Nutrition Literacy, Mediterranean Diet adherence and lifestyle of Adolescents, Giza, Egypt.

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Abstract

Adolescence is a critical time in life when health behavior, including eating habits becomes established. Nutrition literacy is the ability of individuals to acquire nutritional knowledge and skills required for making proper nutrition decisions. Mediterranean Diet (MD) is a nutritional strategy that encompasses the entire lifestyle, as it is complemented with proper sleep and physical activity. Despite the MD's numerous benefits adolescents are moving away from it affected by the phenomenon of nutrition transition and westernization of diet, because of globalization and urbanization. Assessing adolescents' nutrition literacy can assist policymakers in developing effective health-promoting initiatives, improving the nutritional status of adolescents and enhancing their health and quality of life.The objective was to assess nutrition literacy status among early adolescents, their adherence to the Mediterranean diet (MD)and lifestyle. A cross-sectional design performed among a sample of adolescents (350) in Giza,Egypt. Nutrition literacy was assessed using the 'Adolescent Nutrition Literacy Scale'. Dietary intake was evaluated through a 24-hour food recall, while adherence to the Mediterranean Diet (MD) was assessed using the 'Mediterranean Diet Quality Index' among the adolescents and International Physical Activity Questionnaire (IPAQ) was used to assess physical activity. The studied adolescents showed poor level of nutrition literacy scoring 39.05 ± 19.87, the majority of participants (88%) didn't receive nutrition education at school. The mean nutrition literacy score is significantly higher among adolescents who were highly adherent to Mediterranean diet (scored >8 in KIDMED index score), with high level of practicing physical activity, practicing more healthy eating habits, and reported less screen time exposure. In conclusion the study indicated suboptimal nutrition literacy among adolescents with significant positive correlation to Mediterranean diet adherence and engagement in healthy lifestyle behaviors such as maintaining healthy eating habits, performing physical activity and reducing screen time exposure.
Keyword: Nutrition literacy, Adolescents, diet, Life style, Egypt.

Introduction

Adolescence is a period of accelerated development. It is characterized by significant alterations in the physical, cognitive, and mental profiles. Adolescence is a critical time in life when positive health behavior, including eating habits, emerges and becomes established *(Larsen and Luna,2018)*.Mediterranean diet (MD) is one aspect of healthy eating habits. It is regarded as the gold standard for eating properly, which leads to longevity, improved health, and a higher quality of life. Furthermore, it reduces the risk of obesity, Cardio-vascular diseases (CVDs), diabetes, cancer, osteoporosis, and mental diseases *(Ceraudo et al.,2022)*.The Mediterranean diet - a plant-based diet - emphasizes the intake of vegetables, fruits,whole grains and legumes on a regular basis. They are a

good source of low-glycemic-index carbohydrates and fiber, which slow down sugar absorption, lowering postprandial glucose levels, improving insulin sensitivity, and decreasing cholesterol absorption as well as vitamins and minerals *(Capurso,2021)*. MD focuses on the daily consumption of plant oils and nuts that include antioxidants such as unsaturated fatty acids (oleic and linoleic acids) and vitamin E, which lower Low Density Lipo-Protein (LDL) cholesterol while protecting High Density Lipo-Protein(HDL). Furthermore, MD involves modest fish consumption, which is a good source of omega-3 fatty acids and high-value proteins. The Mediterranean diet also calls for the weekly consumption of dairy products and poultry, which provide excellent protein sources with moderate to low fat content. Low consumption of sweets and red meat and is accompanied by a lower intake of cholesterol and sugar *(Trautwein and McKay,2020)*. As a result, MD has been shown to prevent metabolic syndrome and reduce the occurrence of obesity and overweight. MD's health advantages stem not just from its separate components but also from the synergistic action between them. MD is a nutritional strategy that encompasses the entire lifestyle, as it is complemented with proper sleep and physical activity *(Muscogiuri et al.,2022)*.

Despite the MD's numerous benefits, most people, particularly adolescents, are moving away from it. Adolescents are particularly affected by the phenomenon of nutrition transition, or westernization of diet, because of globalization and urbanization. It leads to eating fast food, salty snacks, chips, and candies, which are high in refined carbohydrates, salt, saturated fats, and soft drinks. This is accompanied by poor lifestyle behaviors as sedentary activities (computer and television use), which leads to a negative energy balance and increases the risk of chronic diseases such as obesity, cardiovascular disease, and diabetes *(Jones et al., 2022)*.Inadequate adherence to MD among teenagers is associated with nutrition illiteracy. Nutrition literacy is acquiring the ability to understand and utilize nutritional knowledge as well as the skills required for making proper nutrition decisions. It was shown that increased nutrition literacy is connected with higher adherence to MD. There was also a link found between nutrition literacy and Body Mass Index(BMI), dietary habits, and daily life style behavior *(Taleb and Itani ,2021)*. Teenagers' nutrition literacy was positively associated with reduced frequency of consumption of unhealthy snacks and fast food *(Mohsenet al., 2022)*.Assessing adolescents' nutrition literacy can assist policymakers in developing effective health-promoting initiatives. This can be reflected in improving the nutritional status of adolescents, enhancing their health and quality of life *(Silva, 2023)*. As far as we know, there has been no previous research conducted in Egypt to assess nutrition literacy among adolescents and its effect on adherence to the Mediterranean diet.

