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Does the nutritional literacy of adolescents affect their eating behavior?

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ABSTRACT

Aims: Diseases such as obesity, diabetes, hypertension, which develop as a result of the deterioration in the diet quality of adolescent individuals in our country and around the world and unhealthy eating habits acquired during this period, pose a risk for future health. Adolescents need to correctly perceive, evaluate and apply nutrition-related information for healthy food consumption. For this reason, studies have been conducted in recent years on nutrition literacy. Which is defined as the ability to acquire, understand and adopt basic nutrition information. This study was designed to determine whether the adolescents nutritional literacy (ANL) is effective in the eating behaviors of individuals.

Methods: This cross-sectionally planned study was conducted between June April-June 2022 at Kırıkkale University Faculty of Medicine Department of Child Health and Diseases. The sociodemographic characteristics. Nutritional literacy and eating behaviors of adolescents were determined by face-to-face interview method and their anthropometric measurements were examined. These measurements were evaluated with the height length of adolescents according to age, body mass index (BMI) Z scores. The participants' nutritional literacy was revealed with the 'ANL Scale' and their eating behaviors were revealed with the 'Adolescent Eating Habits Checklist' (AEHC).

Results: Of the 220 volunteer adolescents who participated in the study. 62.3% were girls and 37.7% were boys. The Functional Nutritional Literacy (FNL) score of girls was higher than that of boys ($p=0.01$). The total score of the Adolescent Nutrition Literacy (ANL) Scale. Interactive Nutrition Literacy (INL). Critical Nutrition Literacy (CNL) and Adolescent Eating Habits Checklist (AEHC) scores were lower for adolescents who did not do regular physical activity ($p<0.05$). The total score of the ANL Scale. CNL and AEHC scores of the adolescents who did not consume fast food were higher than those of the adolescents who consumed fast food ($p<0.05$). There was a negative correlation between the frequency of fast food consumption and AEHC score ($p<0.05$).

Conclusion: As a result of the study, it was found that adequate nutrition literacy of adolescents can have a positive effect on their eating habits. For this reason, it was considered necessary to provide education to adolescents in order to increase awareness of nutritional literacy.

Keywords: Adolescent, nutrition literacy, eating habits checklist

INTRODUCTION

According to the World Health Organization (WHO) adolescence is defined as the period from ages 10 to 19.[1] During this time. adolescents experience increased growth and development, along with heightened nutritional needs. The dietary habits established in adolescence are significant because they impact later life and are linked to nutritional disorders and nutrition-related diseases.[2,3] Diseases such as obesity, diabetes, hypertension, which develop as a result of the deterioration in the diet quality of adolescent individuals in our country and around the world and unhealthy eating habits acquired during this period, pose a risk for future health. Adolescents need to correctly perceive, evaluate and apply nutrition-related information for healthy food consumption.[4] As information on diet and nutrition becomes more accessible, people must make informed food choices to safeguard their health amid rising chronic disease rates.[5,6] Nutrition literacy has become increasingly important as it relates to healthy eating and the nutritional environment.[7]

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For this reason. studies have been conducted in recent years on nutrition literacy, which is defined as the ability to acquire, understand and adopt basic nutrition information. However, research on nutrition literacy is limited due to the inadequate reliability assessments of the tests used. the validity of new tools being tested only on select groups, and the current health literacy criteria not adequately encompassing nutrition literacy.[8,9] Therefore. this study aims to identify factors affecting nutritional literacy and eating behaviors among adolescents.

METHODS

This cross-sectionally planned study was conducted at Pediatric Clinic of Kırıkkale University Faculty of Medicine Hospital between April and June 2022. The inclusion criteria for the study were adolescents aged between 10 and 18 years without any chronic diseases except obesity and not on continuous medication. The sociodemographic characteristics. Nutritional literacy and eating behaviors of adolescents were determined by face-to-face interview method and their anthropometric measurements were examined. The participants' weight. Height, and body mass index were measured. These measurements were evaluated with the height length of adolescents according to age. body mass index (BMI) Z scores.

The sociodemographic information and lifestyle behaviors of the participants were gathered using a survey form consisting of 24 questions developed by the researcher based on existing literatüre.[4] The survey collected data on the adolescents' age, body weight, height, eating habits, physical activity levels, and behaviors such as sleep and screen time. It also included questions about the educational status of their families, family income level. and the occupations of the parents. The participants' nutritional literacy was revealed with the 'Adolescent Nutrition Literacy Scale (ANLS) and their eating behaviors were revealed with the 'Adolescent Nutritrion Habits Checklist' (ANHC). The study was approved by the Kırıkkale University Faculty of Medicine Department. Scientific Research and Publication Ethics Board (Date: 23.03.2022, Decision No: 87606).

