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Effects of Perceptions of The Immediate Surroundings on Obesity and Physical Activity Levels in University Students

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Abstract

The aim of this study was to examine the effects of perception of the close environment on obesity and physical activity levels in university students. Included in this study were 113 students between 18–25 years of age, taking into account that there may be erroneous and missing data according to the 95% confidence level in the pre-sample size calculation table according to the confidence level and acceptable error for the research, 10% more than the recommended sample size was calculated and 113 students participated. Up to 20% of the participants were fitted with a pedometer and heart rate monitor for 1 day to determine their objective physical activity levels. Height measurement, body weight measurement, bioimpedance analysis, International Physical Activity Questionnaire-Short Form (IPAQ-SF), pedometer, heart rate, and Immediate Walkability Perception Questionnaire (IWPQ) were applied to the participants. As a result, a significant relationship was found between the number of steps and the shops, facilities, and other nearby places in the vicinity ($P < 0.05$; $r = –0.353$). At the same time, a significant relationship was observed between the stores, facilities, and other nearby places in the vicinity and the level of physical activity ($P < 0.13$; $r = –234$). Relationships were found between the body mass index (BMI), Body fat percentage, and abdominal circumference data, which are considered as obesity indicators, and the sub-dimensions of the perception of walkability in the immediate environment, but none of these were statistically significant.

Keywords: Walkability, Physical Activity, Obesity, Neighborhood

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Introduction

Turkey is among the most obese countries in Europe (World Health Organization, WHO). The effects of sedentary life are among the biggest factors of this obesity problem in the country. Many situations that make the people immobile can be listed, and the most important of these is the built environment. Studies have shown that physical activity is affected by the built environment. In the study, it was aimed to examine the effects of the walkability perception in the immediate environment on obesity and physical activity.

The WHO reported that obesity has become a global problem. Obesity should not be seen only as an aesthetic problem. According to the degree of obesity, many first- and second-degree health problems arise. The importance of fighting this disease, which is thought to play an important role in nutritional disorders, cardiovascular diseases, type 2 diabetes, orthopedic problems, mental disorders, and many other problems with psychological content, is increasing. The simplest way to avoid this disease is proper nutrition and physical activity. There are many things that limit physical activity. However, incorporating physical activity into daily life will direct us to act directly. By providing this correlation, it is necessary to increase mobility in our daily work life or increase walkability in the immediate environment. It is thought that the effects of street connections, walking and bicycle paths, traffic danger, and crime safety on our perception of walking in the immediate environment are high.

In its 2002 report, the WHO stated that health problems resulting from a sedentary lifestyle cause 1.9 million deaths annually worldwide. Rising health expenditures in the treatment of health problems caused by an inactive lifestyle have reached levels that will damage a country’s budget (Akyol et al., 2008). We can consider the costs of this situation on individuals and society in two ways. The first is the increase in health expenditures to keep obesity under control, and the second is the working hours that cannot be evaluated due to obesity-related diseases (Leicester & Windmeijer, 2004). Inpatient and daily hospital stay, outpatient treatment, manpower costs (doctors, nurses, other healthcare workers, dietitians, physiotherapists), laboratory and imaging costs, medications, surgeries, reports received due to obesity and obesity-related additional diseases, employment lost due to disability expenses, such as opportunities, deterioration in quality of life and related expenditures, health expenditures and health promotions, and health researches continue to harm a country's economy (Ko, 2008).

Urbanization, the lack of safe places to be active, the lack of access to physical activity equipment, the distance from places such as parks and gymnasiums, the cost and time constraints of physical activities, intense work tempo, transportation, and socioeconomic conditions are some of the things that affect physical activity (Cavill et al., 2006; Motl et al., 2006; Ferreira et al., 2007). But the simplest way to be physically active is walking. The current research shows that physical activity is affected by the built environment. The built environment can facilitate physical activity by being supportive (Mitchell, 2016). To put it more clearly, individuals must gain the perception of walkability in order to walk. When a person's perception of walkability is considered, it is an inevitable fact that they are under the influence of the attractiveness of the environment, possibilities, access to facilities, traffic density, and construction. When it comes to walking, it can be defined as the simplest physical act used to travel from one place to another using only one's own energy. The use of this inexpensive transportation method by people is directly proportional to the effect of the environment they are in. In other words, things such as the presence of environments that encourage them to walk, a low traffic density, low crime rate, and the presence of shopping centers that can meet their personal needs are among the main things that lead individuals to walk.