Objectives:
To evaluate nutrition literacy status among the studied sample.
To explore the relation between nutrition literacy and adherence to Mediterranean diet.
To assess the adolescent dietary intake and lifestyle.

Participants and Methods

Study design: A cross-sectional study performed in the outpatient clinics of Omrania Family Health Center in Giza governorate.
Study participants: The participants attending the outpatient clinics of Omrania Family Health Center were included when they met the inclusion criteria:1- Aged between 10 and 13 years. 2- Had the

willingness to participate in the study and excluded when they had severe acute or chronic diseases or not willing to participate.

Data Collection:

Face-to-face interview were done for data collection using a questionnaire composed of:

1)The first section contained the participant's socio-demographic characteristics (age, school grade, parent's occupational status and education level, etc.).

2)The second section contained information about the daily and dietary habits (e.g., duration of sleep, time of screen exposure e.g. mobile tablet or TV, generally preferred foods for main meals and snacks, snack pattern, frequency of fast-food consumption, and daily water consumption).

3)The third section included the Mediterranean Diet (MD) Quality Index for Children and Adolescents (KIDMED) *(Serra-Majem et al.,2004)* to measure adherence to the MD.

4)Fourth section included adolescent nutrition literacy scale ANLS *(Bari,2012)*.

5)Fifth section was the 24-hour dietary recall *(Freedman et al.,2017)*. The participants were asked if they had nutrition education at school.

6)Final section: Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ) *(Öztürk ,2005)*.

All questionnaires were translated into Arabic and then re-translated into English to ensure validity.

Mediterranean diet quality index (KIDMED): is a valid and reliable questionnaire consisting of 16 statements, including the characteristics of the MD. It measures the adherence of adolescents to the MD and dietary adequacy *(Serra-Majem et al.,2004)*. It included 12 positive and 4 negative expressions. Participants who answered yes to positive expressions get +1 points, and those who answered yes to negative expressions get -1 points.The adherence of the participants to the MD is interpreted by dividing the total score of the index into three categories. These are: 1) low adherence (0–3 points); 2) moderate adherence (4–7 points); and 3) high adherence (8–12 points) *(Serra-Majem et al.,2004)*.

Adolescent nutrition literacy scale (ANLS): was used to measure the status of nutrition literacy among the participants. ANLS evaluated three components of NL which are: Functional NL (FNL), Interactive NL (INL), and Critical NL (CNL). FNL demonstrated the capacity to understand nutrition concepts. INL referred to the communication skills required to receive nutritional information. CNL reflected the ability to critically analyze, evaluate and to apply nutritional information. It consisted of 22 items, and every item is on a five-point Likert scale, with scores ranging from 1 to 5 (1=strongly disagree, 2=disagree, 3=undecided, 4=agree, 5=strongly agree). The minimum score on this scale is 22, and the maximum score is 110 *(Bari,2012)*.The scores were categorized, where a score of 22–57.2 indicates low nutrition literacy 57.2–74.8 is considered moderate, and 74.8–110 is classified as high nutrition literacy *(Bari,2012)*.

Dietary intake: was calculated using a 24-hour recall based on the food consumption record. Food and nutrient photographic atlas could be used to record the type and portion size of the food, fluid, or meal. This was done to make sure that adolescents reported their food intake accurately. When participants couldn't or could only partially recall what they had eaten the day before, the record of food consumption was completed by asking their parents *(Freedman et al.,2017)*. The dietary energy and different nutrient intake for the eaten food items were calculated using a food calculator **(Food nutrient calculator)**.

Physical activity: a brief form of **IPAQ** was used to evaluate the physical activity of participants, composed of seven questions about time spent in different activities. Adolescents were divided into three categories: inactive, moderately active and active According to their level of physical activity *(Öztürk ,2005)*.