The participants were grouped based on specific criteria:

- Sleep duration
- Screen time: 0-6 hours. 7-12 hours, and >12 hours
- Fast food consumption frequency: never. <3 times/day, and ≥3 times/day (4)
- Family income status (self-reported): no regular income, income does not cover expenses, income covers expenses

Height-for-age and BMI Z-scores of adolescents were calculated with the Child Metrics application and classified according to WHO's reference values for ages 5-19.[10]

Adolescent Nutrition Literacy Scale

Bari developed an ANLS survey with 29 questions based on Pettersen et al.'s[11] work in a cross-sectional study involving 506 adolescents in the Kampala region of Uganda. The scale is divided into the following three subgroups: Functional Nutrition Literacy (FNL) that measures the ability to apply basic nutrition-related literacy skills; Critical Nutrition Literacy (CNL) that assesses the ability to evaluate situations that hinder good nutrition through critical thinking; Interactive Nutrition Literacy (INL) that evaluates the skills to interact and communicate effectively about nutrition topics. The scale aims to provide a comprehensive assessment of adolescents' nutritional literacy by evaluating their basic skills. critical thinking abilities and interactive capabilities related to nutrition. The adaptation of the scale to Turkish was conducted in 2017. using data collected from 474 adolescents.[12] The validated scale is a five-point Likert-type scale consisting of 22 items divided into three sub-dimensions. The total possible score ranges from a minimum of 22 to a maximum of 110. Higher scores on the scale indicate a higher level of nutritional literacy. reflecting the ability to apply knowledge and skills in real-world nutrition-related situations.[4,12]

Adolescent Nutrition Habits Checklist

The Adolescent Nutrition Habits Checklist is used to assess the validity of the ANLS by evaluating eating habits among adolescents. It was originally developed by Johnson et al.[13] in 2002 and consists of 23 items that measure healthy eating behaviors. Each correct answer related to healthy eating is awarded one point. The maximum score attainable on the scale is 23 points. An increase in scores signifies an improvement in the healthy eating behaviors of adolescents The Turkish adaptation of the ANHC was conducted by Arikan et al.[4] in 2012. The adapted scale consists of 19 items divided into the following categories: sugar consumption (4 items), fat intake (6 items), fruit-vegetable consumption (6 items), carbohydrate-fast food consumption (2 items), general diet status (1 item). Each correct response regarding healthy nutrition is worth one point. The maximum score on the checklist is 19 points. Higher scores indicate better adherence to healthy eating behaviors among adolescents. This checklist is a valuable tool for evaluating adolescents' nutritional habits and identifying areas for improvement in promoting healthier eating patterns.

Statistical Analysis

The analysis of the data obtained from the study was conducted using the SPSS (Statistical Package for Social Science) version 26.0 software. The mean ($\bar{X}$) and standard deviation values were calculated for quantitative data. Frequency tables and percentage values were provided for categorical variables. The Kolmogorov-Smirnov test was used to assess the suitability of the data for a normal distribution. An independent two-sample t-test was used to evaluate whether there was a difference between the means of two independent groups. One-way analysis of variance (ANOVA) was used to determine if there were differences between the means of three or more independent groups. For variables showing significant differences. Tukey's test (a Post Hoc test) was used to identify which specific group(s) caused the difference. Linear regression was employed to evaluate the relationship between adolescents' height-for-age and BMI Z-scores. and the scores of ANHC. ANLS. and their sub-dimensions. A p-value of less than 0.05 was considered statistically significant. This statistical approach provided a thorough analysis of the study data. enabling a better understanding of the differences and relationships observed

RESULTS

Of the 220 volunteer adolescents who participated in the study. 62.3% were girls and 37.7% were boys. A majority of the participants (57.2%) are high school students. While 12.2% come from families with insufficient income to meet their

expenses. Additionally, 21.8% of the adolescents' mothers are employed. Examining the educational background of the adolescents' families reveals that 35.5% of the mothers and 40.9% of the fathers have graduated from high school and 6.8% of the parents are divorced. It was also found that a large portion of adolescents (71.8%) do not engage in regular physical activity, 90.4% sleep between 7 and 12 hours daily and 79.6% spend at least 1 hour per day in front of a screen. Demographic characteristics are shown in Table 1

