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Evaluation of One Health Concept and Climate Change Awareness Among Cukurova University Students

One Health Concept and Climate Change Awareness

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Abstract: **Objective:** The One Health concept is an approach that evaluates human, animal, and environmental health together, and its importance is increasingly recognized. Climate change is related to the One Health concept and is a significant public health issue. Awareness of these topics, especially among young people, is crucial. This study aims to evaluate Cukurova University students' knowledge of the One Health concept and their awareness of climate change.

Method: The cross-sectional research was conducted in September 2024 at the Department of Public Health, Cukurova University. The study population consisted of students from Cukurova University, with 217 students participating in the research. The data collection form included sociodemographic information, questions related to the One Health concept and global climate change, along with the Global Climate Change Awareness Scale (GCCAS). The Shapiro-Wilk test, Chi-square, Mann-Whitney U, and Kruskal-Wallis tests were utilized for data analysis, followed by post-hoc analysis. A p-value of less than 0.05 was considered statistically significant.

Results: The average age of the students was 23.02±3.94 years. Among the university students included in the study, 53.5% considered themselves uninformed about the One Health concept. There was no significant difference between medical faculty students and those from other faculties in terms of their self-assessed knowledge of the One Health approach and awareness of global climate change. The students' awareness of global climate change was found to be moderate. Their awareness of the sub-dimensions related to natural and human environments and energy consumption was high, while their awareness of global organizations, agreements, and the causes of climate change was moderate.

Conclusion: It can be suggested that there are deficiencies in undergraduate education, particularly in medical education, regarding the One Health approach and global climate change. We recommend that more emphasis be placed on the topics of One Health and climate change in undergraduate curricula.

Keywords: One Health, Climate Change, Awareness

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INTRODUCTION

One Health is an integrative approach aimed at improving the health of humans, animals, and the environment (1). According to the CDC's definition, One Health is a collaborative, multi-sectoral, and interdisciplinary approach that works at local, regional, national, and global levels to achieve optimal health outcomes by recognizing the interconnectedness between humans, animals, plants, and their shared environment. A successful One Health approach is made possible through collaborative efforts. Health professionals, including doctors, nurses, public health experts, and epidemiologists, work alongside animal health specialists (veterinarians, agricultural workers), environmental scientists (ecologists, wildlife specialists), and other fields. The concept of One Health is not new; however, it has gained prominence in recent years. One of the primary reasons for this is the increase in human population and its expansion into new geographical areas, resulting in more individuals living in close contact with both wild and domesticated animals (2). Some areas encompassed by One Health include food safety, the control of zoonotic diseases (diseases transmitted from animals to humans), combating antibiotic resistance, climate change, and the impacts of climate on the health of animals, ecosystems, and humans (3).

Climate change refers to any alterations in climate over time; these changes may arise from natural fluctuations or human activities. Climate change is a direct cause of humanitarian emergencies resulting from heatwaves, wildfires, floods, tropical storms, and hurricanes, increasing their scale, frequency, and intensity (4). Intense short-term temperature fluctuations lead to significant health impacts due to extreme heat (hyperthermia) and extreme cold (hypothermia), increasing mortality rates associated with cardiovascular and respiratory diseases. Climate-related illnesses, such as diarrhea, malaria, and malnutrition, contribute to a significant number of deaths worldwide (5).

The One Health approach, which allows for a holistic assessment of human health in relation to

animal and environmental health, and the concept of climate change, which has started to affect human health more significantly in recent years, are important societal concepts. Actions to mitigate the effects of climate change are crucial both at the individual and societal levels. The most important point here is to raise awareness regarding climate change. The awareness of young people on this issue is also of particular significance. This study aims to evaluate university students' awareness of the One Health approach and climate change.

