 (-9.95-6.4)	**0.014**	-0.70 (-12.77-6.85)	-0.82 (-16.3-15.0)	0.474
Fluid ratio	-0.33 (-3.01-4.37)	0.15 (-5.25-7.18)	0.204	-0.17 (-2.83-0.96)	-0.14 (-3.88-6.63)	0.506
Lean mass ratio	-0.51 (-4.04-5.93)	0.15 (-7.35-5.28)	0.201	-0.18 (-3.72-1.37)	-0.31 (-5.43-9.09)	0.579
Mineral ratio	-0.03 (-0.29-0.44)	0.01 (-0.39-0.39)	0.152	-0.10 (-0.19-0.07)	-0.20 (-0.39-0.47)	0.545
Protein ratio	-0.13 (-0.74-1.48)	<0.001 (-1.7-1.0)	0.178	-0.01 (-0.69-0.34)	-0.07 (-1.2-1.99)	0.716
Internal adiposing	<0.001 (-1.0-1.0)	<0.001 (-1.0-1.0)	0.370	<0.001 (-1.0-1.0)	<0.001 (-4.0-2.0)	0.679
Muscle ratio	-0.57 (-4.17-5.60)	0.13 (-7.13-5.03)	0.158	0.06 (-3.55-1.46)	-0.35 (-4.12-8.70)	0.628
Bone ratio	-0.01 (-2.06-0.41)	-0.01 (-2.26-0.43)	0.443	-0.08 (-0.24-0.23)	-0.05 (-1.90-0.38)	0.920
Soft muscle tissue ratio	-0.28 (-1.99-1.66)	-0.75 (-3.98-1.42)	0.159	-0.14 (-5.47-3.50)	-0.83 (-3.71-4.63)	0.593
Skeletal muscle ratio	-0.17 (-1.18-1.02)	-0.45 (-2.38-0.85)	0.162	-0.08 (-3.34-2.10)	-0.51 (-2.26-2.82)	0.579
Extracellular fat ratio	-0.12 (-0.66-0.54)	-0.24 (-1.33-0.51)	0.238	-0.05 (-1.91-1.14)	-0.28 (-1.21-1.49)	0.650
Intracellular fat ratio	-0.13 (-0.89-0.76)	-0.34 (-1.78-0.64)	0.164	-0.06 (-2.49-1.56)	-0.38 (-1.69-2.11)	0.565
Cellular mass	-0.19 (-1.49-1.26)	-0.50 (-2.68-0.84)	0.180	-0.01 (-3.69-2.36)	-0.55 (-2.49-3.41)	0.607

(min.; minimum, max.; maximum, p;0.05, * Mann-Whitney U test)

Table 3: Analysis of changes in body composition according to changes in body awareness in male and female participants.