Table 1. Demographic characteristics

	Female		Male		Total	
	n	%	n	%	n	%
Children's education status						
No education	5	3.6	9	10.8	14	6.4
Primary school	48	35	32	38.6	80	36.4
High school	84	61.3	42	50.6	126	57.3
Mother's education status						
lliterate/non-literate	3	2.2	4	4.8	7	3.2
Primary school	65	47.4	40	48.2	105	47.7
High school	50	36.5	28	33.7	78	35.5
University	19	13.9	11	13.3	30	13.6
Father's education status						
lliterate/non-literate	1	0.7	0	0	1	0.5
Primary school	42	30.7	26	31.3	68	30.9
High school	57	41.6	33	39.8	90	40.9
University	37	27	24	28.9	61	27.7
Well-organized income	18	13.1	6	7.6	24	11.1
Organized income that covers expenses	104	75.9	63	79.7	167	77.3
Organized income that does not cover expenses	15	10.9	10	12.7	25	11.6

BMI: Body mass index, IQR: Interquartile range, X̄ ±SD: Standart ± deviation

The Functional Nutritional Literacy score of girls was higher than that of boys (p=0.01). The total score of the ANLS. INL. CNL and AEHC scores were lower for adolescents who did not do regular physical activity (p<0.05). The total score of the ANLS. CNL and ANHC scores of the adolescents who did not consume fast food were higher than those of the adolescents who consumed fast food (p<0.05). There was a negative correlation between the frequency of fast food consumption and ANHC score (p<0.05). The age and certain anthropometric measurements of the adolescents are detailed in Table 2. There was no significant difference in mean of age and BMI between genders (p=0.440, p=0.242 respectively). The median weight was significantly higher in males than females (p=0.015) but there was no difference in mean of heigt between them (p=0.479).

Table 2. Age and some anthropometric measurements of adolescents

Variables	Female n=137	Male n=83	p
Age (year) X̄ ±SD	14.35±2.04	14.10±**2.36**	0.440
BMI (kg/m) X̄ ±SD	22.61±**5.08**	21.71±**5.38**	0.242
	Median (IQR)	**Median (IQR)**	
Height (cm)	160 (155-166)	165 (154.5-175.0)	0.479
Weight (kg)	54(46.1-69.0)	57 (48.0-71.0)	0.015

According to the distribution of various characteristics related to the eating habits of the adolescents. 80.5% of the adolescents skip meals. Among the skipped meals, breakfast is skipped by 26% lunch by 36.2%, dinner by 4.5%, and snacks by 33.3%. Additionally, 72.7% of the adolescents consume snacks. Of those who snack, 33.2% consume fruits and vegetables, while29.5% consume items from the "other" category. Furthermore, 62.7% of

Table 3 illustrates the distribution of height and BMI scores among adolescents categorized by age. The data shows that 3.2% of the participants are classified as very short. 6.8% as short. 62.3% as having normal height, 20.9% as tall, and 6.8% as very tall. Regarding BMI 2.2% of the participants are considered very thin, 12.3% are underweigh,. 47.3% are of normal weight, 17.3% are slightly overweight, and 20.5% are classified as obese.

Table 3. Adolescents' BMI scores distribution by age

BMI	Female		Male		Total	
	n	%	n	%	n	%
<3p	5	3.6	5	6	10	4.5
5-15.p	11	8	4	4.8	15	6.8
15-85p	73	53.3	39	47	112	50.9
85-97p	16	11.7	16	19.3	32	14.5
>97p	32	23.4	19	22.9	51	23.2

Table 4 presents a comparison of scores from the ANLS and the ANHC based on the sociodemographic characteristics of the adolescents. The data reveals that while there are no significant differences in the ANLS total score, INL, CNL and ANHC scores based on gender (p>0.05). There is a significant difference in ANLS scores by gender with girls having higher FNL scores compared to boys (p=0.01). There are no significant differences in the ANLS total score, FNL, INL, and CNL scores based on the adolescents' educational level (p>0.05), but differences in ANLS scores by educational level are significant (p<0.05). Specifically, adolescents in primary school have higher ANHC scores than those in high school (p=0.04). Family income level does not significantly affect the ANLS total score, FNL, INL, and CNL scores (p>0.05). However, there are significant differences in ANHC scores related to the father's employment status with adolescents whose fathers are employed having higher ANHC scores than those whose fathers are not (p=0.02). Additionally, the INL score is higher for adolescents whose mothers are employed compared to those whose mothers are not (p<0.05).There are no significant differences in the ANLS total score, FNL, INL, CNL, and ANHC scores based on the educational level or marital status of the families (p>0.05). Adolescents who do not engage in regular physical activity have lower ANLS total, INL, CNL, and ANHCL scores compared to those who are physically active (p<0.05). Furthermore, adolescents who spend at least 1 hour in front of a screen have significantly lower ANHC scores than those who do not spend any time in front of the screen (p=0.01).