METHOD

This cross-sectional study was conducted in September 2024 at the Department of Public Health at Çukurova University. Ethical approval was received from the Çukurova University Faculty of Medicine Research Ethics Committee dated 04.10.2024 and numbered 148. The population of the study consisted of students from Çukurova University. Considering a power of 80%, α error: 0.05, and a two-tailed test, the minimum sample size required was determined to be 199. A total of 217 students were reached using a convenience sampling method. No exclusion criteria were determined, and Çukurova University students who agreed to participate in the study and filled out the online survey were included in the study. The online questionnaire explained the purpose of the research, stating that the information obtained through the research form would be used for scientific purposes, evaluated in accordance with scientific ethical standards, and would not be used for any other purposes. Access to the questionnaire was granted only if the participants accepted these conditions. The data collection form included sociodemographic information, questions related to the One Health approach and climate change, and the Global Climate Change Awareness Scale (GCCAS). The questions regarding the One Health approach and climate change examine participants' knowledge levels on these, sources of information, the scope of the subjects, and their awareness of the effects of climate change on health.

Global Climate Change Awareness Scale (GCCAS)

The GCCAS was developed by Deniz and colleagues in 2020 and consists of 21 items across four sub-dimensions (6). Items 1 to 9 pertain to the dimension of Impacts on Natural and Human Environments, items 10 to 15 relate to the dimension of Awareness of Global Organizations and Agreements, items 16 to 18 address the dimension of Underlying Causes, and items 19 to 21 are concerned with the dimension of Energy Consumption Relationship. There are no negatively coded items in the scale. All dimensions can be summed. The scale yields a maximum score of 105 and a minimum score of 21. Additionally, the total score averages for the scale and its sub-dimensions are interpreted as follows after dividing by the number of items: a score between 1-2.33

indicates low awareness, 2.34-3.66 indicates moderate awareness, and 3.67-5.00 indicates high awareness. The Cronbach alpha coefficient calculated to determine the internal consistency of the scale is 0.826.

Statistical Analysis

The data analysis was conducted using SPSS 21 software. Qualitative data were presented as frequency and percentage, while quantitative data were reported as arithmetic mean, standard deviation, and median. The Shapiro-Wilk test was employed as a normality test. Chi-square, Mann-Whitney U, and Kruskal-Wallis tests were utilized for data analysis, followed by post-hoc analysis. A p-value of less than 0.05 was considered statistically significant.

Table 1. Sociodemographic Characteristics		
Characteristics	mean±SD	median(min-max)
Age	23.02±3.94	23(18-55)
Characteristics	n	%
Gender		
Male	77	35.5
Female	140	64.5
Marital status		
Married	10	4.6
Single	204	94
Other	3	1.4
Faculty		
Medical	115	53
Non medical	102	47
Mother's education level		
Illiterate	18	8.3
Literate	17	7.8
Primary school	54	24.9
Middle school	12	5.5
High school	42	19.4
University and above	74	34.1
Father's education level		
Illiterate	4	1.8
Literate	7	3.2
Primary school	49	22.6
Middle school	16	7.4

Table 1. Sociodemographic Characteristics		
Characteristics	mean±SD	median(min-max)
High school	43	19.8
University and above	98	45.2
Income level		
≤17.002	138	63.6
17.003-34.004	51	23.5
≥34.005	28	12.9
Place of longest residence		
City center	150	69.1
District	51	23.5
Village	16	7.4
Presence of healthcare worker in family		
Yes	83	38.2
No	134	61.8
Family member working in animal health		
Yes	12	5.5
No	205	94.5
Family member working in food health		
Yes	15	6.9
No	202	93.1
Family member working in environmental health		
Yes	3	1.4
No	214	98.6

RESULTS

The average age of the 217 university students included in the study is 23.02±3.94 years. Of the participants, 64.5% are female, 94% are single, and 53% are medical school students. Information regarding the sociodemographic characteristics of the participants is presented in Table 1.

Of the university students included in the study, 53.5% believe they are not knowledgeable about the concept of “One Health.” Only 15.7% of the participants have gained knowledge as part of their education. When asked “What comes to mind when you hear the term One Health approach?” 85.7%

responded with the integration of human, animal, and environmental health. Additionally, 77.9% of participants think they have knowledge about climate change, with 40.1% acquiring information from publications. When asked “What comes to mind when you hear the term climate change?” 58.8% answered “Changes in the average state and/or variability of the climate.” Furthermore, 58.1% believe they understand the health impacts of climate change. The diseases most frequently associated with climate change, in order, are water-related diseases (96.3%), respiratory diseases (95.9%), and infections (94.5%) (Table 2).