Anthropometric measurements: Weight was measured with minimum clothing, without shoes, and by using a digital scale. A handheld stadiometer with a precision of 0.1 cm was used to measure height.The participants were standing with their feet close together and their heads in the Frankfort plane. Body Mass Index (BMI) was calculated as weight (kg)/height (m2). The participants were divided into four groups based on their BMI-for-age percentiles:

Underweight (<5 percentile)

Normal" (≥5-<85 percentile)

Overweight (≥85-<95 percentile)

Obese" (≥95 percentile) *(CDC,2022)*.

Sample size and technique: It was estimated to be 350 participants using EpiInfo 6.It was calculated based on the prevalence of nutrition literacy among adolescents in a previous study which was 55.4% **(Khlood,2023)**, 95% confidence and a 5% margin of error. The researcher inquired about the number of outpatient attendants between 10 and 13 years of age in the previous six months in the FHC to be taken as the population size. Any participant fulfilling the inclusion criteria was included in the study using the purposive sampling technique.

Statistical analysis: Data was analyzed using SPSS version 23.0. The test of normality was performed by the Kolmogorov-Smirnov test. Numbers and percentages were used to represent qualitative data. The mean and standard deviation were used to represent quantitatively normally distributed data. Chi square and One-way ANOVA test were used to compare the socio-demographic characteristics, dietary and daily habits as well as nutrient intake of participants with their ANLS scores.In multiple comparisons of the variables, the "Tukey" test was used for equal variances. Correlation analysis was used between KIDMED score with ANLS score and its categories. A P-value <0.001 was considered to be statistically significant.

Ethical consideration: Objectives of the study were explained to the participants, and they were completely free to accept or refuse. Participants who refused were excluded from the study and written consent was taken from the participants' caregivers. Throughout the process of data collection, entry, and analysis, strict confidentiality was maintained regarding the personal information of the participants. This was ensured by using an anonymous questionnaire, in accordance with the principles outlined in the Helsinki declaration.The study protocol was approved by the research ethics committee, Faculty of medicine, Cairo University (-511-2023)

Results

A total sample of 350 were included in the study, the number of boys and girls was nearly equal, and their mean age was 12.83 ± 1.56 years(Boys 11.91± 1.37 and girls 12.85± 1.7). Second-grade preparatory students made 43.7% of the participants. More than half of the participants' fathers 56.9%, and most of their mothers 79.4% were illiterate or had low level of education. Most of the participants' fathers 58.9% were employed compared to only 18% of their mothers. In terms of family

income, the majority of participants' families 69.1% had monthly incomes below 5000 L.E. According to BMI for age boys were much more obese and overweight than girls p<0.01. The mean nutrition literacy score for adolescents was 39.05 ± 19.87 (poor level), and girls scored significantly higher than boys p<001 **(Table 1)**.

The mean nutrition literacy score is significantly higher among adolescents with high level of practicing physical activity, not skipping a main meal, those who prefer eating fruits and vegetables for snacks and consuming fast food 2-3 days per week (P<0.01) respectively. Furthermore, the highest nutrition literacy score was significantly higher among participants who are highly adherent to Mediterranean diet and scored >8 in KIDMED index score.By comparing the mean scores of Nutrition Literacy subcategories;it was found that scores in all subcategories were higher among females as compared to males. **(Table 2)**.

The majority of participants (88%) didn't receive nutrition education at school **(Figure 1)** and about two thirds of them (69%) had low nutrition literacy score while (11%) had high nutrition literacy score **(Figure 2)**.

As regards the Dietary intake according to nutrition literacy level, adolescents with high nutrition literacy had lower intake of energy and higher intakes of fibers (g), protein (g), phosphorus (mg),Potassium (mg), vitamin C (mg), Vitamin E (mg), folic acid (mcg), iron (mg) and zinc (mg) than those with low or moderate nutrition literacy (p <0.01).Moreover adolescents with high nutrition literacy had the highest protein as a percent of energy intake, while those with low nutrition literacy has the highest intake of carbohydrate and moderate nutrition literacy has the highest intake of fat as a percent of total energy intake (p<0.01) **(Table 3)**.

The KIDMED was correlated significantly with ANLS score p (<0.01) (r= 0.783). Each subgroup of nutrition literacy is related to different aspects of the participants' knowledge and approach towards nutrition. It was found from the analysis that FNL is significantly positive correlated with CNL (p<0.01) (r= 0.635) as well as INL (p <0.01) (r= 0.587) **(Table 4)**.