Table 5 presents a comparison of scores from the ANLS and the ANHC based on various eating habits of the adolescents. The data shows that FNL and INL scores do not differ significantly based on fast-food consumption status (p>0.05). However. there are significant differences in the ANLS total score, CNL and ANHC scores, with adolescents who do not consume fast food scoring higher in these areas compared to those who do consume fast food (p<0.05). Regarding meal skipping there are no significant differences in the ANLS total score, FNL, INL and CNL scores (p>0.05). However significant differences in ANHC scores are observed based on the frequency of fast-food consumption (p=0.03). Specifically. adolescents who consume fast food three or more times per day have lower ANHC scores compared to those who do not consume fast food (p=0.03). There are no significant differences in the ANLS total score, FNL, INL, CNL, and ANHC scores based on meal skipping status (p>0.05).

Table 4. Comparison of adolescent nutrition literacy scale and adolescent nutrition habits checklist scores according to sociodemographic characteristics of adolescents

Demographic variables	ANLS total score X ±SS	p	FNL score X̄±SS	p	INL score X̄±SS	p	CNL score X̄±SS	p	ANHC score X̄±SS	p
Gender										
Female	69.83±9.81		24.17±5.52		17.92±4.91		27.67±4.56		8.70±3.94	
Male	67.75±10.20	0.13	22.25±5.96	**0.01**	16.98±5.13	0.17	27.93±3.83	0.65	8.55±4.47	0.80
Educational status										
Continuing primary education	68.57±9.67	0.58	23.54±5.54	0.84	17.40±4.62	0.69	27.59±4.39	0.61	9.32±4.13	**0.04**
Continuing high school	69.37±10.21		23.38±5.90		17.68±5.26		27.89±4.24		8.18±4.09	
Income status										
No income	69.02±8.24		24.20±5.17		17.08±4.41		27.87±3.39		8.25±4.22	
Income meets expenses	69.07±10.45	0.77	23.59±5.73	0.47	17.67±5.19	0.85	27.67±4.51	0.84	8.79±4.12	0.72
Income does not cover expenses	67.68±8.65		22.28±6.68		17.4±4.71		28.20±3.87		8.24±4.21	
Father's employment status										
Employee	69.02±9.76	0.89	23.37±5.72	0.53	17.56±5.01	0.96	27.84±4.28	0.41	8.84±4.0	**0.02**
Non-Employee	69.33±12.17		24.19±6.11		17.61±5.04		27.04±4.52		6.76±4.7	
Mother's employment status										
Employee	70.35±10.68	0.30	23.62±5.43	0.81	19.08±5.17	**0.01**	27.35±3.83	0.44	8.14±3.8	0.34
Non-Employee	68.69±9.78		23.40±5.85		17.15±4.89		27.88±4.42		8.78±4.2	
Mother's educational status										
Illiterate	72.42±2.22		23.28±6.82		20.57±2.87		28.57±4.15			
Primary school	67.78±9.63		23.44±5.70		16.66±4.77		27.54±4.14			
Middle school	69.72±10.58		22.93±5.30		17.29±4.98		28.70±3.96			
High school	69.26±9.82	0.80	23.37±5.64	0.92	17.89±4.78	0.31	27.88±4.48	0.34	0.68	
Bachelor's degree	69.69±11.45		24.57±7.07		18.50±6.32		26.46±4.48			
Postgraduate	69.75±12.63		23.75±4.27		17.00±5.59		26.00±5.09			
Father's educational status										

Illiterate	67.73±9.97		22.56±6.44		16.93±5.33		28.21±3.46					
Primary school	69.18±10.64		23.28±5.9		17.15±5.40		27.23±4.98					
Middle school	68.83±10.12		23.37±5.56		17.45±4.82		27.96±4.37					
High school	69.73±9.06	0.94	23.84±5.73	0.81	18.26±4.81	0.92	27.54±4.33		0.92		0.73	
Bachelor's degree	71.25±13.38		25.12±5.43		19.12±5.81		27.00±5.04					
Marital Status of Families												
Married	68.96±10.08		23.46±5.74		17.52±5.05		27.68±4.37					
Divorced	70.33±8.73	0.60	23.20±6.06	0.86	18.20±4.42	0.61	28.93±2.89		0.28		0.83	
Regular physical activity status												
Yes	72.40±10.5		24.33±6.16		19.14±5.31		28.79±3.93		10.50±4.19			
None	67.74±9.44	**0.02**	23.10±5.56	0.14	16.95±4.76	**0.00**	27.37±4.38	**0.00**	7.91±3.89		**0.00**	
Sleep time												
0-6 saat	66.28±8.86		23.42±4.19		16.71±5.28		26.14±4.8		8.00±5.65			
7-12saat	69.04±10.07	0.64	23.33±5.85	0.55	17.66±5.10	0.68	27.79±4.30	0.56	8.67±4.15		0.90	
>12 saat	70.64±9.63		25.07±5.01		16.64±3.29		28.21±4.09		8.5±3.36			
Time spent on screen												
Hiç	68.60±7.83		24.50±4.35		16±6.11		28.10±4.93		10.30±4.27[a]			
<1 saat	69.97±8.88	0.83	23.25±6.07	0.83	18±5.09	0.54	29.0±3.88	0.16	10.17±4.17		**0.01**	
≥1 saat	68.89±10.33		23.42±5.78		17.57±4.93		27.50±4.32		8.24±4.00[b]			

