

# Determining the level of food safety awareness by nutritional literacy in health sciences faculty students

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## ABSTRACT

**Objectives:** The aim of the research is to determine the nutrition literacy level and food safety awareness level of students who studied at faculty of health sciences. This descriptive study also demonstrates university students' nutrition literacy statuses, food safety attitudes, nutritional statuses, and food preferences.

**Methods:** The research was conducted as a descriptive and cross-sectional survey study in order to determine the nutrition literacy level and food safety awareness level of the students. Two hundred and eight individuals, including 174 women and 34 men, participated in the study. The data were obtained from face-to-face and on-line interviews then they were analyzed in a software. The survey is consisted of three parts: socio-demographic form, Evaluation Instrument of Nutrition Literacy on Adults and the Food Safety Attitude scale.

**Results:** In this study, the majority of the participants studied in the department of nutrition and dietetics (55.29%) and audiology (26.92%), followed by health management (7.21%), physiology and rehabilitation (5.77%), nursing (4.33%) and social work (0.48%) department. The relationship between nutrition literacy and food safety among the students of the faculty of health sciences was significant ( $p < 0.01$ ).

**Conclusions:** This study showed that the nutrition literacy level was sufficient and the food safety attitude was positive in university students. However, it is needed to prospective studies to understand the importance of nutrition literacy and food safety awareness.

**Keywords:** Nutrition literacy, student, food safety, health

Nutrition plays a role in the maintenance of a living organism's health as well as the healthy development of an organism. Malnutrition is associated with a decline in growth and development and a lack of immune resistance against diseases. 2022 report by the World Health Organization (WHO) emphasized that the incidence rate of non-communicable diseases such as diabetes and cardiovascular diseases and the rate of mortality from these diseases have increased since

2000 despite the fact that the incidence rate of communicable diseases has decreased, and life expectancy has extended. Nutrition depends on factors such as economic status, education, and cultural habits. The study published by the WHO found that the rate of diet-related diseases was higher in low-income countries [1]. Nutrition education is crucial to minimizing the risk of diseases. In a study conducted by Aktaş *et al.* [2] on nutrition knowledge in pregnant women be-

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fore and after nutrition education, it was observed that nutrition knowledge scores of pregnant women elevated following the nutrition education, and nutrition knowledge scores prior to the nutrition education were associated with socioeconomic factors.

Following the evidence proving that nutrition education plays a role in the treatment of diseases, the term “nutrition literacy” emerged for the evaluation of individuals’ levels of nutrition knowledge. Nutrition literacy is defined as the ability to obtain, process, and understand fundamental nutrition information and services that are needed to make nutrition-related decisions [3]. The objectives of nutrition literacy are to enhance the quality of nutrition education, develop a critical perspective toward nutrition information, and create awareness of problems regarding food and nutrition [4]. Nutrition literacy is associated with socioeconomic factors. A study performed with university employees showed that the nutrition literacy level was higher in university graduates than in primary school graduates, and in unmarried employees than in married employees [5]. While several scales have been designed and developed for nutrition literacy, there is not a single common scale applicable to every country and every age group. Since nutrition literacy is quite a new concept in Türkiye, there are ongoing attempts to develop a new scale to measure and evaluate it, and the number of studies on nutrition literacy has been increasing. The nutrition literacy scale that is currently in use in Türkiye is the Evaluation Instrument of Nutrition Literacy on Adults (EINLA) [6].

Food safety is of utmost importance for individuals’ protection from food-related diseases and for supplying quality food. Lack of food safety causes serious issues such as difficulty in accessing quality food and a spike in food poisoning cases. Failure to provide proper and adequate conditions due to such factors as global warming, socioeconomic situation, and unstable market prices leads to the failure to ensure food safety [7]. The report published by the Food and Agriculture Organization (FAO) stated that food and agricultural policy supports across the globe have not been implemented in a just and equal manner to encourage healthy practices, and that this situation has made it difficult to access healthy food; and highlighted that individuals’ access to a healthy diet will be facilitated with the development of solutions such as making public budgets cost-effective, reducing countries’ trade

problems, and creating healthy nutrition-focused food and agricultural policies [8]. Persistence of the food safety issue will obviously result in individuals not having access to quality and sufficient food, thereby augmenting the risk of diet-related diseases. Prevention of food safety problems depends on consumers’ levels of nutrition knowledge as much as it depends on producers’ knowledge of such. A study by Gözener *et al.* [9] demonstrated that most of the students participating in the study heard of the food safety concept, found the food items they consumed risky, and preferred to spend extra money on safe food items. Although there are scales developed for nutrition literacy, there is no scale for measuring the level of awareness of food safety. Thus, there is a need for studies to create a prospective scale regarding food safety awareness.