Table1:

Socio-demographic characteristics of the studied group

		Boys (n=187)		Girls (n=163)		Total		p value
		No	%	No	%	No	%	
Grade	Sixth primary	56	29.90%	50	30.70%	106	30.3%	0.57
	First preparatory	52	27.80%	39	23.90%	91	26%	
	Second preparatory	79	42.3%	74	45.4%	153	43.7%	
Father education	Illiterate or low education	103	55.10%	96	58.90%	199	56.90%	0.47
	Moderate or high education	84	44.90%	67	41.10%	151	43.10%	
Mother education	Illiterate or low education	144	77.00%	134	82.20%	278	79.40%	0.23
	Moderate or high education	43	23.00%	29	17.80%	72	20.60%	
Father occupation	Not working	10	5.4%	6	3.7%	16	4.6%	0.52
	Daily worker	64	34.2%	64	39.3%	128	36.6%	
	Employee	113	60.4%	93	57%	206	58.8%	
Mother occupation	Not working	126	67.40%	110	67.50%	236	67.40%	0.9
	Daily worker	28	15.00%	23	14.10%	51	14.60%	
	Employee	33	17.60%	30	18.40%	63	18.00%	
Family income per month	Below 5000 L.E	127	67.90%	115	70.60%	242	69.10%	0.59
	Above 5000 L.E	60	32.10%	48	29.40%	108	30.90%	
BMI	Under weight	41	21.90%	58	35.60%	99	28.30%	<0.01
	Ideal	71	38.00%	82	50.30%	153	43.70%	
	Overweight	42	22.50%	15	9.20%	57	16.30%	
	Obese	33	17.60%	8	4.90%	41	11.70%	
Adolescent Nutrition literacy sore $\pm$ SD		27.9 ±13.8		51.8±18		39.05±19.87		<0.01

Table 2:
Comparison of the daily and dietary habits with their mean ANLS score

		No	%	Mean	SD	p value	No	%	Mean	SD	p value	No	%	Mean	SD	p value
Physical activity	High	46	24.6	32.2	12.8		30	18.4	50.8	14.6		76	21.7	39	13.1	
	Moderate	102	54.5	27.2	13.5	0.005	74	45.4	47.5	14.9	0.065	176	50.3	34.1	15.1	P<0.01
	Low	39	20.9	23.4	7.6		59	36.2	44.4	6.3		98	28	23.6	8.9	
Total time of screen exposure	0-1 hours	26	13.9	29.2	19.4		44	27.0	53.8	17.8		70	20	41.1	21.7	
	1-3 hours	55	29.4	25.5	18.8	0.323	73	44.8	48.5	17.3	0.019	128	36.6	37.5	19.11	0.035
	3 or more	106	56.7	23.6	15.9		46	28.2	43.4	16.9		152	43.4	34.1	17.22	
Duration of sleep	0-6 hours	28	15.0	25.8	14.9		63	38.7	49.9	15.7		91	26	34.8	16.81	
	6-9 hours	152	81.3	29.6	17.3	0.44	91	55.8	45.2	18.6	0.206	243	69.4	37.4	19.38	0.42
	9-12 hours	7	3.7	24.4	21.7		9	5.5	42.6	20.8		16	4.6	33.4	23.76	
BMI for age	Under weight	41	21.9	25.8	18.3		58	35.6	42.5	17.5		99	28.3	34.2	19.7	
	Ideal	71	38.0	29.8	17.1	0.41	82	50.3	47.6	15.7	0.292	153	43.7	38.2	18.9	0.41
	Overweight	42	22.5	25.5	17		15	9.2	48	18.3		57	16.3	36.5	19	
	Obese	33	17.6	24.9	16.6		8	4.9	48.2	20		41	11.7	35.2	17.5	
Skipping main meal	Yes	139	74.3	25.9	15.4	0.26	98	60.1	39	18.3	<0.01	237	67.7	32.8	16.7	<0.01
	No	48	25.7	29.1	20.7		65	39.9	59.3	19.5		113	32.3	44.2	21	
Preferred food for snacks	Milk, milk products	20	10.7	24.9	17.2		24	14.7	60.2	19.1		44	12.6	43.5	20.4	
	Nuts	6	3.2	27.4	19.4		8	4.9	38.1	18.3		14	4	32.9	20.2	
	Fruits or vegetables	13	7.0	33.5	22.4		16	9.8	59.4	21.8		29	8.3	46.4	23.2	
	Sweet food (candies)	27	14.4	26.9	9.9	0.54	21	12.9	31	25.6	<0.01	48	13.7	28.7	11.8	<0.01
	Chips, Popcorn, crackers	56	29.9	26.9	19.9		51	31.3	48	17.3		107	30.5	37.9	19.3	
	Carbonated beverage	65	34.8	23.7	15.3		43	26.4	44	16.5		108	30.9	33.6	17.2	
Water consumption per day	<6 Glasses	83	44.4	28.8	14.7		54	32.8	42.8	13.8		136	38.9	35.3	15.8	
	6-8 Glasses	61	32.6	32.6	19.6	0.004	86	52.8	43.9	17.7	0.063	147	42	38.3	20.5	0.33
	>8 Glasses	43	23.0	21	18.3		25	15.2	52	19.1		67	19.1	35.1	21.2	
Frequency of consumption of fast food	Never	28	15.0	37.3	18.6		13	8.0	59.7	19.9		41	11.7	48.5	20.8	
	Once / week	9	4.8	32.4	16.5		8	4.9	32.1	21.6		17	4.8	32.24	22.79	
	2-3 days / week	36	19.3	25.9	20.1	<0.01	44	27.0	46.4	17.4	<0.01	80	22.8	34.4	21.19	<0.01
	4-5 days / week	69	36.9	29.5	9.8		57	35.0	34.5	20.7		126	36.3	32.01	11.53	
	Every day	45	24.1	17.2	19.3		41	25.2	59.3	8.6		86	24.4	38.78	22.12	
KIDMED index score	< 3 low adherences	104	55.6	21.7	14.5		39	23.9	39.6	9.4		143	40.9	30.6	15.9	
	4-7 moderate	66	35.3	25.5	18.3	0.048	94	57.7	51.5	12.7	<0.01	160	45.7	39	19	<0.01
	>8 high adherence	17	9.1	31.4	19.2		30	18.4	59.4	8.3		47	13.4	45.9	21.9	

