

# THE RELATIONSHIP BETWEEN ECOLOGICAL FOOTPRINT LEVELS AND AWARENESS OF MEDICAL FACULTY STUDENTS

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## ABSTRACT

**Objective:** Anthropogenic activities and the resulting ecological footprint are increasing daily, putting pressure on ecosystems and the environment. This study aims to determine the relationship between ecological footprint values and awareness among medical faculty students.

**Material and Method:** A cross-sectional study was conducted with the participation of 352 students at Istanbul University Faculty of Medicine. The ecological footprint calculator and Ecological Footprint Awareness Scale were used as data collection tools. Statistical analyses, including the Mann-Whitney U, Kruskal Wallis, and Spearman correlation tests, were performed using the SPSS statistical package.

**Results:** The participants' average ecological footprint was  $6.6 \pm 1.7$  global hectares (gha) per person. The earth number value was calculated as  $4.1 \pm 1.1$ , and the carbon

footprint for CO<sub>2</sub> emissions was  $11.1 \pm 4.3$  tons per person. The carbon footprint accounts for approximately 56 % of the total ecological footprint. According to the ecological footprint awareness scale, participants showed the highest awareness in the sub-dimensions of energy consumption ( $\bar{X}=4.1$ ) and water consumption ( $\bar{X}=4.0$ ), while the awareness was lowest in the sub-dimension of nourishment ( $\bar{X}=2.9$ ). A weak negative correlation was found between the participants' ecological footprint values and the results obtained from the ecological footprint awareness scale ( $r=-0.217$ ,  $p<0.001$ ).

**Conclusion:** According to the study, students have a higher ecological footprint than the average values observed in Turkey and the world. Reduce the environmental impacts of human activities; raising awareness and promoting sustainable practices is essential.

**Keywords:** Ecologic systems, environment and public health, carbon footprint, sustainability, medical student.

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# TIP FAKÜLTESİ ÖĞRENCİLERİNİN EKOLOJİK AYAK İZİ DÜZEYLERİ İLE FARKINDALIKLARI ARASINDAKİ İLİŞKİ

## ÖZET

**Amaç:** İnsan kaynaklı faaliyetler ve bunun sonucunda ortaya çıkan ekolojik ayak izi, her geçen gün artıp ekosistemler ve çevre üzerinde baskı oluşturmaktadır. Bu çalışma, tıp fakültesi öğrencilerinde ekolojik ayak izi değerleri ile farkındalıkları arasındaki ilişkiyi belirlemeyi amaçlamaktadır.

**Materyal ve Metot:** Kesitsel tipteki bu çalışmaya İstanbul Üniversitesi Tıp Fakültesi'nde öğrenim gören 352 öğrenci dahil edilmiştir. Veri toplama aracı olarak Ekolojik Ayak İzi Hesaplayıcı ve Ekolojik Ayak İzi Farkındalık Ölçeği kullanılmıştır. Mann-Whitney U, Kruskal Wallis ve Spearman korelasyon testi SPSS istatistik paketi kullanılarak yapılmıştır.

**Bulgular:** Katılımcıların ekolojik ayak izi ortalaması  $6,6 \pm 1,7$  küresel hektar (kha) olarak bulunmuştur.

Katılımcıların yaşam tarzlarını bu şekilde sürdürmeye devam ettirdikleri takdirde yaşamak için gereken dünya sayısı ortalaması  $4,1 \pm 1,1$  ve kişi başına ( $\text{CO}_2$  emisyonları için) karbon ayak izi  $11,1 \pm 4,3$  ton olarak hesaplanmıştır. Karbon ayak izi toplam ekolojik ayak izinin %56'sını oluşturmaktadır. Ekolojik ayak izi farkındalık ölçeğine göre katılımcılar en yüksek farkındalık enerji tüketimi ( $\bar{x}=4,1$ ) ve su tüketimi ( $\bar{x}=4,0$ ) alt boyutlarında gösterirken, en düşük farkındalık beslenme ( $\bar{x}=2,9$ ) alt boyutunda göstermiştir. Ekolojik ayak izi değerleri ile ekolojik ayak izi farkındalık ölçeğinden elde edilen sonuçlar arasında zayıf bir negatif korelasyon bulunmuştur ( $r=-0,217$ ,  $p<0,001$ ).