Walking is an action that is shaped not only because it is the basic mode of transportation, but also for people to explore the city, pedestrian opportunities, and the character of the city and its inhabitants in the built environment, such as streets, pavement, and roads. In addition, walking allows people to socialize with each other. The balance of vehicle and pedestrian use in a city is very important for walkability, because pedestrian spaces should be equal for everyone. Pedestrian roads in terms of equality of use for the elderly, disabled, families with children, and all other people, should be fully equipped in terms of sidewalks, pedestrian crossings, reserved roads, street furniture, and trees. (Hancock et al., 1999).

METHOD

Research Group

In this study, to determine the effect of perception of close environment on walkability among university students, between 18 and 25 years of age, studying at Çanakkale Onsekiz Mart University Bayramiç Vocational School, the confidence level for the research and the acceptable error according to the pre-sample size calculation table according to the 95% confidence level were incorrect and incomplete. Considering that there may be erroneous and missing data, 10% more than the recommended sample size was calculated and 113 students participated. Up to 20% of the participants were fitted with a pedometer and heart rate monitor for 1 day to determine their objective physical activity levels. The participants were asked to wear the pedometer on the right side of the waistband of the pants/skirt. The heart rate measurement watch was placed on their wrist in such a way that there was no gap. The number of students who wore a pedometer and heart rate measurement watch was calculated as 22 students, which was 20% of the sample.

Height measurement

A stadiometer device (SECA, Germany) with an accuracy level of ±0.01 m, located on a stable surface, was used to measure the height of the participants in the research group. Measurements were made after a deep inspiration while the participants were barefoot and in an anatomical stance on the stadiometer. The distance between the point where the sliding caliper of the device touched the vertex of the head and the platform where the sole of the foot touched was recorded as the height in cm.

Bioimpedance Analysis

A bioelectrical impedance device was used to determine the body weight, body fat ratio, body fat mass, lean body mass, and residual mass values of the participants. Attention was paid to take measurements at least 4 h after the last meal of the participants and in the time period when there was no excessive physical activity for the last 12 h and no diuretic drug consumption in the previous 7 days. The gender and age of the participants were recorded in the sections of the computer program of the device. After these descriptive data were entered, the device the participants were asked to hold the electrode arms while their arms were stretched out and their armpits were slightly open. After the participant stayed in that position for approximately 5–10 s, reports showing the values presented by the device via its own software were collected.

International Physical Activity Questionnaire-Short Form (IPAQ-SF)

The IPAQ-SF consists of 9 questions measuring the intensity of physical activity. The questions give information about physical activities, climbing stairs, walking, shopping, and sitting time over the previous seven days. From these data, the total weekly physical activity level (MET/h/week) was classified as low, medium, or high. Individuals who stated that they did not perform physical activity should have low physical activity level $\times \leq 600$ MET-min/week, and the total physical activity should reach minimum $\times \geq 600$–3000 MET-min/week to have an intense or moderate physical activity level (Craig et al., 2003).

Pedometer

A pedometer was used to determine the objective physical activity levels and daily step counts for up to 20% of the participants. The participants were asked to carry the pedometer on their waist for 1 day (except for sleeping and showering) and they were told to wear the pedometer on the right side of the waistband on their pants or skirt.

Step counts obtained with the pedometer were classified as <5000 (sedentary), 5000–7499 (mildly active), 7500–9999 (slightly active), 10000–12499 (active), and >12500 (highly active) (Tudor-Locke and Bassett, 2004).