In this respect, the findings of the study conducted particularly with students at the faculty of health sciences showed that students were incompetent in terms of food literacy and food safety, they paid more attention to expiry dates and nutritional values when purchasing food and found the label information inadequate. The aim of the study is to determine the nutrition literacy level and food safety awareness level of health sciences faculty students and thus to create awareness of nutrition and food safety. This study will shed light on university students’ nutrition literacy statuses, food safety attitudes, nutritional statuses, and food preferences. The data for this research were obtained through the comparison of the responses to survey questions, the Evaluation Instrument of Nutrition Literacy on Adults (EINLA), and the Food Safety Attitude scale with criteria such as participants’ field of study, sex, demographic status, and nutritional status. This study will contribute to creating awareness of nutrition and food safety. The following are the hypotheses of the study:

H1: General nutrition knowledge has an impact on food safety.

H2: Reading comprehension has an impact on food safety.

H3: Knowledge of food groups has an impact on food safety.

H4: Portion size has an impact on food safety.

H5: Digital literacy and knowledge of food labeling have an impact on food safety.

## METHODS

### Research Methodology

The research was conducted as a descriptive and cross-sectional survey study in order to determine the nutrition literacy level and food safety awareness level of students at the faculty of health sciences.

### Place, Time, and Characteristics of the Research

The research was carried out at Istanbul Aydın University and Istanbul Health and Technology University between the dates of May 2022 and July 2022. Some of the students from nutrition and dietetics, nursing, physiotherapy and rehabilitation, health management, social work, and audiology departments participated in the study through face-to-face interviews while some participated therein online. A limitation of the study is taking a limited number of university students as a sample since applying the survey to the whole society is difficult.

### Research Universe and Sample

The universe of this research consisted of students at Istanbul Aydın University Faculty of Health Sciences and Istanbul Health and Technology University Faculty of Health Sciences. The formula below was used to calculate the sample of the study, and a total of 302 students were planned to be included in the research. However, the study was concluded with the participation of 208 students due to reasons such as students' unwillingness to participate in the survey and lack of time. A total of 208 individuals, 174 women and 34 men, participated in the study. The sampling formula is following:

Sample size formula based on the known number of individuals in the population:

$$n = N \cdot t^2 \cdot p \cdot q / d^2 \cdot (N-1) + t^2 \cdot p \cdot q$$

**N:** Number of Individuals in the population

**t:** The statistic that determines the error in the research

**p:** Participation status to the research

**q:** Non-participation status to the research

**d:** Standard deviation determining the sampling error in the study

**n:** Sample size [10].

### Ethical Aspect of the Research

The research was found to be ethical with the de-

cision no. 2022/112 and dated 04.08.2022 by Istanbul Aydın University Non-Interventional Clinical Research Ethics Committee. The faculty were informed prior to the application of the survey, and the students were given informed consent forms.

### Data Collection Methodology

The data were obtained through face-to-face interviews and also online Google Forms, and the SPSS (Statistical Package for the Social Sciences) software was utilized to analyze the data. The survey is consisted of three parts: socio-demographic form including information on nutritional status and food preferences, the Evaluation Instrument of Nutrition Literacy on Adults (EINLA), and the Food Safety Attitude scale.

### Socio-Demographic Form

The socio-demographic form given to the university students included questions about individuals' university and department, age, sex, income status, and satisfaction with their university and department; as part of the nutrition preferences section, questions about whether they have breakfast, and if yes, where they have it, how many meals they have in a day, if they skip a meal, and if yes, why they skip a meal, which types of foods they prefer, and their thoughts on their nutrition knowledge level and nutritional status; and as part of the food preferences section, questions about whether they have heard of the food safety concept, if label details are adequate, health risks in food items, if they get sick, why exactly they get sick because of food, and handwashing habit.