**Sonuç:** Bu çalışmaya göre öğrenciler, Türkiye ve dünyada görülen ortalama değerlerden daha yüksek ekolojik ayak izine sahiptir. İnsan faaliyetlerinin çevresel etkilerini azaltmak için; farkındalık artırmak ve sürdürülebilir uygulamaları teşvik etmek önemlidir.

**Anahtar kelimeler:** Ekolojik sistemler, çevre ve halk sağlığı, karbon ayak izi, sürdürülebilirlik, tıp öğrencisi.

## INTRODUCTION

With the publication of the Sustainable Development Goals by the United Nations and the increasing awareness of climate change, the activities of institutions related to environmental issues have escalated.<sup>1</sup> The concept of an ecological footprint can be utilized to measure environmental sustainability, examining the interconnection between humans and nature while revealing the pressure on natural resources and the factors contributing to it.<sup>2</sup> Indeed, the ecological footprint assesses human demands, resource consumption, and the capacity of ecosystems to provide and replenish these resources.<sup>3</sup> The fact that all resources supporting life on Earth and biological production are limited has been accepted in calculating ecological footprints.<sup>4</sup> Consequently, due to the consumption of Earth's resources throughout one's lifetime, waste disposal into nature, and the misguided belief that Earth's resources are inexhaustible, a cycle of demand and consumption has emerged that surpasses the Earth's regenerative capacity.<sup>5</sup> Ecological footprint estimates are categorized into six fundamental areas based on human consumption: carbon, grazing, forests, fishing, cropland, and built-up land footprints.<sup>6</sup> According to recent estimates, a regeneration capacity equivalent to that of 1.6 planets is needed to meet human demands for natural resources and ecosystem services.<sup>7</sup> This ratio increases to 2.8 when measured according to the consumption levels of European

nations. As a result of the excessive consumption of resources, humans are faced with issues such as climate change, pollution, invasive species and illnesses, habitat loss, and a decline in biodiversity.<sup>6</sup>

Studies have been carried out, especially in education faculties, to determine the ecological footprint levels and awareness of university students in Turkey. However, there is limited research on medical faculty students globally and in Turkey. Within the framework of the public health internship in the faculty of medicine curriculum, efforts have been made to enhance awareness regarding sustainability and environmental health issues. In this context, to halt the destruction of our planet, it may be necessary to guide younger generations in abandoning their western-style consumption patterns. Education is one of the most effective ways for young individuals to adopt behavioral changes by raising awareness.<sup>1,8</sup> Theoretical and practical training in environmental health is provided in various programs within the framework of public health internships in the curricula of medical schools. Nevertheless, the extent to which the concept of ecological footprint and its associated consumption are addressed within the context of environmental health varies across different medical schools.<sup>9</sup> Therefore, this study aimed to explain medical faculty students' ecological footprints and awareness levels and the relationship between these variables.

## MATERIAL AND METHOD

### Sample Size

In this study, a cross-sectional research model was used. The population of this study comprised students enrolled at the Faculty of Medicine at Istanbul University in the academic year 2021-2022. In this study, the convenience sampling method, which is one of the non-random sampling methods, was used, and data were collected from those who accepted to participate within the specified time. The researcher prepared survey questions on the online Google forms platform and sent them to all students through the faculty of medicine's student office. The questionnaire was sent to the students only once to avoid duplication. Data were collected between 15 March and 15 April. The online survey was so that incomplete answers were not allowed, and the IP data of the participants were not kept in the records. Therefore, no duplicate IP was found when checked. In this context, 376 medical students agreed to participate, and 25 were excluded from the study due to incorrect data entries (marking two or more answers for any question). Therefore, the analysis was carried out using the data collected from 352 students. Ethical approval was obtained from Istanbul University Clinical Research Ethics Committee (Dated: 21/02/2020 E-312).

### Data Collection Tools

#### 1. Ecological Footprint Calculator

Fifteen questions in the Ecological Footprint Calculator of the Global Footprint Network were included in the survey form the researcher created. Although the calculator is publicly accessible, approval was obtained by e-mail from the system administrators. The questions in the Ecological Footprint Calculator tool have English and other language versions, but no Turkish language option exists. For this reason, the applicability of the questions was evaluated by translation and back-translation by English teachers (B.Y., P.G., E.A.) and as well as a native speaker (K.Y.). The final version of the tool with questions translated into Turkish was transferred to Google Forms by the researchers.