Body composition change	Female (n=77)			Male (n=53)		
	Increased BA (n=31) Median (Min-Max)	Decreased BA (n=46) Median (Min-Max)	p	Increased BA (n=30) Median (Min-Max)	Decreased BA (n=23) Median (Min-Max)	p
Weight	-1.40 (-6.20-3.50)	-0.50 (-5.50-4.40)	**0.009**	-1.55 (-10.80-2.30)	1.30 (-8.30-10.20)	**<0.001**
Body mass index	-0.50 (-2.20-1.30)	-0.20 (-2.00-1.60)	**0.011**	-0.55 (-3.40-0.70)	0.40 (-2.60-3.10)	**<0.001**
Body fat ratio	-0.25 (-5.70-5.60)	0.60 (-5.80-7.40)	0.201	0.15 (-9.20-4.40)	1.10 (-1.30-5.30)	**0.023**
Metabolic age	<0.001 (-5.0-5.0)	<0.001 (-5.0-3.0)	**0.022**	<0.001 (-6.0-3.0)	<0.001 (-3.0-3.0)	0.855
Basal metabolic rate	-27.00 (-119-33)	-8.00 (-80-56)	0.061	-53.00 (-124-53)	-5.00 (-192-169)	**0.001**
Obesity level	-2.36 (-9.95-6.35)	-0.98 (-9.3-7.3)	**0.010**	-2.50 (-16.25-3.41)	2.02 (-12.8-15.0)	**<0.001**
Fluid ratio	0.23 (-4.14-7.18)	-0.98 (-9.29-7.34)	0.218	-0.14 (-3.22-6.63)	2.02 (-12.8-15.0)	**0.022**
Lean mass ratio	0.28 (-5.60-5.72)	-0.51 (-7.35-5.93)	0.213	-0.15 (-4.36-9.09)	-1.10 (-5.43-1.37)	**0.020**
Mineral ratio	0.02 (-0.29-0.39)	-0.03 (-0.39-0.44)	0.172	-0.005 (-0.23-0.47)	-0.06 (-0.39-0.07)	**0.018**
Protein ratio	0.03 (-1.17-1.48)	-0.12 (-1.73-1.13)	0.140	0.07 (-0.93-1.99)	-0.22 (-1.16-0.34)	**0.015**
Internal adiposing	<0.001 (-1.0-1.0)	<0.001 (-1.0-1.0)	0.082	<0.001 (-4.0-1.0)	<0.001 (-1.0-2.0)	**0.050**
Muscle ratio	0.24 (-5.34-5.20)	-0.44 (-7.13-5.60)	0.294	0.24 (-4.12-8.70)	-1.06 (-3.99-1.89)	**0.024**
Bone ratio	-0.05 (-2.06-0.40)	0.07 (-2.26-0.43)	0.129	0.01 (-0.56-0.38)	-0.09 (-1.90-0.20)	**0.027**
Soft muscle tissue ratio	-0.83 (-3.98-1.33)	-0.37 (-3.60-1.66)	0.136	-1.54 (-3.71-1.85)	-0.09 (-5.47-4.63)	**0.003**
Skeletal muscle ratio	-0.50 (-2.38-0.80)	-0.22 (-2.15-1.02)	0.149	-0.94 (-2.26-1.13)	-0.06 (-3.34-2.82)	**0.003**
Extracellular fat ratio	-0.24 (-1.33-0.49)	-0.24 (-1.33-0.49)	0.192	-0.55 (-1.21-0.55)	-0.55 (-1.21-0.55)	**0.003**
Intracellular fat ratio	-0.38 (-1.78-0.59)	-0.17 (-1.60-0.76)	0.152	0.68 (-1.69-0.85)	-0.05 (-2.49-2.11)	**0.003**
Cellular mass	-0.59 (-2.68-0.79)	-0.25 (-2.60-1.26)	0.294	-1.04 (-2.49-1.25)	0.05 (-3.69-3.41)	**0.001**

(min.; minimum, max.; maximum, p;0.05, * Mann-Whitney U test)

Table 4: Analysis of the correlation between the changes in perceived stress and body awareness and the changes in other parameters in female and male participants.

		Female			Males		
		BA	**MET**	**PS**	**BA**	**MET**	**PS**
Weight	rho	-0.307	-0.316	0.298	-0.576	-0.219	0.119
	p*	**0.007**	**0.005**	**0.004**	**<0.001**	0.115	0.398
Body mass index	rho	-0.304	-0.320	0.286	-0.593	-0.202	0.113
	p*	**0.007**	**0.005**	**0.009**	**<0.001**	0.147	0.421
Obesity level	rho	-0.303	-0.319	0.295	-0.584	-0.209	0.115
	p*	**0.007**	**0.005**	**0.009**	**<0.001**	0.134	0.414
Basal metabolic rate	rho	-0.254	-0.013	0.228	-0.431	0.064	0.118
	p*	**0.026**	0.908	**0.046**	**0.001**	0.648	0.401
Fat ratio	rho	-0.118	-0.337	0.133	-0.400	-0.328	-0.005
	p*	0.308	**0.003**	0.248	**0.003**	**0.017**	0.974
Fluid ratio	rho	0.107	0.333	-0.127	0.401	0.336	-0.008
	p*	0.354	**0.003**	0.272	**0.003**	**0.014**	0.956
Lean mass ratio	rho	0.108	0.338	-0.127	0.400	0.341	-<0.001
	p*	0.351	**0.003**	0.272	**0.003**	**0.012**	0.89
Body awareness	rho	-	0.220	-0.323	-	0.002	-0.279
	p*	-	**0.050**	**0.004**	-	0.988	**0.043**
Perceived stress	rho	-0.323	-0.266	-	-0.279	0.093	-
	p*	**0.004**	**0.020**	-	**0.043**	0.506	-

(rho: correlation coefficient, p; 0.05, *Spearman correlation test)

DISCUSSION

In our study, we investigated the effects of seasonal changes on body awareness, body composition and perceived stress. Body awareness, which one of the important parameters for being healthy and maintaining this state of health, has been one of the outstanding issues in scientific studies conducted in the field of health in recent years. Studies conducted have reported that body awareness interacts with cognition, joint position sense, depression and health-related quality of life, and evaluating and developing body awareness may be useful in problems such as appetite problems, emotional problems, depression and sleep disorders (9,10,19). In line with this information, our study evaluated pre-summer and post-summer perceived stress, physical activity level and body composition parameters that may be related to these in healthy university students. University students were selected for this study because this age group (18-26) are young adults whose lifestyles and physical activities are sensitive to seasonal changes. The fact that they move away from the academic environment and spend more free time during the summer season may have significant effects on their stress levels and body awareness. Furthermore, individuals in this age group are generally in good health, making the body composition changes that the study should focus on more specific and generalizable.