Table 3:

Nutrient intake according to nutrition literacy level

Dietary intake	Low nutrition literacy (n=102)		Moderate nutrition literacy (207)		High nutrition literacy (46)		p value
	Mean	SD	Mean	SD	Mean	SD	
Total energy intake	1736.54	419.65	1789.38	376.12	1727.57	345.89	0.4
protein (g)	26.74	12.44	32.93	12.96	38.22	13.01	<0.01
Protein (% of energy)	8.33	3.71	9.28	2.83	12.76	4.54	<0.01
Carbohydrate(g)	196.18	82.13	206.99	91.58	190.64	89.19	0.39
Carbohydrate%	58.76	12.76	54.19	9.35	51.26	11.92	0.01
Total fat (g)	81.9	40.18	83.6	47.67	88.72	39.16	0.68
Total fat (% of energy)	32.91	8.43	36.53	10.4	35.98	9.07	<0.01
Fibers (g)	7.2	2.7	8.13	2.91	8.98	2.18	<0.01
Cholesterol (mg)	321.45	92.65	302.91	91.78	313.22	92.72	0.24
Calcium (mg)	402.52	102.34	417.83	112.12	421.13	137.61	0.47
Magnesium (mg)	171.63	76.18	182.14	82.98	187.35	88.12	0.45
Phosphorus (mg)	671.85	12.7	666.92	17.61	682.21	22.4	<0.01
Potassium (mg)	921.64	30.52	942.17	39.1	972.05	39.29	<0.01
Sodium (mg)	2891.78	411.83	2921.78	407.92	2882.12	402.23	0.74
Vitamin C (mg)	32.87	7.44	39.16	9.18	49.1	11.59	<0.01
Vitamin E (mg)	4.28	1.25	5.12	2.08	5.64	2.44	<0.01
Folic acid (mcg)	132.65	20.18	149.16	24.83	154.72	26.54	<0.01
Iron (mg)	3.15	1.18	4.21	2.28	4.64	2.15	<0.01
Zinc (mg)	2.91	1.29	3.74	1.64	3.82	1.98	<0.01

Table 4:

Correlation between KIDMED with ANLS and Correlation between FNL with CNLand INL

		ANLS			CNL	INL
KIDMED	Pearson Correlation	0.783**	FNL	Pearson Correlation	0.635**	0.587**
	P value	<0.01		P value	<0.01	<0.01