The final version of the tool with questions translated into Turkish was transferred to Google Forms by the researchers. Due to the presence of non-standardizable responses (nominal, open-ended, and continuous), validity and reliability analyses could not be performed for the measurement instrument. Due to this reason, only face validity has been conducted.

Among the 15 questions in total, the first and second questions focus on food consumption, questions from 3

to 10 are focused on the size of one's house, how many people live in the house, garbage production, renewable energy consumption, and questions from 11 to 15 are concerned with transportation, the status of driving a car or motorcycle, the characteristics of the vehicle or motorcycle being used, including fuel consumption, and the frequency of use of carpooling, public buses, and planes.<sup>10</sup>

Data from certain nations' National Footprint and Biocapacity Accounts supported the individual Footprint Calculator. The national per capita footprints can be assigned to various end-use categories (food, shelter, mobility, goods, and services) and land categories (forest, cropland, energy, fish, carbon, and grazing land). This yields a matrix that utilizes a country's average consumption profile to divide its Ecological Footprint across these many categories. The individual calculator asks questions that raise or reduce the values of various components of this matrix compared to the national average behaviour. For instance, if a person says they consume twice as much beef as the national average, their "beef" footprint will double, and their overall footprint score will be recalculated accordingly.

The calculation tool displays the ecological footprint result in terms of the type of land (built-up land, forest products, cropland, grazing land, fishing grounds, carbon footprint) and type of consumption (food, shelter, mobility, goods, services) as two different categories and their sub-categories. Additionally, it indicates how many additional equivalent planets would be required if everyone lived as the survey respondent did.<sup>11</sup> The main reasons for using data and tools from the Global Footprint Network in our study were that there are books, reports, and articles published annually about the concept of ecological footprint and case studies based on countries produced by the Global Footprint Network. In addition, the platform provides publicly accessible data on relevant topics (such as the ecological deficit, ecological footprint, and biocapacity) from many countries on the open data platform developed by the University of York and the Footprint Data Foundation.<sup>12</sup>

#### 2. Ecological Footprint Awareness Scale

The "Ecological Footprint Awareness Scale" developed by Coskun and Sankaya (2014) was used to determine the awareness levels of the participants regarding the concept of ecological footprint. This scale comprises five dimensions and 40 items. Cronbach's alpha values for 5 sub-dimensions vary between 0.55 and 0.87. These dimensions are food (Items 1 to 8), transportation and shelter (Items 9 to 15), energy (Items 16 to 27), waste (Items 28 to 35), and water consumption (Items 36 to 40). The scale is a five-point Likert-type scale, and

each item has the response options of "Strongly Agree," "Agree," "Partly Agree," "Disagree," and "Strongly Disagree". The standardised score to be obtained from the sub-dimensions of the scale is a minimum 1 and a maximum 5 and the scale is evaluated by calculating the sub-dimensions. The high score obtained from the scale indicates high awareness.<sup>13</sup>

### 3. Data on the World and Turkey

Ecological footprint parameters of the study for Turkey and the world were downloaded from the Global Footprint Network and analyzed in the form of land type (built-up land, forest products, cropland, grazing land, fishing grounds, carbon footprint).<sup>10</sup>

### Statistical Analysis

The Kolmogorov-Smirnov test results were examined to determine whether the scores obtained from the participants' responses demonstrated a normal distribution or not, and the histogram in which the normal distribution curve was drawn was examined with normal Q-Q and box-plot graphs. It was determined that the data did not demonstrate a normal distribution. In the data analysis, Mann-Whitney U test was used to compare paired groups and Kruskal-Wallis analysis was used for comparisons where the number of groups was more than two. Spearman correlation analysis was used to evaluate continuous variables. Correlation coefficients (r) were estimated as 0.0-0.19 "very weak", 0.20-0.39 "weak", 0.40-0.59 "moderate", 0.60-0.79 "strong", and 0.80-1.00 "very strong". The correlation between ecological footprint parameters (including dimensions) and ecological footprint awareness scale dimensions was examined by Spearman correlation analysis. The statistical significance level was accepted as  $p < 0.05$  for all research data, and the data were analyzed using SPSS Statistics for Windows, Version 21.0 (IBM Corp. Armonk, NY, USA)