Table 2. Participants' knowledge about the one health approach and climate change		
CHARACTERISTICS	n	%
Belief in Knowledge of One Health Approach		
Yes	24	11.1
No	116	53.5
Unsure	77	35.5
Sources of Information on One Health Approach		
From a friend	19	8.8
From social media	18	8.3
From publications (articles,journals,books)	16	7.4
As part of my education	34	15.7
First Association with the One Health Approach		
Evaluation of human, animal and environmental health together	186	85.7
Evaluation of human and environmental health together	22	10.4
Evaluation of human and animal health together	5	2.3
Evaluation of animal and environmental health together	4	1.8
Scope of One Health Approach According to Participants		
Environmental health (water, air pollution, climate change)	213	98.2
Food safety and foodborne diseases	211	97.2
Zoonotic diseases	199	91.7
Antimicrobial resistance	196	90.3
Vector-borne diseases	195	89.9
Laboratory services	166	76.5
Others	45	20.7
Belief in knowledge of Climate Change		
Yes	169	77.9
No	11	5.7
Unsure	37	17.1
Sources of Information on Climate Change		
From a friend	8	3.7
From social media	83	38.2
From publications (articles,journals,books)	87	40.1
As part of my education	24	11.2
First Association with climate change		
Changes in average climate conditions and/or variability	127	58.8
Natural events caused by temperature changes	50	23
Decrease in ozone	15	6.9
Temperature extremes	14	6.5
Heat/cold waves	5	2.3
Air pollution	4	1.8
Changes in air and their effects on living beings	1	0.5
Awareness of Health Effects of Climate Change		
Yes	126	58.1
No	26	12
Unsure	65	30
Health effects of climate change according to participants		
Cardiovascular diseases	189	87.1
Respiratory diseases	208	95.9
Cerebrovascular diseases	178	82
Infections	205	94.5
Gastrointestinal diseases	184	84.8
Psychiatric disease	188	86.6
Vector-borne diseases	183	84.3
Water-related diseases	209	96.3
Skin diseases	203	93.5
Eye diseases	183	84.3
Immune system diseases	189	87.1

When comparing the faculties of students included in the study with regard to their belief in knowledge, there was no significant difference between medical faculty students and other students (p: 0.688). However, in the questions regarding the scope of One Health Approach, students who believed that antimicrobial resistance, zoonotic

diseases, vector-borne diseases, food safety, foodborne diseases, and environmental health were included in the scope of One Health Approach were found to be significantly higher among medical faculty students (p values: 0.018, 0.006, 0.011, 0.008, 0.047 respectively) (Table 3).

Table 3. Comparison of students knowledge status regarding one health

Characteristic		Faculty		Total n(%)	p
		Medical faculty n(%)	Other faculties n(%)		
Belief in having knowledge about One health	Yes	11(9.6)	13(12.7)	24(11.1)	0.688
	No	64(55.7)	52(51)	116(53.5)	
	Not sure	40(34.8)	37(36.3)	77(35.5)	
	Total	115(100)	102(100)	217(100)	
Scope of one health					
Antimicrobial resistance	Yes	109(94.8)	87(85.3)	196(90.3)	0.018
	No	6(5.2)	15(14.7)	21(9.7)	
Zoonotic diseases	Yes	111(96.5)	88(86.3)	199(91.7)	0.006
	No	4(3.5)	14(13.7)	18(8.3)	
Vector-borne diseases	Yes	109(94.8)	86(84.3)	195(89.9)	0.011
	No	6(5.2)	16(15.7)	22(10.1)	
Food safety and foodborne diseases	Yes	115(100)	96(94.1)	211(97.2)	0.008
	No	0(0)	6(5.9)	6(2.8)	
Environmental health	Yes	115(100)	98(96.1)	213(98.2)	0.047
	No	0(0)	4(3.9)	4(1.8)	
Laboratory services	Yes	88(76.5)	78(76.5)	166(76.5)	0.993
	No	27(23.5)	24(23.5)	51(23.5)	
Other	Yes	23(20)	22(21.6)	45(20.7)	0.907
	No	92(80)	80(78.4)	172(79.3)	
	Total	115(100)	102(100)	217(100)	