**. Correlation is significant at the 0.01 level (2-tailed).
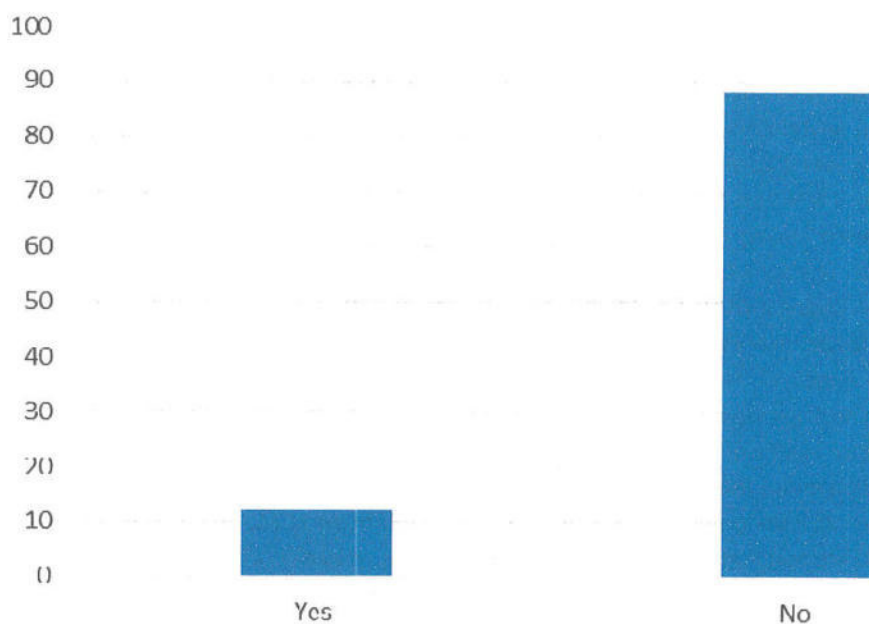
Figure 1:

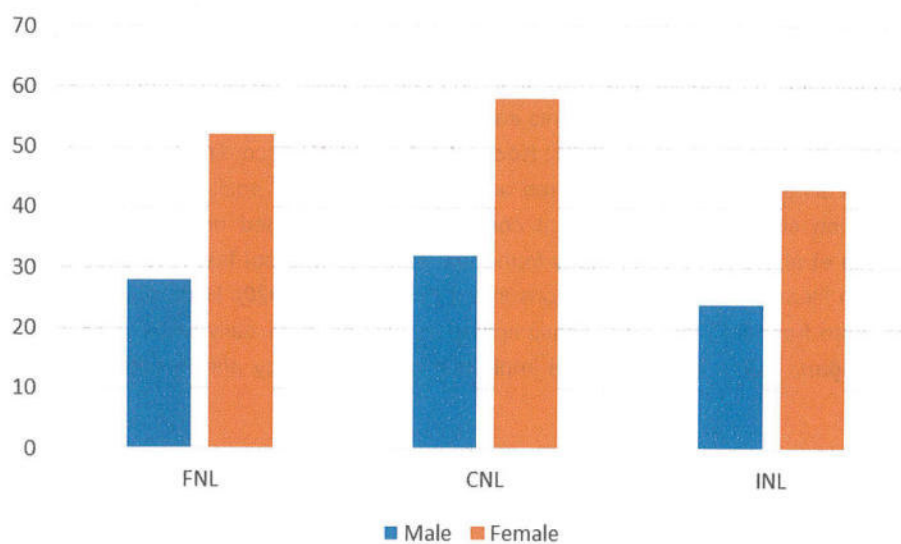Frequency distribution of nutrition education at school

Figure 2:

Comparison of nutrition literacy among males and females

FNL, Functional nutrition Literacy; CNL, critical Nutrition Literacy; INL, Interactive Nutrition Literacy

Discussion

Assessing the levels of nutrition literacy in adolescents can help in implementing cost-effective strategies and improving nutritional well-being *(Joulaei et al.,2018)*. Nutrition literacy has been the subject of interest in several studies conducted in Lebanon, Palestine, and Iran that highlighted how low nutrition literacy was common in these countries *(Khlood, 2023)*.Likewise, the study findings demonstrated a poor level of nutrition literacy among the studied early adolescents. Similar findings were reported in studies among Turkish adolescents denoting a significant proportion of them exhibited low levels of nutrition literacy *(Ayer and Ergin, 2021)* and a nationwide study in Saudi Arabia which depicted the same findings *(Khlood, 2023)*. Also similar results were concluded in a study in China*(Zeng et al., 2022)*. Research had shown that adolescents in developed nations tend to have significantly higher levels of nutrition literacy compared to their counterparts in underdeveloped countries. The latter findings were justified by the increased investments made by developed countries in the development of nutrition education strategies for use both inside and outside of the school setting. In the same manner, the findings shown could also be explained by the fact that 88% of the participants reported not getting nutrition education at school *(Mohsen et al., 2022)*. The poor level of nutrition literacy is alarming and requires improvement. The majority of the study participants responded they received no nutrition education at school. This finding gives important messages to public healthcare planners to focus on an improving nutrition literacy among school children. By comparing the mean scores of ANLs, FNL, CNL and INL, it was found that scores in all subcategories were significantly higher among females ($p < 0.01$). Similar results were reported in a Turkish study *(Kalkan ,2019)*.This can be related to the fact that girls pay more attention to their diet. They have better nutrition knowledge. In addition, girls are usually engaged in food selection and cooking.