* Independent 2-sample t test (t) and one-way analysis of variance ANOVA (F). post-hoc Tukey test were applied. ** ANLS: Adolescent Nutrition Literacy Scale. ANHC: Adolescent Nutrition Habits Checklist. FNL: Functional Nutrition Literacy. INL: Interactive Nutrition Literacy. CNL: Critical Nutrition Literacy

Table 5. Comparison of adolescent nutrition literacy scale and adolescent nutrition habits checklist scores according to the features of adolescents' nutritional habits

Nutrition habits	ANLS total score X̄ ±SS	p	FNL score X̄±SS	p	INL score X̄±SS	p	CNL score X̄±SS	p	ANHC score X̄±SS	p
Fastfood Consumption Status										
Yes	68.37±9.57		23.28±5.62		17.41±4.91		27.36±4.17		8.09±3.9	
None	71.17±11.1	**0.04**	24.09±6.26	0.41	18.20±5.38	0.35	29.38±4.45	**0.00**	10.84±4.38	**0.00**
Fastfood consumption frequency										
None	70.50±10.28		23.67±6.36		18.07±5.13		28.37±4.97		9.89±4.65[a]	
<3 time/ day	68.86±9.80	0.14	23.70±5.13	0.11	17.56±4.92	0.24	27.65±3.90	0.24	8.29±4.25	**0.03**
≥3 time/ day	65.33±9.76		20.72±7.46		15.83±5.06		26.55±4.55		6.88±3.26[b]	
									a>b	
Skipping meals										
Skip	69.22±10.07	0.64	23.62±5.62	0.41	17.76±5.04	0.29	27.67±4.44		8.52±4.18	0.42
Non-skip	68.48±9.77		22.86±6.20		16.92±4.88		28.10±3.78	0.54	9.06±3.99	

Independent 2-sample t test (t) and one-way analysis of variance ANOVA (F). post-hoc Tukey test were applied. ** ANLS: Adolescent Nutrition Literacy Scale. ANHC:Adolescent Nutrition Habits Checklist. FNL: Functional Nutrition Literacy. INL:Interactive Nutrition Literacy. CNL:Critical Nutrition Literacy

Table 6. Comparison of adolescent nutrition literacy scale and adolescent nutrition habits checklist scores according to height-for-age Z-score of adolescents

Height Z scores by age	ANLS total score $\bar{X}$ ±SS	p	FNL score $\bar{X}$±SS	p	INL score $\bar{X}$±SS	p	CNL score $\bar{X}$±SS	p	ANHC score $\bar{X}$±SS	p
Very short (<-2SD)	59.7±12.4		18.00±6.29[a]		14.85±5.30		26.85±3.62		7.00±4.86	
Short (≥ -2-<-1SD)	71.46±7.90	0.11	25.80±6.47[b]	0.001	17.33±4.43	0.48	28.33±5.20	0.74	8.86±3.92	0.21
Normal (≥-1<1SD)	69.10±10.60		23.71±5.83		17.62±5.39		27.53±4.36		8.92±4.16	
Tall (≥1-<2SD)	68.93±8.73		22.80±5.01		17.43±3.89		28.39±4.00		7.54±3.78	
Very tall (≥2 SD)	70.86±6.37		23.20±4.98		19.06±4.83		27.93±4.13		10.00±4.45	

* One-way analysis of variance ANOVA (F) and post hoc Tukey test were performed, ** ANLS: Adolescent Nutrition Literacy Scale, ANHC: Adolescent Nutrition Habits Checklist, FNL: Functional Nutrition Literacy, INL: Interactive Nutrition Literacy, CNL: Critical Nutrition Literacy

Table 7. Comparison of adolescents' BMI Z score and adolescent nutrition literacy scale and adolescent nutrition habits checklist scores by age