Heart Rate

A heart rate monitor was used to determine the objective physical activity levels and heart rate for up to 20% of the participants. Using the signals that measure the heart rate from the wrist to the watch, the device recorded the heart rate data for 24 h.

Immediate Walkability Perception Questionnaire (IWPQ)

The survey was applied to measure the neighborhood's perception of the environment (Cervero & Duncan, 2003; Cerin et al., 2006; Moudon et al., 2006; Leslie et al., 2007). It consists of 6 parts: access to services, street connectivity and infrastructure for walking/cycling, aesthetics, traffic hazards, and crime rate.

Analysis of Data

The data obtained from the measurements and surveys within the scope of the study were analyzed using the SPSS package program. The number of variables (n) of the data were presented as percentages (%). The significance level of the data was accepted as 0.05 in all of the statistical analyses. All of the measurements were completed taking into account the pandemic conditions and were made in a way that would not risk the health of the participants.

Results

Table 1. Identifying Information of the Participants.

	N	Min	Max	x̄	ss
Age	113	18	43	20.66	3.009
BMI	113	152.00	195.00	170.9292	9.43182
Body Fat Mass	113	16	47	22.85	4.908
Lean Mass	113	2	74	15.16	10.197
Body Fat Percentage	113	32	93	52.13	12.612
BMI	113	3.60	47.90	21.6982	9.96104

Descriptive information such as the age, height, BMI, body fat mass, lean body mass, and body fat percentage of the participants are given in Table 1.

Table 2. Average of Sub-Dimensions of the Perception of the Close Environment of the Participants

	N	Min	Max	x̄	ss
Nearby Store Facilities and Others	113	1.30	.50	3.1556	0.74637
Transportation to Facilities	113	1.00	5.00	2.8555	0.63757
Streets Nearby	113	1.00	4.00	2.5885	0.66221
Walking and Cycling Areas	113	1.50	3.50	2.5177	0.35937
Aesthetics in My Neighborhood	113	1.25	3.75	2.2323	0.49968
Traffic Hazard	113	1.33	4.00	2.4100	0.47142
Crime	113	1.00	4.00	2.2596	0.76989
Step Count	35	539	17333	8301.14	3782.272
Heart Rate	35	80	105	90.46	10.033

The average standard deviation and minimum and maximum values of the 6 dimensions of the participants' perception of walkability in their immediate environment are given in Table 2.

Table 3. Descriptive Statistics of the Participants based on the Step Classifications.

		Sedentary	Mildly Active	Slightly Active	Active	Highly Active
Age	x̄	21	22	21	20	22
	ss	2	2	3	1	3
	Min	19	19	18	18	19
	Max	24	25	25	22	25
Weight (kg)	x̄	71	69	70	66	71
	ss	12	10	16	13	10
	Min	55	57	44	56	60
	Max	85	87	95	89	81
Height (cm)	x̄	172.29	169.71	174.30	174.00	174.00
	ss	7.48	7.63	10.85	7.30	9.38
	Min	157.00	158.00	154.00	158.00	160.00
	Max	180.00	178.00	187.00	180.00	180.00
Body fat mass (kg)	x̄	14	16	13	12	13
	ss	5	8	9	7	6
	Min	5	2	3	4	5
	Max	20	27	25	22	19
Lean mass (kg)	x̄	57	53	57	54	58
	ss	9	9	13	12	9
	Min	40	39	36	36	48
	Max	67	61	71	69	68
Skeletal muscle mass (kg)	x̄	32	30	33	30	33
	ss	6	5	8	8	5
	Min	21	21	19	19	27
	Max	38	35	41	39	39
BMI	x̄	24	24	23	22	24
	ss	4	4	4	4	3
	Min	18	19	18	18	19
	Max	28	30	30	27	26
Body fat percentage (%)	x̄	19.39	23.33	17.34	18.66	18.48
	ss	6.54	10.98	10.52	10.12	8.56
	Min	8.40	3.60	5.50	6.20	7.80
	Max	28.60	36.50	39.80	35.50	28.20

The descriptive information of the participants according to the step classification is given in Table 3. The step classification of the participants was taken as a reference from the study by Tudor-Locke & Bassett (2004).