### RESULTS

A total of 352 medical faculty students participated in the study and 204 (58%) of them were female. While 43 (12.2%) of the participants did not specify the class they were studying, the distribution of the classes was 72 (20.5%) from 2<sup>nd</sup> grade, 60 (17%) from 4<sup>th</sup> grade, 56 (15.9%) from 6<sup>th</sup> grade, 51 (14.5%) from 5<sup>th</sup> grade, 40 (11.4%) from 3<sup>rd</sup> grade, 30 (8.5%) from 1<sup>st</sup> grade. 73.6% of the students live in Province and 28.1% live in the Marmara region. While 46.6% of the students' mother's education level was university, 59.7% of the students' father's education level was university. Other characteristics are explained in detail in Table 1. Also, 275 (78.1%) of the students reported that

Variables	n (%)	Variables	n (%)
<b>Gender</b>		<b>Family type</b>	
Female	204(58.0)	Nuclear family	297(84.4)
Male	148(42.0)	Extended family	55(15.6)
<b>Place of residence (for longest)</b>		<b>Monthly income</b>	
Village or town	34(9.7)	Low	33(9.4)
District	59(16.8)	Medium	218(61.9)
Province	259(73.6)	High	101(28.7)
<b>The region where students lived the longest</b>		<b>Mother's educational level</b>	
Marmara region	99(28.1)	Primary school	67(19.0)
Central anatolia region	72(20.5)	Elementary School	32(9.1)
Mediterranean region	56(15.9)	High school	89(25.3)
Southeast anatolia region	39(11.1)	University	164(46.6)
Black sea region	38(10.8)	<b>Father's educational level</b>	
Eastern anatolia region	24(6.8)	Primary school	36(10.2)
Aegean region	24(6.8)	Elementary school	30(8.5)
		High school	76(21.6)
		University	210(59.7)

	Mean	Std. Deviation	Median	Minimum	Maximum
Earth number	4.1	1.1	3.9	2.0	9.9
Ecological footprint	6.6	1.7	6.3	3.2	16.1
Carbon footprint CO <sub>2</sub>	11.1	4.3	10.1	4.3	48.0
Carbon footprint/ecological footprint	56.0 %	7.1	56.0	2.4	75.0
<b>Land type ecological footprint</b>					
Carbon footprint gha	3.8	1.3	3.5	0.2	12.0
Fishing grounds	0.2	0.1	0.2	0.0	0.3
Grazing land	0.2	0.1	0.1	0.1	1.7
Cropland	1.6	0.4	1.6	0.5	2.8
Forest product	0.7	0.2	0.6	0.2	1.4
Built up land	0.2	0.1	0.2	0.1	2.1
<b>Consume type ecological footprint</b>					
Food	2.0	0.6	2.0	0.3	3.5
Shelter	1.8	1.2	1.5	0.0	12.0
Mobility	0.7	0.6	0.5	0.0	3.5
Services	1.0	0.3	1.0	0.3	2.9
Goods	1.1	1.1	1.0	0.0	19.0

environmental issues attracted their attention, while 224 (63.6%) reported that environmental issues were discussed in their families.

The average ecological footprint of the students was found to be 6.6 kha, and the average carbon footprint was determined as 11.1 tons per capita as CO<sub>2</sub> emissions. The students' values regarding ecological footprint parameters were summarised in Table 2.