It was clearly noticed in the current study that higher nutrition literacy was associated with several healthy dietary pattern including higher MD adherence, not skipping a meal, preference of fruits and vegetables consumption for snacks and lower fast-food consumption. Based on earlier research, which is consistent with these findings, adolescents eating patterns improve as their level of nutrition literacy rises *(Doustmohammadinan et al., 2021; Kocand Arkan, 2021)*.According to a recent study, nutrition literacy levels among school-aged children and adolescents were positively correlated with smaller fast-food portion sizes and less frequent consumption of packaged or processed snacks (Doustmohammadinan et al,2021). Another study found that students who eat fast food once a week have stronger nutrition literacy than those who consume it daily *(Dilsiz, 2020)*. High nutrition literacy was also linked to more frequent main meal consumption, as well as more daily water consumption *(Yilmazel and Bozdoğan, 2021)*. These findings imply that nutrition literacy affects eating habits of adolescents.

The study also examined the dietary intake of adolescents, and the results revealed that those with the highest nutrition literacy scores had higher intake of protein, fibers, phosphorous, potassium, vitamin C, folic acid, iron, and zinc when compared with those with low or moderate nutrition literacy scores. Similarly, *Pinarli, 2019 found* a significant positive relationship between nutrition literacy and dietary protein (%), fibers, and potassium intake among females. Additionally, it was depicted from other studies that increased nutrition literacy was associated with a reduction in sugar intake and an improvement in energy balance in boys. It has been shown that nutrition literacy increases dietary diversity and leads to higher consumption of fruits, vegetables, whole grains, legumes, and nuts*(Joulaei et al., 2018)*. This is in accordance with the MD, as these foods are rich in vitamins and

minerals and also contain high levels of complex carbohydrates and fibres*(Ioniță-Mîndrican et al., 2022)*. On the other side, studies showed that low nutrition literacy can act as a barrier to dietary diversity and nutritional adequacy *(Doustmohammadian et al., 2020)*. Therefore, these results support the link between nutrition literacy and adherence to MD.The current study revealed that higher MD adherence was associated with increased nutrition literacy. This finding aligns with conclusions drawn from previous researches *(Yurtdaş et al., 2023, Taylor et al., 2019, Tehrani et al., 2021 and Aureli and Rossi 2022)*. Given the correlation between MD adherence and nutrition literacy, early adolescent MD adherence may be significantly predicted by nutrition literacy.

The present study demonstrated that adolescents with elevated nutrition literacy exhibited healthier lifestyles, characterized by increased physical activity and reduced screen time exposure. That was similar to other studies that found a higher nutrition literacy among active adolescents than inactive ones *(Yurtdaş et al., 2023; Egg et al., 2020)*.It has been reported in literature that adolescents spend most of their time in front of screens, for example, smart phones, tablets and televisions *(Keskin et al., 2017)*. This is similar to the current study findings, as the largest proportion of the participants stated that they spent 3 or more hours in front of the screen. Moreover, the study showed that low screen time was significantly associated with higher nutrition literacy scores, and that was similar to other studies *(Myszkowska-Ryciak,2020)*. Also, the nutrition literacy scores of adolescents who watched TV less than one hour per day were found to be significantly higher than those who spent more time watching TV *(Grassi et al., 2020)*. These findings were explained by some authors, who stated that there is a relationship between health literacy, which is a concept including nutritional literacy and is defined as the ability of individuals to make decisions that have a positive impact on their health, and an active lifestyle *(Buja et al., 2020)*.

Diet quality in adolescents has proven to show some positive health outcomes such as a decrease in obesity indicators, an increase in cognitive function and mental health improvement *(Cohen et al, 2016)*. From the aforementioned study results, it was obvious that the studied adolescents with high nutrition literacy had a better eating pattern and a better life style in terms of physical activities and screen time exposure. In addition to the demonstrated findings that adolescents with high nutrition literacy had lower intake of energy Those with moderate nutrition literacy showed highest intake of fat (p<0.01)low nutrition literacy had the highest intake of carbohydrate as a percent of total energy intake. The findings of the current study did not indicate any association between nutrition literacy and BMI. Despite the high number of studies examining the relationship between nutrition literacy and BMI, their results were inconsistent. Some studies found that they are inversely associated *(Li et al., 2022)*, while others didn't find a significant relationship in line with the current study findings *(Taleb and Itani, 2021)* . This can be explained by the fact that BMI is influenced not only by the level of nutritional literacy but also by other factors such as lifestyle, environmental, psychological, or genetic factors *(Koç et al., 2021)*. The present study did not investigate the relationship between these other factors and BMI.