BMI Z score by age	ANLS total score $\bar{X}$ ±SS	p	FNL score $\bar{X}$±SS	p	INL score $\bar{X}$±SS	p	CNL score $\bar{X}$±SS	p	ANHC score $\bar{X}$±SS	p
Extreme underweigth	64.80±12.70	0.62	21.80±6.45	0.67	16±4.30	0.69	27±4.60	0.86	8.40±4.80	0.31
Underweight	70.20±9.90	0.64	21.70±6.10	0.61	18±5.56	0.59	27.40±4.60	0.48	8.10±4.60	0.86
Normal	69.70±10.70		23.00±6.30		18.01±4.76		28.20±4.47		8.90±4.00	
Overweigt	68.40±8.97		24.00±4.53		16.81±5.50		27.60±3.80		8.10±3.80	
Obese (Obez)	67.80±8.80		23.24±4.75		17.08±4.89		26.90±4.00		8.70±4.20	

One-way analysis of variance ANOVA (F) was applied, ANLS: Adolescent Nutrition Literacy Scale, ANHC: Adolescent Nutrition Habits Checklist, FNL: Functional Nutrition Literacy, INL: Interactive Nutrition Literacy, CNL: Critical Nutrition Literacy

Table 6 compares adolescents' height-for-age Z scores with their scores on the ANLS and the ANHC. The data shows that there are no significant differences in the ANLS total score. INL and CNL scores based on height-for-age Z scores ($p>0.05$). However adolescents with very short height have significantly lower FNL scores compared to those who are short ($p=0.002$). Additionally ANHC scores do not differ significantly based on height-for-age Z scores ($p>0.05$). Table 7 presents a comparison of adolescents' BMI Z-scores by age with their scores on the ANLS and the Adolescent Nutritional Habits Checklist. The data indicates that there are no significant differences in the ANLS total score. FNL, INL and ANHC scores among adolescents classified as very thin. underweight. normal weight. slightly overweight or obese based on their BMI Z-scores for age ($p>0.05$).

DISCUSSION

This cross-sectional study aimed to explore the 'Relationship Between Nutritional Literacy. Eating Behavior, and Influencing Factors in Adolescents. Maintaining healthy eating habits is crucial for overall health. It is recommended for adolescents to develop a routine of consuming 4-6 meals per day. including 2-3 snacks alongside the three main meals, while considering their physical activity levels and individual needs.[14] In our study 80.5% of adolescents skipp meals. with lunch (36.2%) and snacks (33.3%) being the most frequently missed. A study involving 625 adolescents found that 69.3% skipped at least one meal.[15] Similarly, Yavuz and Özer's [16] study with 933 adolescents identified lunch as the most commonly skipped meal. followed by breakfast. These findings highlight the need for educational interventions for adolescents and their families on proper nutrition and the importance of regular meals.

Micronutrient deficiencies commonly occur during adolescence due to rapid growth and development. To counteract these deficiencies, it is crucial to include fruits and vegetables in snacks.[17] In this study, 72.7% of adolescents reported consuming snacks with fruits and vegetables (33.2%) and milk and dairy products (21.8%) being the most frequently consumed items. Another study in Izmir found that adolescents' snacks included 57.4% fruits and vegetables, 42.6% milk and dairy products, and 70.9% fast food.[4] In our study about one-third of adolescents included fruit in their snacks, and 21.8% included milk and dairy products. These results are consistent with previous findings. However, a limitation noted in this and other studies is the lack of data on the quantity of food consumed.

Fast food often referred to as 'garbage food' in Western terminology. has become an unavoidable aspect of contemporary life and nutrition.[18] Research involving adolescents has revealed a high frequency of fast food consumption. These foods. which are high in energy and fat. contribute to the development of obesity and related health issues.[19] Consistent with previous studies.[4,20] In this study found that 80% of adolescents consume fast food. The fact that 15.5% of them also consume junk food (such as hamburgers, lahmacun, french fries, and packaged products) during snacks

indicates a nutritional problem among adolescents in our country.

Regular physical activity is essential for enhancing health, physical fitness, and overall competence in children and adolescents. Physically active adolescents generally have better cardiorespiratory health, lower body fat, stronger muscles and bones, and improved mental health compared to their inactive peers.[21] The World Health Organization advises that adolescents engage in at least 60 minutes of moderate to vigorous physical activity each day.[22] Despite this, inadequate physical activity is a global issue with 81% of adolescents not meeting the recommended activity levels.[23] In a study with 1033 adolescents 63% of children took part in organised sport training.[24] In our study finding that 71.8% of adolescents did not engage in regular physical activity aligns with these previous results. During adolescence marked psychological and biological changes significantly impact the sleep-wake cycle. Adolescents require 8-10 hours of sleep per day which is more than the sleep needed by children and adults.[25,26] A study in Austria reported that adolescents slept between 8.5 and 9.1 hours.[27] Similarly, in our study found that 90.5% of adolescents slept between 7 and 12 hours per day. The high rate of obesity In our study may be due to the fact that obesity is among the reasons for admission to the pediatric nutrition and diet clinic.