**Table 3.** The relationship between the demographic variables of the participants and the relevant parameters of the ecological footprint

	Earth number	Ecological footprint	Carbon footprint CO <sub>2</sub>	Carbon footprint /Ecological footprint %
<b>Gender</b>				
Female	3.4(3.8-4.6)	5.5(6.3-7.5)	8.6(10.1-12.7)	52.0(56.0-60.0)
Male	3.4(3.9-4.6)	5.5(6.3-7.6)	8.2(10.1-13.0)	51.0(55.0-60.8)
p <sup>1</sup>	0.896	0.961	0.768	0.291
<b>Class</b>				
Grades 1-3	3.8(3.3-4.4)	6.2(5.5-7.2)	10(8.5-12.6)	56.0(52.0-60.0)
Grades 4-6	3.9(3.4-4.7)	6.4(5.5-7.7)	10.5(8.4-13.0)	56.0(51.0-60.0)
p <sup>1</sup>	0.267	0.251	0.422	0.767
<b>Mother's educational level</b>				
High school and lower	3.9(3.3-4.6)	6.4(5.3-7.5)	10.55(8.5-13.0)	56.5(52.0-61.0)
University	3.8(3.4-4.6)	6.2(5.5-7.5)	9.65(8.4-12.3)	55.0(50.3-59.0)
p <sup>1</sup>	0.550	0.524	0.110	0.008
<b>Father's educational level</b>				
High school and lower	4(3.4-4.7)	6.5(5.5-7.7)	10.7(8.6-13.6)	57.5(52-61.3)
University	3.8(3.4-4.5)	6.2(5.5-7.4)	9.8(8.2-12.4)	55.0(51.0-59.0)
p <sup>1</sup>	0.131	0.115	0.017	0.003
<b>Income level</b>				
Low	3.8(3.4-4.9)	6.3(5.6-8.1)	10.6(8.3-14.3)	59.0(49.0-64.0)
Moderate	3.8(3.3-4.6)	6.2(5.4-7.5)	10.1(8.4-12.7)	56.0(52.0-60.0)
High	3.9(3.4-4.6)	6.4(5.5-7.5)	9.9(8.7-12.8)	55.0(51.0-58.0)
p <sup>2</sup>	0.642	0.530	0.486	0.461
<b>Place of residence</b>				
District or village-town	3.3(3.8-4.7)	5.4(6.3-7.6)	8.3(10.6-13.8)	53.0(57.0-61.0)
Province	3.4(3.9-4.6)	5.5(6.3-7.5)	8.5(10.0-12.6)	51.0(55.0-59.0)
p <sup>1</sup>	0.961	0.967	0.360	0.044
<b>Are you interested in environmental issues?</b>				
Yes	4.3(3.5-4.9)	6.9(5.7-7.9)	10.8(8.8-13.3)	56.0(51.0-60.0)
No	3.8(3.3-4.5)	6.2(5.4-7.4)	10.0(8.4-12.6)	56.0(51.0-60.0)
p <sup>1</sup>	0.007	0.007	0.042	0.936

1: Mann-Whitney U test.  
2: Kruskal-Wallis test. Values in the table are averages, and numbers in brackets represent 95% confidence intervals.

**Table 4.** Statistics of the ecological footprint awareness scale and its dimensions

	Mean	Std. Deviation	Median	Minimum	Maximum
<b>Nourishment</b>	2.9	0.5	3.0	1.0	4.1
<b>Transportation and accommodation</b>	3.1	0.7	3.1	1.0	5.0
<b>Energy</b>	4.1	0.7	4.2	1.2	5.0
<b>Waste</b>	3.6	0.8	3.6	1.0	5.0
<b>Water consumption</b>	4.0	0.8	4.0	1.0	5.0
<b>The overall average of the scale</b>	3.6	0.5	3.6	1.1	4.8

The ratio of carbon footprints to ecological footprints of students with their mother's education level ( $p=0.008$ ), both carbon footprint and the ratio of carbon footprint to ecological footprint, were found to be statistically significant with the father's education level ( $p=0.017$ ,  $0.003$ , respectively). The ratio of carbon footprints to ecological footprints of students living in the district village or town was found to be significantly higher than the students living in the provinces ( $p=0.044$ ). The earth number, ecological footprint, and carbon footprint value (CO<sub>2</sub>) of students who are interested in environmental issues are statistically higher than those who are not interested, and the difference between them was found to be significant ( $p=0.007$ ,  $0.007$ ,  $0.042$  respectively). These differences are presented in Table 3. However, there was no such difference in other demographic variables of the participants.

According to the ecological footprint awareness scale results, the highest awareness of the students was in the energy sub-dimension ( $\bar{X}=4.1$ ), while the lowest awareness was in the nourishment sub-dimension ( $\bar{X}=2.9$ ). Measurements of the participants' ecological footprint awareness scale and its dimensions were presented in Table 4.