Interpreting the results of the study in terms of BMI, large proportion of the studied group had a normal BMI, males were significantly more obese and overweight than females. These findings were inconsistent with other study conducted among Nigerian adolescents *(Agu et al., 2023)*. Generally, there is a higher prevalence of overweight and obesity among females in developing countries. However, worries about one's appearance, especially in adolescent girls, can cause poor eating habits, such as irregular mealtimes, which can contribute to weight changes*(Adnan et al., 2022)*.

Limitations:

Firstly,cross-sectional design hinders discovering a causal relationships between nutrition literacy and physical activity, diet quality, and intake. Secondly, the face-to-face interview technique used in data collection may be susceptible to social desirability and response bias. Thirdly, the recruitment of a non-randomized convenience sample limits the findings to the studied group. Despite these limitations, the study benefits from the use of validated instruments, such as the 24-hour dietary recall, which enables analysis of typical dietary intake among adolescents, and rigorous hypothesis-driven analysis.

Conclusion

The results of this study indicated suboptimal nutrition literacy among early adolescents. Furthermore, there was a significant correlation between a higher nutrition literacy score and increased adherence to a Mediterranean diet, as well as engagement in healthy lifestyle behaviors such as maintaining healthy eating habits, performing physical activity and reducing screen time exposure.

Recommendation

These results highlight the significance of enhancing nutrition literacy among early adolescents in order to promote healthy dietary patterns and lifestyle behaviors. It is crucial to increase adolescents' awareness and develop educational content that fosters healthy lifestyle behaviors, while also implementing health policies in this area. Future studies are needed in this domain with long-term follow-up plans. Additionally, future research should focus on identifying strategies to enhance nutrition literacy among adolescents, in order to design effective nutritional interventions that promote healthy eating habits among secondary school students.

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الثقافة الغذائية،الالتزام بالنظام الغذائى المتوسطى و نمط حياة المراهقين فى الجيزة،مصر

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الملخص العربي

تعد المراهقة مرحلة حرجة من مراحل الحياة حيث يترسخ فيه السلوك الصحي، بما في ذلك العادات الغذائية. الثقافة الغذائية هى قدرة الأفراد على اكتساب المعرفة والمهارات التغذية اللازمة لاتخاذ القرارات الغذائية السليمة. حمية البحر الأبيض المتوسط تعتبر إستراتيجية غذائية شاملة تشمل نمط الحياة بأكمله، حيث يتم استكمالها بالنوم المناسب والنشاط البدني.و على الرغم من فوائدها العديدة، فإن المراهقين يبتعدون عنها بسبب ظاهرة الانتقالية الغذائية وتغريب النظام الغذائي، بسبب العولمة . تقييم الثقافة الغذائية للمراهقين يساعد واضعي السياسات على تطوير مبادرات فعالة لتعزيز الصحة، وتحسين الحالة التغذوية للمراهقين، وتحسين صحتهم وجودة حياتهم.الهدف من البحث تقييم حالة محو الأمية التغذية وارتباطها بالالتزام بنظام البحر الأبيض المتوسط الغذائي وبارامترات القياس البشري وسلوكيات نمط الحياة لدى المراهقين. تم اجراء دراسة مقطعية بين عينة من المراهقين (٣٥٠) في الجيزة، مصر. تم تقييم المدخول الغذائي على مدار ٢٤ ساعة، بينما تم تقييم الالتزام بنظام البحر الأبيض المتوسط الغذائي باستخدام «مؤشر جودة النظام الغذائي المتوسطي» بين المراهقين وتم استخدام استبيان النشاط البدني الدولى لتقييم النشاط البدني

أظهرت النتائج ضعف مستوى الثقافة الغذائية حيث سجل ٣٩.٠٥ ± ١٩.٨٧، ولم يتلق غالبية المشاركين (٨٨٪) تعليما غذائيا في المدارس. متوسط درجة المعرفة الغذائية أعلى بشكل ملحوظ بين المراهقين الذين كانوا ملتزمين بشدة بنظام البحر الأبيض المتوسط الغذائي (سجل 8 حفي درجة المؤشر مع مستوى عالٍ من ممارسة النشاط البدني، وممارسة عادات غذائية أكثر صحة، والإبلاغ عن تعرض أقل لوقت الشاشة

وخلصت الدراسة إلى ان الغذائية تعتبر دون المستوى الأمثل بين المراهقين.وجد ارتباط إيجابي كبير بين المعرفة الغذائية و الالتزام بالنظام الغذائي المتوسطي والمشاركة في سلوكيات نمط الحياة الصحية مثل الحفاظ على عادات الأكل الصحية وأداء النشاط البدني وتقليل التعرض لوقت الشاشة.

الكلمة الرئيسية: الثقافة الغذائية، المراهقين، النظام الغذائي، نمط الحياة، مصر.