### Evaluation Instrument of Nutrition Literacy on Adults (EINLA)

This is a nutrition literacy scale that is developed by Cesur (2014) in order to determine nutrition literacy status and consists of 35 questions and 5 sections. The scale was tested for validity and reliability, and it was found to be valid. The first section of the scale contains questions on general nutrition knowledge, the second reading comprehension questions, the third food groups questions, the fourth portion knowledge questions, and the fifth digital literacy and food labeling reading questions. Each correct answer is given 1 point while each unanswered or wrong answer receives 0 points. Accordingly, the nutritional literacy

level of those who score 0-11 points in total is considered “insufficient”, 12-23 points “borderline”, and 24-35 points “sufficient” [6].

*Food Safety Attitude Scale*

Developed by Memiş [11] in 2009 to determine food safety status, the scale is composed of a total of 18 questions, of which 9 are affirmative and 9 are negative. The scale was tested for validity and reliability, and it was found to be valid. It is a 3-point Likert scale and offers “Agree”, “Partially Agree” and “Disagree” options. In affirmative questions, answers are given 3 points, 2 points, or 1 point respectively from “Agree” to “Disagree” while in negative questions, the scoring is reversed as 1 point, 2 points, and 3 points [11].

**Statistical Analysis**

SPSS Statistics 22.0 software was utilized for statistical analyses of the research findings. In the study performed with a sample size of 208 individuals, descriptive statistics of participants’ answers to the survey questions were provided. The relationship between the scales was examined with correlation (Spearman’s rho) and regression analyses. The normality of the scales was tested with the univariate normality test (Shapiro-Wilk). Nonparametric tests and methods were used to compare and analyze the variables that were not normally distributed according to the normality test results. The results were evaluated at 95% and 99% confidence intervals, and at  $p < 0.05$  and  $p < 0.01$  significance levels.

**Table 1. Some socio-demographic characteristics of students by percentage**

Socio-demographic characteristics		n	%
<b>Participants’ universities</b>	Istanbul Aydın University (IAU)	94	45.19
	Istanbul Health and Technology University (ISTUN)	114	54.81
<b>Participants’ ages</b>	18-20	104	50
	21-23	99	47.6
	24 and above	5	2.4
<b>Participants’ sexes</b>	Male	34	16.35
	Female	174	83.65
<b>Participants’ departments</b>	Health Management	13	7.21
	Nursing	8	4.33
	Physiotherapy and Rehabilitation	11	5.77
	Social Work	1	0.48
	Nutrition and Dietetics	110	55.29
	Audiology	65	26.92
<b>Participants’ income status</b>	Income Lower Than Expenses	42	20.19
	Income Equal to Expenses	121	58.17
	Income Higher Than Expenses	45	21.63
<b>Participants’ satisfaction with their departments.</b>	Yes	157	75.48
	No	13	6.25
	Partially	38	18.27
<b>Participants’ satisfaction with their universities</b>	Yes	93	44.71
	No	33	15.87
	Partially	82	39.42

## RESULTS

### Descriptive Statistics and Frequency Analysis for Socio-Demographic Characteristics

Table 1 provides the socio-demographic characteristics of the study participants. Accordingly, 83.65% of the students were female, and 50% were within the age range of 18-20 years. Nutrition and Dietetics (55.29%) and Audiology (26.92%) students demonstrated a high participation rate. Of the students participating in the study, 45.19% were studying at Istanbul Aydın University while the remaining 54.81% were studying at Istanbul University of Health and Technology. It was determined that the participants were generally satisfied with the university and department they chose.

### Descriptive Statistics and Frequency Analysis for Participants' Nutritional Statuses

Table 2 shows that regarding having breakfast, 55.29% of the students take care to eat breakfast, 36.06% of them have breakfast sometimes, and 8.65% do not eat breakfast. When asked about the place they have their breakfast, 61.06% of the participants said they prefer preparing breakfast at home, 12.50% purchase food from the street, 2.88% eat breakfast at the school canteen, 1.44% of them have their breakfast at a restaurant, 17.79% eat breakfast at school or dormitory dining hall, and finally, 4.33% of them said they don't eat breakfast. When it comes to the number of meals the students eat in a day, 36.54% eat 1-2 meals, 45.19% 3 meals, 12.02% 4 meals, 4.81% 5 meals, and 1.44% 6 meals. When asked if they skip a meal, 76.92% said they do while 23.08% do not skip a meal. As to the reason behind skipping a meal, 39.42% of the study participants said they don't want to prepare food, 34.13% cannot find time to prepare food, 13.94% find it difficult to prepare food, and 12.50% said they skip a meal due to other reasons. Regarding their thoughts on their nutritional statuses, 27.88% of the students believe they eat healthy and 34.62% believe otherwise, and 37.50% of them are not sure about their nutritional statuses. As for their evaluations on their nutrition knowledge level, 52.88% of the participants thought they had good nutrition knowledge, 31.73% were not sure about their nutrition knowledge level, and 15.38% did not think they had good nutrition knowledge.