Stunting is defined as low height for age and chronic malnutrition. It is an indicator of malnutrition and health conditions.[28] In the Türkiye Nutrition Health Survey, it was found that the prevalence of stunting in children and adolescents aged 6-18 was 6.4% and this rate decreased with age.[29] In a study conducted in 2020 in Ankara with 1484 participants to evaluate the growth of children and adolescents people between the ages of 10-17. 2.2% were stunted (<-2SD), 95.1% were normal (>-1SD,<1SD), 2.5% were tall (>2SD), 0.2% of them are too long.[30] In our study, the rate of stunting among adolescents is lower than the countrywide rate, but is similar to the study by Özer et al.[30]

The total scores for the ANLS, INL, and ANHC were similar across genders ($p>0.05$). However the FNL score was higher for girls ($p=0.01$). This finding is supported by a study conducted at Gazi University which explored the relationship between nutritional knowledge. habits. Behaviors, and body mass indexes in 1304 adolescents.[31] It was observed that the nutrition knowledge levels of female students were significantly higher than those of male students. Additionally a study in Iran measuring nutritional literacy with the ANLS found that girls had a higher FNL nutritional literacy level. with this difference being statistically significant.[32] These results suggest that girls may be more sensitive to nutrition literacy, possibly influenced by their body perception as they tend to view themselves as more overweight compared to boys who are actually overweight.

The educational level of parents is a key socioeconomic factor influencing adolescent nutrition. Galvan-Portillo et al.[33] found a significant correlation between nutrition knowledge and adolescents' nutritional literacy.Contrary to this,in our study showed that the ANLS total score, FNL. INL. CNL. and ANHC scores which reflect nutrition behavior were similar across different levels of parental education ($p>0.05$). However. the study revealed that the INL score was higher among adolescents with working mothers, and the ANHC score indicating positive nutritional habits was higher among adolescents with working fathers ($p=0.02$, Table 4, 5). While the increased participation of women in the workforce might negatively impact children's food preferences and eating habits the presence of working parents may contribute to better nutritional habits by potentially enhancing the family's overall welfare.

To explore the connection between physical activity and nutritional behavior in adolescents, a study with 436 participants evaluated physical activity levels using the "Physical Activity Questionnaire for Children" and assessed nutritional behavior with the "Nutrition Behavior Scale".[34] The study found a significant positive relationship between physical activity and nutritional behavior among adolescents. Another study involving 740 participants examined the relationship between nutritional literacy and various factors including physical activity, and found a link between physical activity level and nutrition literacy.[35]

Yılmazel and Bozdoğan[36] used the ANLS to assess the nutritional literacy of 307 adolescents revealing that those who engaged in regular physical activity had higher nutritional literacy levels. Similarly Koca and Arkan[40] utilized the ANLS and the ANHC with 467 adolescents. finding that those who participated in regular sports had higher scores across ANLS total scores, CNL, INL, and ANHC. Consistent with these findings. In our study also showed that adolescents who engaged in physical activity had higher scores in ANLS total. INL. CNL. and ANHC ($p<0.05$). The increase in nutrition literacy scores among physically active adolescents is thought to reflect their awareness of the role of physical activity in maintaining a healthy lifestyle.

Nutrition sleep quality and sleep duration are interconnected concepts. Poor nutrition. overnutrition. and obesity can lead to sleep-related issues.[37] Adolescents generally require 8-10 hours of sleep per day.[38] Lafci's[39] study found that adolescents with a daily sleep duration of 4-6 hours had lower INL levels compared to those who slept 7-9 hours or more than 10 hours. In contrast, Koca and Arkan[40] observed that adolescents sleeping 7-12 hours daily had higher ANHC scores. In this study however no significant relationship was found between adolescents' sleep duration and their nutritional literacy or eating behavior. This lack of significant findings may be attributed to the fact that most participants had adequate sleep durations.

Technological advancements over the past two decades have led individuals to spend more time in front of screens. During adolescence the search for identity and the desire for social interaction further increase screen time. This shift has contributed to the development of unhealthy lifestyle habits. including weight gain and poor eating behaviors. Increased screen time is often associated with a higher intake of low-nutritional-value foods such as pizza, hamburgers, chips, and sugary drinks while fruit and vegetable consumption decreases.[40]

A study involving 467 adolescents which assessed nutritional literacy using the ANLS and eating behavior with the same scale. found that those who watched television for less than 1 hour per day had significantly higher SNLS total scores, FNL, and INL scores.[4] Similarly, in our study revealed that while ANLS total scores, INL, FNL, and CNL scores were similar across different screen times. adolescents who spent 1 hour or

more in front of screens had significantly lower ANHC scores compared to those who did not spend time in front of screens (p=0.01). This suggests that higher nutritional literacy and better subheading scores may be linked to less screen time and a more conscious approach to healthy living.