When the sub-dimensions of the ecological footprint awareness scale are examined whether there is not a difference between female and male students; in the nourishment (female: 3.0, male: 2.9,  $p=0.380$ ), transportation and accommodation (f:3.1, m:3  $p=0.360$ ), energy (f:4.2, m:4.3,  $p=0.710$ ), waste (f:3.8, m:4.3  $p=0.970$ ), water consumption (f:4.0, m:4.1,  $p=0.550$ ). At the same time, no difference was observed between all sub-dimensions of the ecological footprint awareness scale and other sociodemographic variables. Negative and significant correlations were determined between the participants' ecological footprint awareness scale average scores (total average score) and the earth number, ecological footprint, and carbon footprint CO<sub>2</sub> values ( $p<0.001$ ). Again, a negative and significant correlation was determined (Table 5) when the correlation between ecological footprint awareness scale dimensions (nourishment, transportation and accommodation, energy, waste, water consumption) and ecological footprint parameters (earth number, ecological footprint, carbon footprint CO<sub>2</sub>, carbon footprint /ecological footprint, carbon footprint gha) was evaluated.

The ecological footprint of the world was calculated as 2.77 gha, of Turkey as 3.34 gha and of the students as 6.6 gha. The comparisons of the land type ecological footprint of the world, Turkey, and the students participating in the study were presented in Figure.

## DISCUSSION

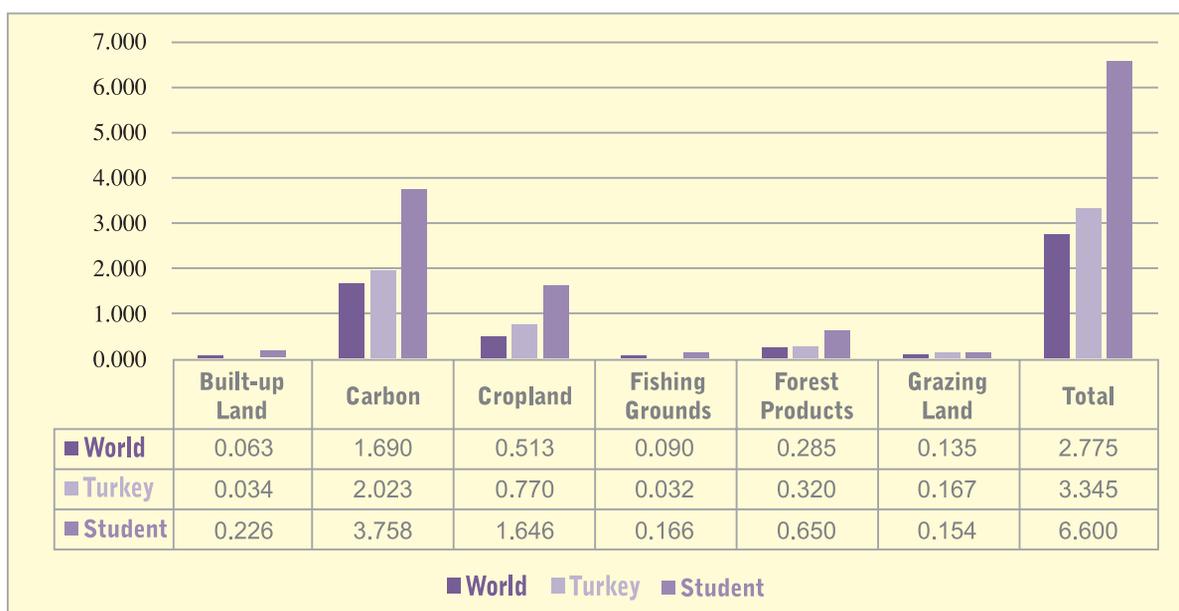
Istanbul University Faculty of Medicine is in a location that can be considered central, but it does not cover a large area and does not have a campus environment. It does not provide a private gym for students to perform sports activities, dormitories for students' accommodation, and cafés, restaurants, etc., for leisure activities (existing ones are common areas with patients). The faculty of medicine offers students limited opportunities, and students must provide themselves with their basic needs, such as accommodation, food and beverage, and transportation. In this regard, it was determined that the ecological footprint average of the students (6.6 gha/person) was higher than the average of Turkey (3.28 gha/person) regardless of gender. The reason for the difference between the students' ecological footprint level and Turkey's ecological footprint may be that the official institutions in Turkey do not have data on ecological footprint, and the data used by the researchers for comparison belong to 2019. Therefore, the ecological footprint level for Turkey has already been increasing over the years. As in the rest of the world, the onset of globalization in Turkey has caused a rise in environmental issues. As a result, ecological deficits began to appear in the 1980s. In the second decade of the twenty-first century, the ecological debt exceeded an area of about 250 million global hectares.<sup>14,15</sup> There is no dormitory at Istanbul University Faculty of Medicine, students frequently use buses and cars for transportation, students often visit the city where their families live, students consume fast food, and fast food is not like vegetables and fruits. Still, meat-containing ready-to-eat foods (hamburgers, pita bread, doner kebab, etc.), there is a lack of energy insulation due to the low budget of these foods, students