### Descriptive Statistics and Frequency Analysis for Food Preferences

Table 3 shows that 82.21% of the students had heard the concept of food safety before while 17.79% had not. When asked if they find the labeling information of packaged food sufficient, 38.46% of them answered yes, and the remaining 61.54% did not find the labeling information sufficient. As to food-borne health risks, the majority 51.44% of the students found food poisoning to be the most important food-borne health risk followed by cancer with 21.15% and food infections (diarrhea, vomiting, etc.) with 18.75%; finally, 6.73% of the study participants said they had no idea about this issue. In response to the question of if they have ever gotten sick because of food they ate, 53.85% of the students said yes while the remaining 46.15% answered no. Regarding the reason for getting sick due to the food they ate, 27.88% stated they had food at a restaurant, 7.21% at home, 6.73% at the school dining hall, 5.29% at the canteen, 6.25% at a kiosk, and 5.77% from a street vendor. Additionally, 40.87% of the participants said that they did not eat out. When it comes to handwashing habits of the students, it was found that 14.90% of them wash their hands when they get dirty, 0.48% after they start preparing food at home, 13.46% before they start preparing food at home, 4.33% before using the toilet, 22.60% after using the toilet, 11.06% before eating, and 2.40% after eating; on the other hand, 30.77% of the students said they practice all the options mentioned here.

### Descriptive Statistics and Correlation Analysis of Variables

“Correlation analysis is a statistical method used to determine the existence of a linear relationship between two numerical measurements and the strength and direction of this relationship if any” [12].

“Interpretation of the correlation coefficient ( $r$ ):

- If  $0 < r < 0.19$ , then very weak relationship or no correlation.
- If  $0.20 < r < 0.39$ , then weak correlation.
- If  $0.40 < r < 0.59$ , then moderate correlation.
- If  $0.60 < r < 0.79$ , then strong correlation.
- If  $0.80 < r < 1$ , then very strong correlation.” [13].

Table 4 presents the results of the correlation analysis between participants' literacy sub-dimensions

**Table 2. Nutritional status of students by percentage**

Nutritional status		n	%
<b>Do they have breakfast?</b>	Yes	115	55.29
	No	18	8.65
	Sometimes	72	36.06
<b>Where do they have breakfast?</b>	At home	127	61.06
	I buy a toasted sandwich, etc. from the street	26	12.50
	I eat at the school canteen	6	2.88
	I have breakfast at a restaurant	3	1.44
	School or dormitory dining hall	37	17.79
	I do not eat breakfast	9	4.33
<b>How many meals do they eat in a day?</b>	1-2 Meals	76	36.54
	3 Meals	94	45.19
	4 Meals	25	12.02
	5 Meals	10	4.81
	6 Meals	3	1.44
<b>Do they skip a meal?</b>	Yes	160	76.92
	No	48	23.08
<b>Why do they skip a meal?</b>	It's difficult to prepare food	29	13.94
	I can not find time to prepare food	71	34.13
	I do not want to eat	82	39.42
	Other	26	12.50
<b>Which types of foods do they prefer?</b>	Meat dishes	63	30.29
	Vegetable dishes	33	15.87
	Fastfood	73	35.10
	Toasted sandwich (with kasar cheese, white cheese, etc.)	9	4.33
	Meatballs and similar dishes	25	12.02
	Other	3	1.44
	All except vegetable dishes	1	0.48
<b>Participants' Thoughts on Their Nutritional Status</b>	I am not picky with food	1	0.48
	I think I eat healthy	58	27.88
	I am not sure	78	37.50
<b>Participants' Evaluation of Their Nutrition Knowledge Level</b>	I do not think I eat healthy	72	34.62
	I think my nutrition knowledge is good	110	52.88
	I am not sure	66	31.73
	I don't think my nutrition knowledge is good	32	15.38