Some changes are seen in the nature and all living beings with the change of seasons. It is a known fact that these changes are mostly physiological and psychological in humans (20). In a study they conducted on 27 pregnant women between the ages of 18 and 49 and women who had children between the ages of 2 and 6 in the United States of America (USA) Yakima Valley, Smith MN et al. reported that in summer and autumn, the amount of cortisol, which is an indicator of stress, and stress anxiety scores were significantly different between seasons (21). In another similar study conducted in Sweden by Persson et al., cortisol concentrations were analysed in 17 women and 7 men who were between the ages of 32 and 61, who had a mean BMI of 24.5±2.3, who were actively working, who were living with their families except for 2, and 21 of whom were non-smokers, and they found seasonal changes in cortisol concentrations. The lowest concentrations were reported in summer months of July and August (22). In the literature, biochemical markers such as cortisol, cortisol awakening response, dexamethasone suppression test, and salivary α-amylase are measured or scales such as Perceived Stress Scale, Depression Anxiety

Stress Scale are used to evaluate stress in humans (23,24). In our study, Perceived Stress Scale was used to evaluate stress since it is easy to apply and evaluate and preferred in literature. In our study which included 130 students between the ages of 18 and 26 and a mean BMI of 22.48±3.51, 77 of the students were female and 53 were male, 13.1% were smokers, 26.9% were social drinkers. According to the results of the Perceived Stress Scale, although cortisol levels were not measured, differences were found between pre-summer and post-summer as in the previously mentioned studies (Table 1). In addition, although variations such as age range, the angle of receiving sun, the duration of exposure to sun, occupation, BMI, living with the family, living alone in another city, consuming alcohol-cigarette, being aware of the current responsibilities which may all affect the level of stress have been reported in these studies, it has also been stated that seasonal changes may be related with stress. In our study, the significant decrease in the level of stress may be due to the fact that students are on holiday with the start of summer and their exam anxiety is over and they are back to their family and friend environment.

In a study Ersoy N. conducted on 31 individuals older than 65 years of age, it was found that 11 were retired men and 70% were housewife, 87.1% of the participants had at least one chronic illness, there was an increase in the state of exercising regularly in summer months, while there was no significant increase in MET value. It was also found in this study that a decrease was found in body weight and body fat ratios in transition to summer and autumn from spring, although not statistically significant (20). In a study conducted in USA by Ma Y. et al. on 593 participants (316 men and 277 women) between the ages of 20 and 70 to find out seasonal changes in food intake, physical activity and body weight, it was found that 84.1% were non-smokers, 63.6% were overweight or obese and a great majority were at least high school graduates and it was found that physical activity level was high in spring and summer months and body weight was the lowest in summer (25). In our study, while it was found that women had higher physical activity level after summer, no significant change was found in men. Although nutritional state was not evaluated, no significant change was found in pre-summer and post-summer body fat ratio in women and men, similar to the literature. Body weight was found to decrease significantly after summer only in women (Table 1). It can be thought that the reason for this result can be the increase in physical activity level with the increase in body awareness after summer. The result that there were no significant changes in body awareness and physical activity level in men supports this hypothesis.

In a study by Christaki et al. of 121 (43 boys, 78 girls) children and adolescents aged 5-15 years, stress levels were found to be statistically significantly higher in overweight children than in normal weight children (26). Scott et al. reported that women and men who were overweight or at the upper limit of normal weight were more likely to gain weight in response to stress than those who were underweight. It is thought that the high levels of insulin observed in overweight individuals are responsible for greater weight gain in response to stress (27). In our study, weight, BMI and OD decreased in women whose stress level decreased and increased, but this decrease was greater in women whose stress level decreased than in women whose stress level increased. In male participants, there was no significant difference in body composition change between the increasing and decreasing stress groups (Table 2). Our results suggest that there may be gender differences in the effect of stress on weight change and adiposity.

The reliability of the PSS and BAQ in this study was found to be consistent with the values reported in the original validation studies. The original PSS reported a Cronbach's alpha of 0.84 (12), which is similar to the values obtained in our study (0.85 and 0.88). Similarly, the original BAQ had a Cronbach's alpha of 0.87 (14), which closely matched our findings of 0.86 and 0.89. These comparisons suggest that the scales retain reliability when applied in the context of our study.