**Table 5.** The correlation between ecological footprint awareness scale dimensions and ecological footprint parameters

		Earth number	Ecological footprint	Carbon footprint CO <sub>2</sub>	Carbon footprint / Ecological footprint
<b>Nourishment</b>	rs	-0.245	-0.242	-0.208	-0.076
	p*	<0.001	<0.001	<0.001	0.153
<b>Transportation and accommodation</b>	rs	-0.111	-0.108	-0.071	-0.001
	p*	0.038	0.043	0.184	0.978
<b>Energy</b>	rs	-0.161	-0.156	-0.148	-0.094
	p*	0.003	0.003	0.006	0.077
<b>Waste</b>	rs	-0.147	-0.147	-0.111	-0.016
	p*	0.006	0.006	0.038	0.771
<b>Water Consumption</b>	rs	-0.118	-0.118	-0.110	-0.068
	p*	0.027	0.027	0.040	0.201
<b>Ecological footprint awareness scale total score</b>	rs	-0.220	-0.217	-0.189	-0.081
	p*	<0.001	<0.001	<0.001	0.129

rs: Spearman's correlation coefficient, \*: Spearman's rank correlation test

in houses far from the university and used vehicles every day. Students consume more paper products than the average citizen can explain the reasons for the high ecological footprint levels. In a study conducted in Spain, it was concluded that the ecological footprint level of university students was between 3.67-4.17 gha/person and was lower than the national ecological footprint level.<sup>1</sup> A study conducted in India concluded that the average ecological footprint level of university students was 5.58 gha/person and was much higher than the national level.<sup>16</sup> The top 5 countries with the highest ecological footprint (data for the year 2022) in the world are Qatar (13.13 gha/person), Luxembourg (10.99 gha/person), United Arab Emirates (8.71 gha/person),



**Figure.** Ecological footprint dimension comparison of the world, Türkiye, and students

Bahrain (8.18 gha/person), and Estonia (8.12 gha/person).<sup>17</sup> In our study, carbon footprint constituted 56% of the ecological footprint levels of the students. A study conducted in the Philippines determined this rate to be 46%. This indicates that students are more likely to travel and purchase goods.<sup>18</sup> As in the world, the most contribution to the increase in the ecological footprint in Turkey is caused by carbon.<sup>17,19</sup> Various studies have examined the emergence of environmental sustainability in anxiety and behavior in terms of gender. Some studies revealed that women were highly interested in and sensitive to environmental issues. In contrast, some of the studies revealed that they were not affected by the gender variable.<sup>2,16,20,21</sup> For example, in a study conducted in Spain, it was determined that men contributed more to green gas emissions and that women contributed to greenhouse gases, especially in purchasing and using personal vehicles.<sup>22</sup> In this study, however, students' ecological footprint level (consume type and land type dimensions) and ecological footprint awareness (including all dimensions) did not differ according to gender. In the study conducted by Chen et al. no significant gender-based difference was observed in attitudes towards the environment.<sup>23</sup>