**Table 3. Food Statuses of Students by Percentage**

Food Status		n	%
<b>Did they hear the food safety concept?</b>	Yes	171	82.21
	No	37	17.79
<b>Is the labeling information of packaged food sufficient?</b>	Yes	80	38.46
	No	128	61.54
<b>Food-borne Health Risks</b>	Food infections (diarrhea, vomiting, etc.)	39	18.75
	Food poisoning	107	51.44
	Cancer	44	21.15
	I have no idea about this	14	6.73
	Other	4	1.92
<b>Did they get sick because of the food they ate?</b>	Yes	112	53.85
	No	96	46.15
<b>Why did they get sick due to food?</b>	Restaurant	58	27.88
	Home	15	7.21
	School dining hall	14	6.73
	Canteen	11	5.29
	Kiosk	13	6.25
	Street vendors	12	5.77
	I do not eat such food	85	40.87
	All	64	30.77
<b>Participants' Handwashing Habit</b>	I wash my hands when they get dirty	31	14.90
	I wash my hands after I start preparing food at home	1	0.48
	I wash my hands before I start preparing food at home	28	13.46
	All	64	30.77
	I wash my hands before using the toilet	9	4.33
	I wash my hands after using the toilet	47	22.60
	I wash my hands before eating	23	11.06
I wash my hands after eating	5	2.40	

and food safety dimensions. According to the analysis, the relationship between the EINLA Level Score ( $24.80 \pm 8.45$ ) and the Food Safety Attitude Score ( $44.93 \pm 7.14$ ) is statistically significant “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.561$ )”.

The relationship between the Food Safety Attitude Score ( $44.93 \pm 7.14$ ) and EINLA General Nutrition Knowledge Score (1. Section) ( $8.08 \pm 2.21$ ) was found to be statistically significant “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.470$ )”.

Moreover, the relationship between the Food Safety Attitude Score ( $44.93 \pm 7.14$ ) and the EINLA Reading Comprehension (2. Section) ( $4.63 \pm 1.54$ ) is statistically significant “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.464$ )”.

The relationship between the Food Safety Attitude Score ( $44.93 \pm 7.14$ ) and the EINLA Food Groups Knowledge Score (3. Section) ( $7.06 \pm 3.60$ ) was found to be statistically significant “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.480$ )”.

Furthermore, the relationship between the Food Safety Attitude Score ( $44.93 \pm 7.14$ ) and EINLA Portion Size Score (4. Section) ( $1.75 \pm 0.90$ ) is statistically significant “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.408$ )”.

Finally, the relationship between the Food Safety Attitude Score ( $44.93 \pm 7.14$ ) and the EINLA Digital Literacy and Food Labeling Knowledge Score (5. Section) ( $3.34 \pm 2.12$ ) is statistically significant “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.408$ )”.

When EINLA scores for different sections were analyzed, it was found that the EINLA General Nutrition Knowledge Score (1. Section) ( $8.08 \pm 2.21$ ) and the EINLA Reading Comprehension (2. Section) ( $4.63 \pm 1.54$ ) are statistically significantly correlated “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.444$ )”.

The EINLA General Nutrition Knowledge Score (1. Section) ( $8.08 \pm 2.21$ ) and the EINLA Food Groups Knowledge Score (3. Section) ( $7.06 \pm 3.60$ ) have a statistically significant relationship “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.545$ )”.

Moreover, the relationship between the EINLA General Nutrition Knowledge Score (1. Section) ( $8.08 \pm 2.21$ ) and the EINLA Portion Size Score (4. Section) ( $1.75 \pm 0.90$ ) is statistically significant “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive weak relationship “( $0.20 < r < 0.39$ ) ( $r = 0.317$ )”.

The EINLA General Nutrition Knowledge Score (1. Section) ( $8.08 \pm 2.21$ ) and the EINLA Digital Literacy and Food Labeling Knowledge Score (5. Section) ( $3.34 \pm 2.12$ ) have a statistically significant relationship “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.522$ )”.

Furthermore, the EINLA Reading Comprehension (2. Section) ( $4.63 \pm 1.54$ ) and the EINLA Food Groups Knowledge Score (3. Section) ( $7.06 \pm 3.60$ ) are statistically significantly correlated “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.535$ )”.