The information regarding the scores obtained by the participants included in the study from the Global Climate Change Awareness Scale is presented in Table 4. Additionally, when evaluating the average scores obtained by dividing the total scores of the scale and its sub-dimensions by the number of questions, the average total score of the participants for the Global Climate Change Awareness Scale was found to be 3.54±0.89. For the sub-dimension

of Natural Human Environments, it was 3.98±1.02; for the sub-dimension of Global Organizations and Agreements, it was 2.93±1.27; for the sub-dimension of Causes of Global Climate Change, it was 3.00±1.26; and for the sub-dimension of Energy Consumption, it was 3.94±1.11. Accordingly, the awareness of the students regarding global climate change is considered to be at a medium level. The awareness in the sub-dimensions of Natural Human

Environments and Energy Consumption was found to be at a high level, while the awareness regarding Global Organizations and Agreements and the

Causes of Climate Change was determined to be at a medium level.

Table 4. Scores Obtained by Participants from the GCCAS

	Average±SD	Median(min-max)
Total score of GCCAS	74.35±18.72	73 (21-105)
Dimension of Effects on Natural and Human Environments	35.90±9.22	38(9-45)
Dimension of Awareness of Global organizations and agreements	17.60±7.64	18 (6-30)
Dimension of causes	9±3.79	9 (3-15)
Dimension of enegy consumption relation	11.83±3.33	12 (3-15)

When comparing the scores obtained from the Global Climate Change Awareness Scale based on the participants' gender, faculty, marital status, income status, longest place of residence, having a healthcare professional in the family, or having a family member working in food, animal, or environmental health, no statistically significant difference was found (Table 5). When comparing the scores obtained from the Global Climate Change Scale based on

the educational status of the participants' parents, the sub-factors of the scale and the total scores were higher in participants with highly educated parents. (Table 5) Among the participants, those who believed they were knowledgeable about global climate change scored higher in sub-factor 1, sub-factor 4, and total scale scores compared to those who did not believe they were knowledgeable (in order of p:0,001, p:0,005, p:0,033) (Table 5).

Table 5. comparison of participants scale scores based on certain characteristics

Characteristics	Factor 1 ^a Medyan(IQR)	Factor 2 ^b Medyan(IQR)	Factor 3 ^c Medyan(IQR)	Factor 4 ^d Medyan(IQR)	GCCAS total Medyan(IQR)
Gender					
Male	36(13)	15(14)	9(6)	13(6)	71(23)
Female	39(18)	18(12)	9(6)	12(6)	77.5(24.75)
p	0.170	0.152	0.660	0.594	0.419
Faculty					
Medicine	36(11)	18(12)	9(6)	13(5)	75(22)
Non medicine	38(18)	16.5(14)	9(12)	12(6)	71(29.75)
p	0.835	0.716	0.822	0.282	0.323
Marital status					
Single	38(15.75)	18(12)	9(6)	12.5(6)	74(23.75)
Married/divorced/widowed	37(20.5)	16(9.5)	6(5.5)	9(7.5)	63(36)
p	0.779	0.964	0.052	0.073	0.272
Income level					
≤17.002	37.5(16.25)	18(12)	9(6)	12(6)	73(23)
17.003-34.004	39(12)	17(14)	8(5)	13(6)	76(25)
≥34.005	41(18)	15.5(15.5)	9(10.5)	13.5(6)	72(40)
p	0.762	0.861	0.548	0.874	0.908
Longest lived location					
City center	38(17.25)	17(13)	9(6)	12(6)	72(23)

Table 5. comparison of participants scale scores based on certain characteristics