Nutritional literacy encompasses the knowledge and skills required for healthy eating.[41] A significant relationship exists between scores from the ANHC. which measures healthy eating behavior and the degree of healthy eating behavior; higher ANHC scores correlate with better eating habits.[3,4].In a study assessing the nutritional literacy of 697 adolescents in Samsun using the ANLS. It was found that those who never consumed fast food had higher nutritional literacy compared to those who ate fast food once a week or Daily.[39] Similarly, in our study revealed that adolescents who did not consume fast food had higher ANLS total scores CNL and ANHC scores compared to those who did consume fast food (p<0.05). Adolescents consuming fast food three or more times a day had a lower ANHC score compared to those who never ate fast food (p=0.03).

Nutritional literacy which includes knowledge and the ability to make informed food choices is linked to improved dietary behaviors. Healthy nutrition during adolescence is crucial for promoting proper growth and development, and plays a significant role in preventing chronic diseases including obesity.[42] In this context the relationship between adolescents' height-for-age and BMI Z scores with their nutritional literacy and eating habits can provide insight into how well-informed dietary choices and behaviors correlate with physical growth and weight management. This relationship underscores the importance of nutritional literacy in fostering healthy eating practices that contribute to overall well-being and prevent obesity.

Functional nutrition literacy involves recognizing health risks obtaining information on preventive health services and utilizing these services to mitigate potential health issues.[43] INL refers to the process of choosing healthy foods by leveraging nutritional knowledge reflecting on ways to enhance this knowledge and implementing healthy eating practices for oneself and society.[44,45]

In this study 17.27% of participants were slightly obese, and 20.46% were obese. However. consistent with other studies.[3,31] No significant relationship was found between BMI Z scores and ANLS total score or ANHC (p>0.05). Regression analysis. accounting for age and gender as potential confounders also showed no significant correlation between body weight Z scores and ANLS or ANHC scores. This lack of correlation may be due to the relatively small sample size of slightly overweight and obese adolescents (37.8% of the participants. totaling 83 adolescents). Despite the absence of a positive correlation between body weight and nutritional literacy scores, adolescents who do not consume fast food had higher ANLS total scores. CNL and ANHC scores. Additionally, those who do not engage in regular physical activity had lower ANLS total scores, INL, CNL, and ANHC scores compared to those who engage in regular physical activity (p<0.05). These findings suggest that while body weight and nutritional literacy may not be directly correlated, healthier eating habits and regular physical activity are associated with higher nutritional literacy and better eating behavior scores.

Height assessment by age is a crucial indicator of nutritional and overall health status in children and adolescents.[30] During adolescence when growth and development accelerate and energy needs increase, ensuring adequate intake of nutrients such as calcium, phosphorus, copper, zinc, and vitamin D is essential for achieving optimal bone density and height for age.

FNL refers to the capability to understand and utilize health services to mitigate health risks through awareness of these risks.[43] In this study, there was no significant relationship between height-for-age Z scores and the ANLS total score, INL, or CNL scores among adolescents with normal, tall, and very tall heights (p>0.05). Among the 220 participants, 10% were categorized as short or very short. Table 4,7 shows no significant differences in ANLS total score, INL, or CNL scores based on height-for-age Z scores (p>0.05). Additionally, ANHC scores were similar across height-for-age categories (p>0.05). However, the FNL score of very short adolescents was significantly lower than that of short adolescents (p=0.002). This finding suggests that short stature which often indicates chronic nutritional deficiencies, aligns with lower functional nutrition literacy scores. This literacy involves recognizing unhealthy foods. understanding the benefits of healthy foods, and making informed food choices.

The development of eating habits. which are established during adolescence. plays a critical role in shaping adult dietary patterns. At age 15 eating behaviors are generally consolidated with only minor changes occurring between ages 15-18 highlighting the significance of this period for future eating habits.[46] These habits can be influenced through observation. role models. and media guidance.

Research indicates that ANHC scores tend to be lower in adolescents with poor eating habits.[4] Good eating habits have been shown to positively impact various dimensions of nutrition literacy.European countries between 2006-2007 found that nutritional knowledge increased by approximately 2% annually accounting for socio-economic and anthropometric variables.[47]

CONCLUSION

This study found that adequate nutritional literacy among adolescents may have a positive effect on their nutritional habits for this reason. It was considered necessary to provide education to adolescents in order to increase awareness of nutritional literacy.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was approved by the Kırıkkale University Faculty of Medicine Department. Scientific Research and Publication Ethics Board (Date:23.03.2022,Decision No:87606)

Informed Consent

The study was designed a cross-sectional study

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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