The EINLA Reading Comprehension (2. Section) ( $4.63 \pm 1.54$ ) and the EINLA Portion Size Score (4. Section) ( $1.75 \pm 0.90$ ) have a statistically significant correlation “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive weak relationship “( $0.20 < r < 0.39$ ) ( $r = 0.354$ )”.

Additionally, the EINLA Reading Comprehension (2. Section) ( $4.63 \pm 1.54$ ) and the EINLA Digital Literacy and Food Labeling Knowledge Score (5. Section) ( $3.34 \pm 2.12$ ) have a statistically significant correlation “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive moderate relationship “( $0.40 < r < 0.59$ ) ( $r = 0.470$ )”.

The EINLA Food Groups Knowledge Score (3. Section) ( $7.06 \pm 3.60$ ) and the EINLA Portion Size Score (4. Section) ( $1.75 \pm 0.90$ ) are statistically significantly correlated “( $p < 0.01$ )”. The relationship between the two variables is, therefore, a positive weak relationship “( $0.20 < r < 0.39$ ) ( $r = 0.363$ )”.

The EINLA Food Groups Knowledge Score (3.



**Table 4. Correlation analysis results between participants' literacy sub-dimensions and food safety dimensions**

Variables	Mean ± SD	Spearman's rho	EINLA Level score	Food safety attitude score	EINLA General nutrition knowledge score (1.Section)	EINLA Reading comprehension score (2.Section)	EINLA Food groups knowledge score (3.Section)	EINLA Portion size score (4.Section)	EINLA Digital literacy and food labeling knowledge score (5.Section)
EINLA Level score	24.80 ± 8.45	r	1.000	0.561	0.753	0.665	0.835	0.512	0.836
		<i>p value</i>		< 0.001	< 0.001	< 0.001**	< 0.001	< 0.001	< 0.001
		n		208	208	208	208	208	208
Food safety attitude Score	44.93 ± 7.14	r		1.000	0.470	0.464	0.480	0.308	0.408
		<i>p value</i>			< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
		n		208	208	208	208	208	208
EINLA General nutrition knowledge Score (1. Section)	8.08 ± 2.21	r			1.000	0.444	0.545	0.317	0.522
		<i>p value</i>				< 0.001	< 0.001	< 0.001	< 0.001
		n			208	208	208	208	208
EINLA Reading comprehension (2. Section)	4.63 ± 1.54	r				1.000	0.535	0.354	0.470
		<i>p value</i>					< 0.001	< 0.001	< 0.001
		n				208	208	208	208
EINLA Food groups knowledge score (3. Section)	7.06 ± 3.60	r					1.000	0.363	0.642
		<i>p value</i>						< 0.001	< 0.001
		n					208	208	208
EINLA Portion size score (4. Section)	1.75 ± 0.90	r						1.000	0.310
		<i>p value</i>							< 0.001
		n						208	208
EINLA Digital literacy and food labeling knowledge Score (5. Section)	3.34 ± 2.12	r							1.000
		<i>p value</i>							< 0.001
		n							208
		<i>p value</i>							
		n							208

**Table 5. ANOVA regression results on the effect of nutrition literacy on food safety**

	Sum of Squares	Standard deviation	Mean of Squares	F	p value
<b>Regression</b>	4010.055	5	802.011	24.791	<b>&lt; 0.001</b>
<b>Residual</b>	6335.002	202	32.351		
<b>Total</b>	10545.058	207			

Section) ( $7.06 \pm 3.60$ ) and the EINLA Digital Literacy and Food Labeling Knowledge Score (5. Section) ( $3.34 \pm 2.12$ ) are statistically significantly correlated (“ $p < 0.01$ ”). The relationship between the two variables is, therefore, a positive strong relationship “( $0.60 < r < 0.80$ ) ( $r = 0.642$ )”.

Lastly, the EINLA Portion Size Score (4. Section) ( $1.75 \pm 0.90$ ) and the EINLA Digital Literacy and Food Labeling Knowledge Score (5. Section) ( $3.34 \pm 2.12$ ) have a statistically significant correlation (“ $p < 0.01$ ”). The relationship between the two variables is, therefore, a positive weak relationship “( $0.20 < r < 0.39$ ) ( $r = 0.310$ )”.