Characteristics	Factor 1 ^a Medyan(IQR)	Factor 2 ^b Medyan(IQR)	Factor 3 ^c Medyan(IQR)	Factor 4 ^d Medyan(IQR)	GCCAS total Medyan(IQR)
District	37(13)	18(12)	9(6)	12(6)	75(23)
Village	42(26)	15(19.75)	7.5(9.75)	14(9)	74(49.25)
p	0.890	0.540	0.796	0.669	0.930
Mother's education level					
Illiterate	30.5(22.5)	12.5(7)	6.5(3.75)	9(7.25)*	63.5(38.5)*
Literate	36(13)	16(9)	7(4.5)	12(6)	70(24.5)
Primary school	39(11)	18(16.5)	9(6)	14(5.25)	78(31.25)
Middle school	42.5(14)	18(15)	8.5(7)	15(5)*	79(30.5)
High school	36(18)	18(12.25)	9(6)	12(6)	73.5(24.75)
University and above	39(13)	17(12.5)	9(7)	13(4.25)*	74(25.25)*
p	0.143	0.107	0.148	0.005	0.045
Father's education level					
Illiterate	19.5(25,75)	12(3)	6(3.75)	8(7.25)	45(33.25)
Literate	27(19)	12(8)	6(6)	7(4)*	59(23)*
Primary school	39(14)	18(13.5)	9(6)	14(6)*	76(29.5)
Middle school	36(15.75)	18(10.5)	7.5(5.75)	12(6)	74(24)
High school	39(16)	18(12)	9(5)	13(6)	73(22)
University and above	39(12.25)	17.5(13)	9(6.25)	13(4)*	76(24.5)*
p	0.164	0.150	0.319	0.020	0.021
Presence of a healthcare worker in the family					
Yes	39(18)	18(12)	9(6)	12(6)	73(26)
No	37.5(13.25)	17(12)	9(6)	12(6)	73.5(22)
p	0.332	0.790	0.433	0.756	0.655
Presence of a family member working in animal health					
Yes	39.5(16)	15.5(16,5)	9(8.5)	13.5(5.5)	73.5(26.75)
No	38(16.5)	18(12)	9(6)	12(6)	73(23.5)
p	0.566	0.692	0.621	0.731	0.985
Presence of a family member working in environmental health					
Yes	41	16	9(4)	13	75
No	38(17.25)	18(12)	9(6)	12(6)	74(23)
p	0.940	0.512	0.967	0.875	0.959
Presence of a family member working in food health					
Yes	36(18)	18(19)	9(8)	13(6)	75(41)
No	38(16.25)	18(12)	9(6)	12(6)	73(23)
p	0.971	0.517	0.633	0.647	0.818
Perception of knowledge on the one health approach					

Table 5. comparison of participants scale scores based on certain characteristics

Characteristics	Factor 1 ^a Medyan(IQR)	Factor 2 ^b Medyan(IQR)	Factor 3 ^c Medyan(IQR)	Factor 4 ^d Medyan(IQR)	GCCAS total Medyan(IQR)
Yes	38(15)	22(13.75)	9(6.5)	12(6.5)	82.5(31.5)
No	37(15.5)	17(14)	9(6.75)	12(6)	72(21.75)
Not sure	39(18)	17(11)	9(6)	13(6)	77(26.5)
p	0.988	0.159	0.436	0.654	0.492
Perception of knowledge on climate change					
Yes	39(12)*	17(13.5)	9(6)	13(5.5)*	75(26.5)*
No	27(9)*	18(3)	9(3)	9(5)*	63(33)
Not sure	36(18)	17(10.5)	9(6.5)	12(7)*	70(26.5)*
p	0.001	0.962	0.624	0.005	0.033

*Post hoc analysis of groups with significant differences: Effects on the Natural and Human Environment

b: Awareness of Global Organizations and Agreements

c: Underlying Causes

d: Relationship with Energy Consumption

DISCUSSION

In our study, 53% of the participants are medical faculty students. Of all the students included in the study, 53.5% stated they were not aware of the “One Health” concept, 35.5% were unsure, and 11.1% believed they were knowledgeable. They indicated their sources of information as part of my education (15.7%), friends (8.8%), and social media (8.3%). In a study conducted with senior students from the faculties of medicine, veterinary medicine, and environmental engineering at Uludağ University in Bursa in 2023 (n=518), 73.7% of the students reported not knowing the “One Health” concept (7). In the same study, 69.1% (n=94) of the students who had heard of the “One Health” concept during their undergraduate education acknowledged receiving education on this topic, with 21.3% citing friends and 9.6% citing social media as their sources of information (7). In a study conducted with interns from the Ege University Faculty of Medicine, 40.2% of the 316 participants stated they had not heard of the “One Health” concept before (8). In a study by Gedik and colleagues involving 165 health management students, it was found that 75.8% had not previously heard of the “One Health” concept (9).