Table 4. Average of the Immediate Surroundings Perception Sub-Dimensions by Step Classification of the Participants.

		Sedentary	**Mildly Active**	**Slightly Active**	**Active**	**Highly Active**
Nearby Store Facilities and Others	x̄	4.01	3.60	3.46	2.80	3.51
	ss	0.37	0.50	0.58	0.87	0.92
Transportation to Facilities	x̄	2.71	2.38	2.60	2.57	2.17
	ss	0.71	0.52	0.60	0.71	1.00
Streets Nearby	x̄	2.29	2.14	2.45	2.36	2.13
	ss	0.81	0.75	0.50	0.56	1.03
Walking and Cycling Areas	x̄	2.48	2.48	2.43	2.38	2.46
	ss	0.33	0.24	0.39	0.40	0.08
Aesthetics in My Neighborhood	x̄	1.93	2.32	2.18	2.04	2.25
	ss	0.47	0.61	0.54	0.67	0.74
Traffic Hazard	x̄	2.43	2.52	2.20	2.67	2.75
	ss	0.37	0.38	0.57	0.43	0.17
Crime	x̄	2.29	2.57	2.23	2.43	2.17
	ss	0.49	0.79	0.79	0.74	0.88

According to the step classification of the participants, the average standard deviation values of walkability perception in the immediate environment are given in Table 4. BMI classification was made by taking the reference values of the World Health Organization (WHO 1997).

Table 5. Distribution of the IWPQ Sub-Dimensions Based on the BMI Classification.

		BMI Classification					
		Low weight	**Normal**	**Pre-obese**	**Class 1 obese**	**Class 2 obese**	**Class 3 obese**
Nearby Store Facilities and Others	x̄	3.00	3.20	3.16	3.10	3.37	4.17
	ss	0.62	0.80	0.78	0.66	0.58	.
Transportation to Facilities	x̄	2.95	2.85	2.81	2.89	2.83	2.00
	ss	0.58	0.71	0.59	0.38	0.24	.
Streets Nearby	x̄	2.56	2.59	2.63	2.67	2.75	1.50
	ss	0.49	0.72	0.72	0.58	0.35	.
Walking and Cycling Areas	x̄	2.44	2.58	2.46	2.56	2.67	2.33
	ss	0.32	0.33	0.45	0.19	0.00	.
Aesthetics in My Neighborhood	x̄	2.14	2.29	2.23	1.83	2.50	2.00
	ss	0.45	0.47	0.60	0.52	0.35	.
Traffic Hazard	x̄	2.39	2.44	2.31	2.89	2.50	2.67
	ss	0.40	0.50	0.47	0.51	0.24	.
Crime	x̄	2.24	2.07	2.56	2.89	2.17	3.00
	ss	0.77	0.68	0.80	1.17	1.18	.

It was found that the low-weight individuals got the best score in the nearby stores and other nearby places sub-dimension. This means that the walking time of the low-weight individuals to shops and facilities in the immediate vicinity was shorter. It was found that the best score in the transportation to facilities sub-dimension was in the low-weight individuals. In the sub-dimensions of the streets, the walking and cycling areas in the close vicinity and aesthetics in the close environment, the class 2 obese group had the best score. The group that thought that the traffic hazard prevented walking the most was the class 3 obese group. The group with a low walking level due to the crime sub-dimension was the class 3 obese group. BMI classification was made by taking the reference values of the World Health Organization (WHO 1997).

Table 6. Waist Circumference Averages Based on Gender.