**Regression Analysis**

Table 5 shows the results of ANOVA for the effect of nutrition literacy on food safety. It is seen that there is a significant relationship between nutrition literacy and food safety ( $F(5,202) = 24.791, p < 0.01$ ).

The model for the effect on food safety based on Table 6 is as follows: “Food Safety =  $30.871 + 0.650 \times$  General Nutrition Knowledge +  $0.873 \times$  Reading comprehension +  $0.407 \times$  Food Groups Knowledge +  $0.411 \times$  Portion Size +  $0.355 \times$  Digital Literacy and Food Labeling Knowledge”.

An examination of the t-test results for the model in Table 6 demonstrates that the effect of portion size and digital literacy and food labeling knowledge on food safety is not statistically significant ( $p > 0.05$ ). On the other hand, general nutrition knowledge has a statistically significant effect on food safety ( $t = 2.607; p < 0.05$ ). Reading comprehension also has a statistically significant effect on food safety ( $t = 2.276; p < 0.05$ ). The effect of food groups knowledge on food safety is statistically significant ( $t = 2.310; p < 0.05$ ). Furthermore, considering the result  $R^2 = 0.380$ , it can be inferred that general nutrition knowledge, reading comprehension, and food groups knowledge explain

**Table 6. t-test regression results on the effect of nutrition literacy on food safety**

Model	Unstandardized Coefficients		Standardized Coefficients	Collinearity Statistics					
	B	Std. Error	Beta	t	p value	Tolerance	VIF	R <sup>2</sup>	Durbin Watson
<b>Fixed</b>	30.871	1.571		19.644	<b>&lt; 0.001</b>			0.380	1.863
<b>General nutrition knowledge</b>	0.650	0.249	0.201	2.607	<b>&lt; 0.010</b>	0.517	1.935		
<b>Reading comprehension</b>	0.873	0.383	0.189	2.276	<b>&lt; 0.024</b>	0.447	2.238		
<b>Food groups knowledge</b>	0.407	0.176	0.205	2.310	<b>&lt; 0.022</b>	0.390	2.566		
<b>Portion size</b>	0.411	0.506	0.052	0.813	0.417	0.746	1.341		
<b>Digital literacy and food labeling knowledge</b>	0.355	0.257	0.105	1.379	0.170	0.524	1.907		

food safety at a rate of 38%. Since VIF and tolerance values are less than 5, it can be deduced that there is no multicollinearity problem between the independent variables; also, the Durbin-Watson value at 1.863 which is close to two enables us to say with 95% confidence that there is no auto-correlation between the observed elements. As a result of the above-explained analyses, hypotheses H1, H2, and H3 have been confirmed while H4 and H5 have not.

## DISCUSSION

In this study, university students' nutrition literacy and food safety awareness are examined as well as the relationship between the two. Besides these, the findings obtained through the socio-demographic form, the EINLA scale, and the Food Safety Attitude scale are discussed in relation to the existing literature. Nutrition and food safety surely play a big role in the maintenance of an individual's health.

Most of the students participating in this research are female students. The number of audiology department students and nutrition and dietetics department students participating in the study as well as the number of second-year undergraduates are higher compared to the others. Considering the education level of students' parents, it is indicated that mothers finished primary school while fathers completed high school; their income, on the other hand, is found to be equal to their expenses. Some studies emphasized that the literacy rate among women is low, it is thus understood that education allows women to develop an awareness of issues such as literacy and food safety [2, 14, 15].

Students are asked about their nutritional status and nutrition education. Some of the participants thought their level of nutrition knowledge is good and they eat healthy while some were not sure about their nutrition knowledge level and their eating habits. School courses are the fundamental means through which students learned about nutrition and food. The participants place higher trust and confidence in the information provided by dietitians and health personnel. It is seen that the participants of the study by Kozan [16] gave similar responses to the questions about nutrition knowledge level and nutritional status as the participants of our study. The research con-

ducted by Uzun [17] denoted that the majority of the students received information about nutrition and food, and they did so mostly by taking courses at school and through communication sources.

As part of the food preferences section of the socio-demographic form, students are asked about whether they have heard of the food safety concept, if labeling details of packaged products are reliable, their handwashing habits, and the things they pay attention to while buying a product. The participants said they have heard of the food safety concept and they take care of hand hygiene in general. According to this study, the following are the elements they care about the most when buying a food item: price, expiry date, labeling information, storage instructions, and shelf life. Nutritional values, calories, vitamins and minerals, weight, cholesterol, sugar, and allergens are not always considered. Still, labeling information on packaged products is thought to be inadequate. Food poisoning and food infections were indicated as the biggest risks regarding food safety. A study conducted with university students in Kyrgyzstan provides similar results to our study in that the students have heard of the food safety concept and they pay attention to similar elements when buying food [18].