Similar to global values, it was determined that the ecological footprint values of families with high income in Turkey were higher than those of families with low income, and this was also reflected in the ecological footprint values of students.<sup>3,19,23</sup> In a study conducted with medical students in Sri Lanka, it was determined that the carbon footprint of students increased gradually with increasing household income.<sup>24</sup> In this study and some similar studies, no significant results were defined regarding ecological footprint level and awareness of students according to income levels.<sup>2</sup> This may be because families provide an average allowance so that students can survive (as we cannot directly measure the amount students spend) or families with relatively high incomes prefer private universities or universities abroad. The ratio of carbon footprints to ecological footprints of students with their mother's education level ( $p=0.008$ ), both carbon footprint and the ratio of were found to be statistically significant with the father's education level ( $p=0.017$ ,  $0.003$ , respectively).

The education level of the students' parents caused a significant difference in the carbon footprint and the ratio of the carbon footprint to the ecological footprint. However, parents' education level (including other socioeconomic variables) did not cause a difference in students' ecological footprint awareness levels. Unlike our result, other studies have found that increasing

the education level of parents and discussing environmental issues in the family cause a significant difference between the dimensions of ecological footprint awareness.<sup>13,25</sup> In the study conducted by Kanbak, it was found that the environmental attitude scores of the students did not make a significant difference according to the mother's education, but made a significant difference according to the father's education.<sup>26</sup> Although not significant, earth number, ecologic footprint and carbon footprint values of the students living in the city for a long time were found to be higher than the students living in the district village-town. As expected, there are studies showing that the ecological footprint levels of those living in the city are high.<sup>1,27</sup> In our study, the reason why the ratio of carbon footprint value to ecological footprint value was higher in those living in district village or town compared to those living in the province may be due to the fact that other components of ecological footprint (fishing grounds, grazing land, cropland, forest product, built-up land) were relatively low.<sup>7</sup> In our study, ecological footprint values of students who were interested in environmental issues were found to be significantly higher than other students. It is worrying that the behaviors of these people who try to connect with and understand nature have a bad impact on nature. Similar to our study, it is observed that students who express that they are happier in nature and adopt pro-environmental attitudes exhibit contradictory anti-environmental behaviors.<sup>1,28</sup>

Weak and negative correlations were determined between ecological footprint, carbon footprint, earth number values, and all ecological footprint awareness scale dimensions. These results can be interpreted as "the calculated ecological footprint value decreased slightly as the ecological footprint awareness of the students increased." Similarly, a study conducted in Turkey determined that environmental awareness turned into positive behavior.<sup>29</sup> However, in some other studies in the literature, it was determined that environmental awareness did not affect the sustainable environmental behaviors of students.<sup>1,26,30</sup> Although awareness and behavior are different concepts, the transformation of awareness into behavior is multidimensional and is affected by various variables.<sup>28</sup> In our study, the students' awareness of the ecological footprint but their high ecological footprint may be due to the fact that the university campus is not pro-environmental, the lack of practices related to sustainability and an urban life. Traditionally, raising awareness through environmental education has been adopted as a way to achieve the goal of behaviour change. However, studies have emphasised that there is an inconsistency between knowledge and behaviour

change, as mentioned above in some studies. It has been stated that the effects of knowledge on behaviour are indirect; that is, other variables affect behaviour, which is complex and multidimensional.<sup>31</sup>

### Strengths and Limitations

The strength of our study is that it is the first to investigate the ecological footprint of medical school students in Turkey, both as a calculation tool and as an awareness dimension. However, since medical faculties from different provinces could not be evaluated. Moreover, the ecological footprint calculation tool did not have a Turkish alternative, the difficulty in finding an answer to the question "What percentage of your home's electricity comes from renewable sources?" and the inability of the researchers to find a definite answer was among the limitations of this study.

### CONCLUSIONS

It was determined that the ecological footprint decreased with the increase in students' awareness about the ecological footprint, but this correlation was weak. Therefore, public authorities, local government units, universities, and non-governmental organizations should act together and lead a sustainable life style to change the behavior pattern created by the consumption culture of students. In addition to this, university infrastructures should be arranged in a way that encourages students to act environmentally sensitively. In this period, when we are experiencing the significant effects of climate change, we can prevent the occurrence of environmental or health crises by reducing the use of unnecessary natural resources at both individual and organizational levels.

\*The authors declare that there are no conflicts of interest.



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