		Abdominal Circumference			
		x̄	ss	Min	Max
Women's Waist circumference	**Normal**	71.1	3.7	79.3	65.6
	Risk	84.7	3.0	87.9	80.3
	High Risk	95.6	5.9	107.0	88.9
Male Waist circumference	**Normal**	78.5	7.7	93.5	66.7
	Risk	97.4	2.1	100.5	95.0
	High Risk	123.1	17.9	138.7	102.9

Another reference value taken as an obesity indicator was waist circumference (the Table reference range was taken from Lean et al., 1998). The average waist circumferences of the participants are given in Table 6 above. These data were obtained using a bioelectrical impedance device.

Table 7. Body Fat % Classification Averages Based on Gender.

		Body Fat Percentage			
		%	n	x̄	ss
Male Body Fat Percentage Classification	Athletic	21.2%	14	7.86	1.58
	Good	16.7%	11	11.91	1.24
	Normal	31.8%	21	16.70	1.69
	Fat	10.6%	7	21.44	.80
	Obese (Fat, Overweight)	19.7%	13	29.32	6.31
Female Body Fat Percent Classification	Athletic	0.0%	0	.	.
	Good	31.9%	15	19.37	2.25
	Normal	25.5%	12	26.88	2.13
	Fat	21.3%	10	32.74	1.85
	Obese (Fat, Overweight)	21.3%	10	40.03	3.06

Body fat percentages obtained using the bioelectrical impedance device were evaluated according to the reference ranges given in the study of Jeukendrup and Gleeson (2010). According to these results, 19.7% of the men and 21.3% of the women were classified as obese

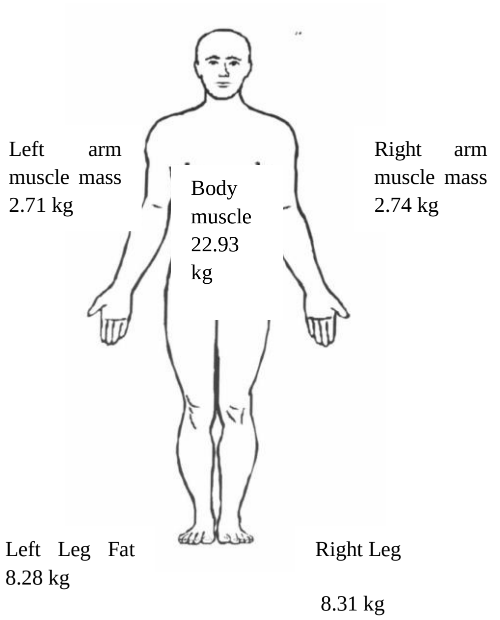


Figure 1. Body Muscle Mass Average.

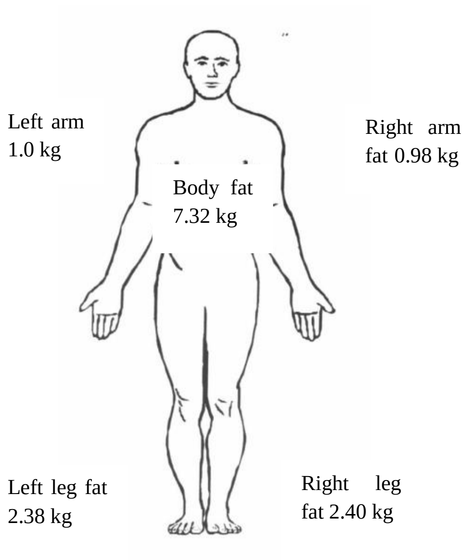


Figure 1. Body Fat Mass Average.