In this study, the average total EINLA score of the students was found to be  $24.80 \pm 8.45$  which meant that the nutrition literacy (NL) level is "sufficient". NL level for males was "borderline" while it was "sufficient" among females. The study provided the following values and results regarding EINLA sub-dimension group scores: General Nutrition Knowledge – average score  $8.08 \pm 2.21$  and NL level "sufficient"; Reading Comprehension – average score  $4.63 \pm 1.54$  and NL level "borderline"; Food Groups – average score  $7.06 \pm 3.60$  and NL level "sufficient"; Portion Size – average score  $1.75 \pm 0.90$  and NL level "insufficient"; Digital Literacy and Food Labeling Knowledge – average score  $3.34 \pm 2.12$  and NL level "borderline". EINLA sub-dimensions were also compared among themselves, and correlations between them were discovered. The study by Cesur found out that the participants' NL level was "sufficient" considering the total score; however, an examination of NL level based on the sub-dimensions of the developed scale showed that the NL level was "sufficient" in relation to general nutrition knowledge, reading comprehension, and food groups while it was

“insufficient” in relation to portion size and digital literacy and food labeling. This study also determined that the NL level is higher in women than men. Our research demonstrated the same result in terms of the NL level among women and men. The number of male and female participants was almost equal in Cesur’s study; however, in this study, the number of female students was much higher than that of male participants, hence the higher NL level for women. Still, it should be noted that various studies highlight that nutrition literacy level is higher among women than men [2-6].

In this study, the average Food Safety Attitude score of the students was found to be  $44.93 \pm 7.14$  which meant that the food safety attitude is “partially positive”. The study by Memiş [11] presented the students’ food safety attitude as “positive” among females and “partially positive” among males.

## CONCLUSION

This study investigated university students’ nutrition literacy statuses and food safety attitudes. Nutrition literacy influences individuals’ nutritional status and eating and diet habits. Both several other studies and this study showed that the level of nutrition literacy is associated with individuals’ nutrition knowledge levels. The current existing literature underlines the fact that increasing nutrition knowledge level leads to an expansion in nutrition literacy level. According to the study, the nutrition literacy level of university students is sufficient. It was found that the students generally strived to have their meals regularly, but they had to skip meals due to reasons such as lack of time and lack of food. Skipping meals did not affect nutrition literacy.

It is known that food safety is effective in protecting societies against diseases. Behaviors such as checking product labeling information and applying hygiene rules have an impact on individuals’ food safety statuses. However, it is highly important that product labeling information be understandable. Students participating in this study think that product labeling information was insufficient, and they mentioned that they had food poisoning. These results show that the food safety controls of relevant facilities should be done regularly, and the labeling information should be legible and understandable. It is concluded

that the food safety attitude of the students was positive, and they make conscious choices. Still, more studies should be carried out to measure societies’ level of awareness of food safety.

Consequently, there is a need to improve students’ awareness of nutrition literacy and food safety and conduct studies on these concepts. Listed below are the suggestions that will positively contribute to future research:

(1) Education and training programs in the field of nutrition and food safety should be organized in universities.

(2) Students’ eating habits and diet may be followed, and free dietitian support can be provided when deemed necessary.

(3) A food safety scale may be prepared to determine and measure the level of food safety awareness.

(4) Product labels should be understandable to everyone. When a product contains ingredients posing health risks, such contents should be indicated on the product package in a manner recognizable by individuals.

(5) Since too many survey questions and especially too long survey time affect the number of participants and the rate of giving correct answers, survey questions in future research should be brief, easily understandable, and concise with the inclusion of really necessary questions for the field of study.

### *Authors’ Contribution*

Study Conception: AYS; Study Design: AYS; Supervision: ÜD; Funding: AYS; Materials: AYS; Data Collection and/or Processing: AYS; Statistical Analysis and/or Data Interpretation: AYS; Literature Review: ÜD, AYS; Manuscript Preparation: AYS and Critical Review: ÜD, AYS.

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