In our study, no significant difference was found between the responses of medical faculty students and students from other faculties regarding whether they considered themselves knowledgeable about the “One Health” concept. It might be expected that students from the medical faculty would be more knowledgeable about the “One Health” concept compared to students from other faculties; however, the findings do not support this. This finding could be significant as it suggests insufficient education on this topic in medical faculties. In questions related to the scope of Public Health, medical faculty students were more likely to respond affirmatively. However, this might not necessarily indicate that they received education on Public Health since medical faculty students are generally expected to have more knowledge on these topics compared to students from other faculties due to their medical education.

77.9% of the participants in our study believed they were knowledgeable about global climate change (GCC). They identified their sources of information as publications (40.1%) and social media (38.22%). In a study by Ek et al., 75% of the students stated they had knowledge about GCC, with 78% citing visual media as their source of information (10). In research conducted by Uzun, it was found that 50.9% of the students had no knowledge about GCC (11).

In a study conducted by Yavuz with medical faculty students, all students had heard of the concepts of global warming and climate change before. The most cited sources of information on climate change were the internet/social media at 94.5% (12). The majority of students in the included studies were found to be knowledgeable about GCC, but the internet/social media, visual media, and publications were prominent as sources of information. This is significant as it suggests that GCC is not sufficiently covered in students' education. In our study, students' awareness of global climate change was found to be moderate. Their awareness of the sub-dimensions of impacts on the natural and human environment and energy consumption was high; awareness in other sub-dimensions was moderate. In a study conducted with Giresun University students in 2023 using the same scale, GCC awareness was also found to be moderate, with high awareness in the dimensions of impacts on the natural and human environment and energy consumption, and moderate awareness in other sub-dimensions (13). The findings of this study are similar to ours. Various studies conducted in our country show that students have heard of the concept of global climate change, but their levels of awareness vary. (14-16)

In our study, no significant difference was found between the scores obtained from the Global Climate Change Awareness Scale (GCCAS) between male and female genders. In a study conducted by Yörük et al. on university students, male students were found to have higher scores on the GCCAS (13). In our study, when comparing the GCCAS scores of students based on their parents' education levels, it was found that the dimension related to energy consumption and the total scale scores were higher among those with parents having a higher level of education. In a 2023 study conducted with medical faculty students, it was found that students whose fathers had an education level of high school or above had a higher knowledge of climate change (12). This finding suggests that increasing the level of education, beginning with the family, which is the smallest and most important unit of society, may

enhance climate change awareness in communities.

A significant difference was observed in the GCCAS scores among those who believed they had knowledge about global climate change. Those who considered themselves knowledgeable obtained higher scores on the GCCAS. In a study, students who thought they had the necessary knowledge and skills to assess the health impacts of climate change were found to have higher knowledge scores compared to those who did not perceive themselves as having the necessary knowledge and skills (12). Students seeing themselves as competent in this area could be associated with the level of their existing knowledge.

In our study, no significant difference was found between the GCCAS scores of medical faculty students and students from other faculties. This finding might suggest that sufficient information is not provided on global climate change in medical education. In a study conducted in 2023 with students from the faculties of medicine, environmental engineering, and veterinary medicine at Uludağ University in Bursa, it was found that environmental engineering students knew this concept at a higher rate compared to medical and veterinary medicine students (7). The differences among faculties might be related to the emphasis placed on the concept of climate change in undergraduate education.

Limitations of the study

The limitation of our study is that the survey was conducted online rather than face-to-face, and the convenience sampling method was used. To improve the study, a larger sample and a probabilistic sampling method are needed.

CONCLUSION

In our study, only 11.1% of university students consider themselves knowledgeable about the One Health concept. There is no significant difference between medical faculties and other faculties regarding their perception of whether they are informed about the One Health approach.

Additionally, there is no significant difference between medical faculty students and other faculty students concerning the scores obtained from the Global Climate Change Awareness Scale. The students' awareness of global climate change is at a moderate level. Their awareness regarding the sub-dimensions of natural and human environments and energy consumption is at a high level, while their awareness of global organizations and agreements and the causes of climate change is at a moderate level. It can be stated that there are deficiencies in undergraduate education, especially in medical education, regarding the One Health approach and global climate change. We recommend that more emphasis be placed on the topics of One Health and climate change in the undergraduate curriculum.

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