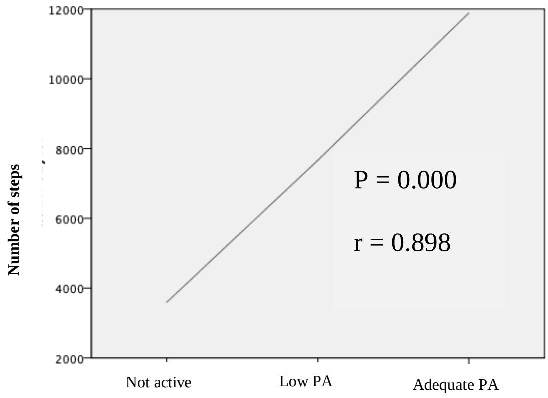
Body region analyses of the participants are given in the figures above. As given in Figure 1, the average left arm muscle mass was 2.71 kg, the right arm muscle mass average was 2.74 kg, the body muscle mass average was 22.93 kg, the left leg muscle mass average was 8.28 kg, and the right leg muscle mass average was 8.31 kg, and as given in Figure 2, the average left arm fat mass was 1.0 kg, the right arm fat average was 0.98 kg, the body fat average was 7.32 kg, the left leg fat average was 2.38 kg, and the right leg fat average was 2.4 kg.

Table 8. Relationship Between the Perception of Walkability in the Neighborhood and Number of Steps, FA Level, Heart Rate, Percentage of Body Fat, Abdominal Circumference ,and BMI.

		Step count	PA Level	Heart Rate	Body Fat Percentage	Abdominal Circumference	BMI
Nearby Store Facilities and Others	r	–0.353	–0.234	–0.408	–0.030	0.111	0.084
	p	**0.038**	**0.013**	**0.015**	0.750	0.241	0.374
	N	35	113	35	113	113	113
Transportation to Facilities	r	–0.163	–0.058	–0.145	–0.051	–0.145	–0.143
	p	0.349	0.541	0.407	0.595	0.126	0.132
	N	35	113	35	113	113	113
Streets Nearby	r	–0.005	.090	–0.041	0.041	–0.028	–0.040
	p	0.979	0.346	0.816	0.670	0.770	0.674
	N	35	113	35	113	113	113
Aesthetics in My Neighborhood	r	0.063	0.008	–0.024	0.053	0.027	0.012
	p	0.718	0.935	0.892	0.579	0.780	0.900
	N	35	113	35	113	113	113
Traffic Hazard	r	0.201	0.007	0.355	0.059	–0.006	–0.027
	p	0.246	0.939	0.036	0.537	0.948	0.780
	N	35	113	35	113	113	113
Crime	r	–0.109	.057	–0.030	–0.154	–0.054	–0.012
	p	0.531	0.545	0.866	0.104	0.566	0.897
	N	35	113	35	113	113	113

A significant correlation was found between the shops, facilities, and other nearby places in the vicinity and the number of steps (P < 0.05; r = –0.353). In other words, it can be said that the individuals went to nearby stores on foot. At the same time, it was observed that the physical activity level of these individuals increased (P < 0.13; r = –234). It can be said that the closer the stores were, the more active the individuals were. No significant difference was found between the number of steps, physical activity level, and heart rate in the other sub-dimensions of the questionnaire.

Relationships were found between the BMI, body fat percentage, and abdominal circumference data, which are considered as obesity indicators, and the sub-dimensions of the perception of walkability in the immediate environment, but none of these were statistically significant.



Graphic 1. Relationship Between the Number of Steps and the FA Level.

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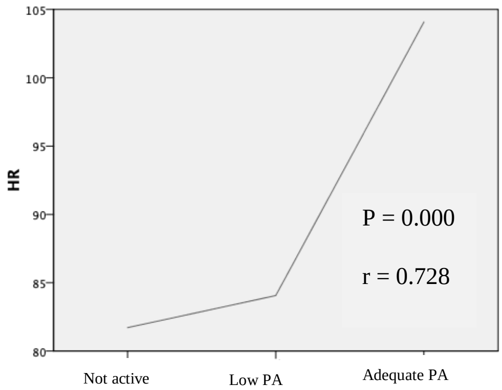
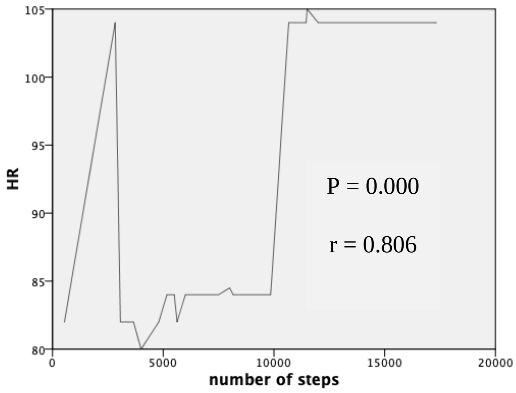
A significant relationship was found between the number of steps and physical activity. It was found that the individuals with an increased number of steps were more physically active.