In studies in the literature, it has been stated that impulsive eating behaviour increases under stress (24,28,29). In a study conducted by Lundahl et al., it was found that women had higher impulsive eating, self-perception of body shape and dieting rates than men (30). In our study, it was found that women with increased stress had lower rates of losing weight when compared with women who had decreased stress. This may be related to the impulsive eating behaviour of women under stress and therefore we suggest this parameter to be included and evaluated in future studies.

Body awareness is defined as a bridge connecting the body and mind, making sure that tissues work in harmony without being damaged. The higher body awareness we have, it will be easier for us to protect our physical health and to have shorter illness process with early awareness (31,32). It mediates a holistic health such as our physical health, mental health, physical activity and mental perception (33). Individuals' being healthy in the society provides a social gain and contributes to creating healthy societies (34). Body awareness has begun to be used in clinical areas since it provides assessment and data about the treatment in cases such as chronic pain, obesity and post-traumatic stress

disorder (8,35). Today, how body awareness changes with the increase in obesity has become a matter of interest and there is no consensus on the issue in literature. In a study conducted by Kalkışım et al. on healthy 189 women and 100 men with a mean age of 19.34 ± 1.48, while no significant correlation was found between body mass index and body awareness, significant correlation was found between body weight and body awareness (35). In a similar study conducted by Vatansever et al. on healthy 37 women and 27 men with a mean age of 22.68±6.75, no significant correlation was found between body awareness level and body mass index (36). However, in another study, Erden and Emirzeoğlu found a significant correlation between BMI and body weight and body awareness level in 36 basketball players with a mean age of 14.5±2.14 (37). In our study, unlike other studies, the correlation between body composition and body awareness was evaluated separately in women and men, and while other studies made a single measurement and evaluated correlations, our study made two different measurements and analysed the changes. In our study, when the correlation between the changes in these parameters was examined, it was found that in individuals who had increased body awareness, weight, BMI and obesity rate mostly decreased (Table 3). According to literature, it can be seen that body awareness affects BMI and body weight, especially in individuals who do sports professionally and in individuals receiving education in the field of health. We think that this result may be due to the fact that medical faculty students, who constitute our study group, have higher level of education and both medical faculty students and professional athletes know their bodies well. In their study, Cheah et al. also found a positive correlation between level of education and body awareness (38). Koltyn et al.'s study result that exercise level affects body awareness positively also supports our inferences (39).

Another topic which is not studied much in literature is the relationship between body awareness and perceived level of stress. In a study they conducted, Gyllensten et al. researched the relationship between psychological well-being and body awareness level in 45 women and 30 men with a mean age of 36.5±8.3. As a result of the study, they found a negative and moderate correlation between anxiety sub-parameter of Psychological Well-being Index (PWBI) and body awareness (40). Similarly, negative weak correlation was found between body awareness and perceived level of stress in both men and women in our study (Table 4). In line with these results, it was found that individuals' psychological state affected body awareness and body awareness decreased with the increase in stress and anxiety level.

The data obtained in this study are specific to healthy university students aged 18-26 years. The results can be generalised to individuals in this age group, but generalisation to different age groups or individuals with different health status may not be appropriate. In addition, the fact that the participants spent their summer holidays in Türkiye and did not work may affect the results of the study. Therefore, it may vary whether similar results can be obtained on individuals living in different geographical regions or working during summer holidays. For the generalisability of the results, it is recommended to conduct additional studies with a wider scope and including different demographic groups.

Although this study examined the immediate effects of seasonal change from a general perspective, longer-term studies may offer a more holistic view. Summer effects can be considered from many angles and more specificity on changes in lifestyles during the summer months may be desirable. Furthermore, future research could be conducted in a larger population for a more comprehensive result. It should consider widening the range of variables investigated, such as sleep patterns, dietary habits, cortisol levels and mental health status, as well as including wider age groups and various sociodemographic characteristics of participants, such as wealth level.

The results of the study were evaluated from the perspective of physicians and physiotherapists and the results were interpreted specific to the research center. It was found that physical activity levels of women increased after the summer season, while there was no significant change in men. It was determined that the stress level decreased in general in both genders after the summer season. It was determined that the weight, BMI and obesity levels of women with decreased stress levels were lower than those of women with increased stress levels, and there was no significant difference between the groups with increased and decreased stress levels in terms of body composition parameters. These results showed that stress may affect men and women differently in terms of weight gain, BMI, OD and body awareness in a university sample. It was also found that body awareness increased significantly in women after the summer, whereas it did not cause a significant change in men. However, body awareness was found to affect men more than women in terms of body composition parameters. These results may suggest that strategies to increase body awareness and reduce perceived stress may be effective in the process of obesity and psychosocial illness. We think that giving sufficient importance to body awareness, which is effective in various diseases, will also contribute to the field of preventive medicine.

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