Graphic 2. Relationship between the Heart Rate and the FA level.



Graph 3. Relationship between the Heart Rate and the Step Number.

A significant relationship was found between the physical activity level and heart rate. It was found that the heart rate of the active individuals also increased. The heart rate monitor gave results proving the accuracy of the answers to the questionnaire.

Other data parallel to these data were found between the number of steps and the number of heart beats. It was found that the individuals with an increased number of steps also had an increased heart rate, and a significant relationship was found between these two data.

Discussion and Conclusion

A significant relationship was found between the stores in the vicinity and the number of steps ($P < 0.05$; $r = -0.353$). It can be said that the individuals went to nearby stores on foot. At the same time, it was observed that the level of physical activity of these individuals increased ($P < 0.13$; $r = -234$). It can be said that the closer the stores were, the more active the individuals were.

Although there was a relationship between the number of steps, physical activity level, and heart rate among the other sub-dimensions of the questionnaire, it was not statistically significant. Relationships were found between the BMI, body fat percentage, and abdominal circumference data, which are considered as obesity indicators, and the sub-dimensions of the perception of walkability in the immediate environment, but none of these were statistically significant. In this process, it was observed that the perception of walkability in the immediate environment had no effect on obesity. While there may be many reasons for this, it is thought that the biggest factor was that the study process took place at the same time as the worldwide COVID-19 pandemic, which affected many factors. It was observed that people reduced exercise such as going for a walk to avoid the risk of contamination. It is also thought that the measures taken by the country's administrators to reduce the course of the pandemic reduced the level of physical activity in individuals and reduced the amount of walking they did. It is also an inevitable fact that this process affected the obesity rate of individuals. When the studies in the literature were evaluated, it was seen in a study examining the relationships between physical environment variables and individuals' walking and cycling, that complementary strategies aimed at influencing universal factors are required, and given the popularity of walking in the community, more emphasis should be placed on creating landscapes that increase walking in recreation and transportation. (Saelens et al., 2003). In a study conducted by Johansson et al. (2016), they examined the relationship of walking on a certain walking route with perceived urban design qualities and concluded that land use and design have an impact on public health.

Much of the published literature on the concept of walkability includes various definitions and variables that hypothesize to create an environment that will increase walking behavior. Successfully providing walkability and establishing its definition correctly will provide convenience to planners and designers in neighborhood design. Perception of walkability affects walking behavior.

Walkability can be an indicator of the quality of a space. Walkability variables are similar to each other in many literatures and the prominent variables comprise residential density, land uses, connections, streets, walking opportunities, aesthetics, security (Akçam & Karaçor 2018).

In addition to all of these, the following conclusions were reached in this research:

- Obese participants were identified and informed about solving problems that may be encountered in the future.
- Participants were informed that obesity can be prevented with physical activity. As a result, it is thought that the hospital costs for the following processes will decrease and accordingly the country's economy will be supported.
- The participant' perception of walkability in the immediate environment was examined and it is thought that it will guide the local governments to make arrangements by paying attention to the built environment features in order to increase the walkability perception of the students in line with the research result.
- In line with health policies in the country, this study will shed light on city planners to build walkable cities.
- It will support taking more encouraging measures to increase walking-related activities according to the physical activity status of walking individuals.

Ethical Statement

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Conflict of Interest

No potential conflict of interest was declared by the authors.

Credit Author Statement

The authors contributed equally to this research.

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