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Nutrition literacy and its relationship with diet quality and quality of life among white-collar employees: a study from Türkiye

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Abstract

Background Nutrition literacy is an important component of health and healthy eating behaviors. The aim of this study was to determine the nutrition literacy (NL) status of white-collar employees and its relationship with adherence to the Mediterranean diet, anthropometric measurements, and lifestyle behaviors, including eating habits, dietary intake, and physical activity level.

Methods This cross-sectional study was conducted with 3459 white-collar employees aged 18–65 who lived in Türkiye. A questionnaire prepared by the researchers was used to obtain information about the demographic characteristics and anthropometric measurements of the participants. Evaluation Instrument of Nutrition Literacy on Adults (EINLA) was used to assess NL, the Mediterranean Diet Adherence Screener (MEDAS) was used to assess diet quality, and the Quality of Life Test Short Form-36 (SF-36) was used to determine quality of life. Data analysis was conducted using the IBM SPSS Statistics 21.0 program.

Results With an average age of 24.3 ± 10.5 years and 50.7% women, women presented higher nutrition literacy than men did ($p < 0.001$). Most participants held university or postgraduate degrees with medium to high income levels and the majority demonstrated sufficient NL. Compared with other participants, those with adequate NL had significantly higher Mediterranean diet adherence, and SF-36 physical (77.27 ± 16.26), and mental (65.45 ± 17.00) scores ($p < 0.001$). Negative correlations were found between the EINLA score and BMI (r=-0.082), waist circumference (r=-0.072), hip circumference (r=-0.036), waist/hip ratio (r=-0.074), and waist/height ratio (r=-0.056) ($p < 0.05$). Additionally, weak positive correlations were observed between the EINLA score and the SF-36 physical ($r = 0.158$) and mental scores ($r = 0.088$), as well as the metabolic equivalent of task (MET) score ($r = 0.042$) ($p < 0.05$).

Conclusions The results of this study demonstrated that NL is a significant predictor of anthropometric measurements and healthy lifestyle behaviors including dietary habits, and quality of life among adults. Nutrition literacy can enable individuals to make informed choices and thus contribute to the prevention of many noncommunicable chronic diseases.

Keywords Diet quality, Mediterranean diet, Nutrition literacy, Quality of life, White-collar employees

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Background

Adequate nutritional knowledge, optimal dietary behaviors, and the maintenance of a healthy weight are recognized as fundamental modifiable factors for enhancing health and preventing chronic diseases [1, 2]. Nutrition literacy (NL) and food literacy have emerged as essential components in promoting and sustaining healthy eating practices. Moreover, inadequate nutrition and dietary practices are major contributors to obesity, diabetes, cancer, and cardiovascular diseases [2–4].

Health literacy is generally defined as an individual's knowledge, motivation, and ability to access, comprehend, evaluate, and apply health information to make informed health decisions. Inadequate health literacy is associated with poorer self-management and increased morbidity and mortality rates in individuals with chronic health conditions, including cardiovascular disease [5, 6], asthma [7, 8], and diabetes [9–11]. While many countries prioritize health literacy in their policies and practices, it remains low among individuals with lower general education and income levels, older adults, and those with long-term health problems [12].

Two specific types of health literacy, nutrition literacy, and food literacy, have emerged as fundamental components in promoting and sustaining healthy eating practices [13]. NL is defined as the capacity to obtain, process, and understand the nutritional information and skills necessary to make appropriate nutritional decisions [14]. In contrast, food literacy extends beyond nutrition knowledge to include the application of nutrition information to make food choices and critically evaluate personal and communal nutrition behaviors [15].

In recent years, awareness of the interaction between nutrition and health, increasing diversity in the food industry, and the proliferation of alternatives for food consumption outsidethe home have highlighted the importance of NLs, leading to increased interest in this subject [16]. Sociodemographic characteristics such as sex, age, educational status, socioeconomic status, and dietary habits influence NL. Individuals with adequate NL should possess the abilities and skills to understand portion sizes, prepare food, make healthy food choices, read, and understand food labels, and access reliable sources of nutritional information [17]. In a study involving 94 adults who visited five different clinics, participants who received NL consultations from registered dietitians reported increased consumption of whole fruits, beans, and leafy greens, as well as a reduction in negative dietary behaviors, compared to the control group [18]. It can be stated that adequate NL is necessary for individuals to maintain adequate and balanced nutrition.

A cross-sectional study involving 2869 adults demonstrated a significant relationship between NL and adherence to the Mediterranean diet [19]. The Mediterranean diet is recognized worldwide as one of the healthiest dietary patterns. Various studies have shown that adherence to this diet is associated with improved longevity, a lower risk of mortality, and a reduced incidence of cancer, and cardiovascular, and metabolic diseases [20]. The demographic differences in adherence to the Mediterranean diet have not been comprehensively studied. The relationship between Mediterranean diet adherence and health literacy is an underexplored research area, with limited data on the impact of NLs on adherence to the Mediterranean diet and lifestyle. Various studies have evaluated the relationship between health literacy and healthy eating or general nutrition, demonstrating a positive relationship between health literacy and healthy eating [21, 22]. Determining the status of NL and understanding the determinants of healthy eating and lifestyle behaviors can help in the adoption of effective strategies to improve health in adults [23, 24]. While significant studies on nutrition literacy have been conducted, the number of studies published in the past five years remains limited. To our knowledge, this study is the first to evaluate the relationship between NL and adherence to the Mediterranean diet with respect to anthropometric measurements, dietary habits, dietary intake, and physical activity. The primary aim of this study was to determine the NL status of adults and its relationship with adherence to the Mediterranean diet, anthropometric measurements, and lifestyle behaviors, including eating habits, dietary intake, and physical activity level.

Methods

Research location, time, and sample selection

This cross-sectional study was conducted between March 2024 and May 2024 with white-collar employees aged 18–65 working in both the private and public sectors who lived in Türkiye and agreed to participate in the study voluntarily. A total of 3459 volunteer adults, 1705 men and 1754 women, participated in the study. Individuals who performed physical labor (blue-collar employees), followed a specific dietary model, and were pregnant or breastfeeding were excluded from the study.

A sample size of 4332 participants was determined via G*Power 3.1 to achieve 95% power with 0.1 effect size and a significance level of $\alpha=0.05$. The flowchart of the participant recruitment process is shown in Fig. 1.

Data collection and evaluation

Demographic information and anthropometric measurements

Data were collected through face-to-face interviews via a questionnaire that was prepared by the researchers. The participants provided their demographic information and medical history in response to the questionnaire.

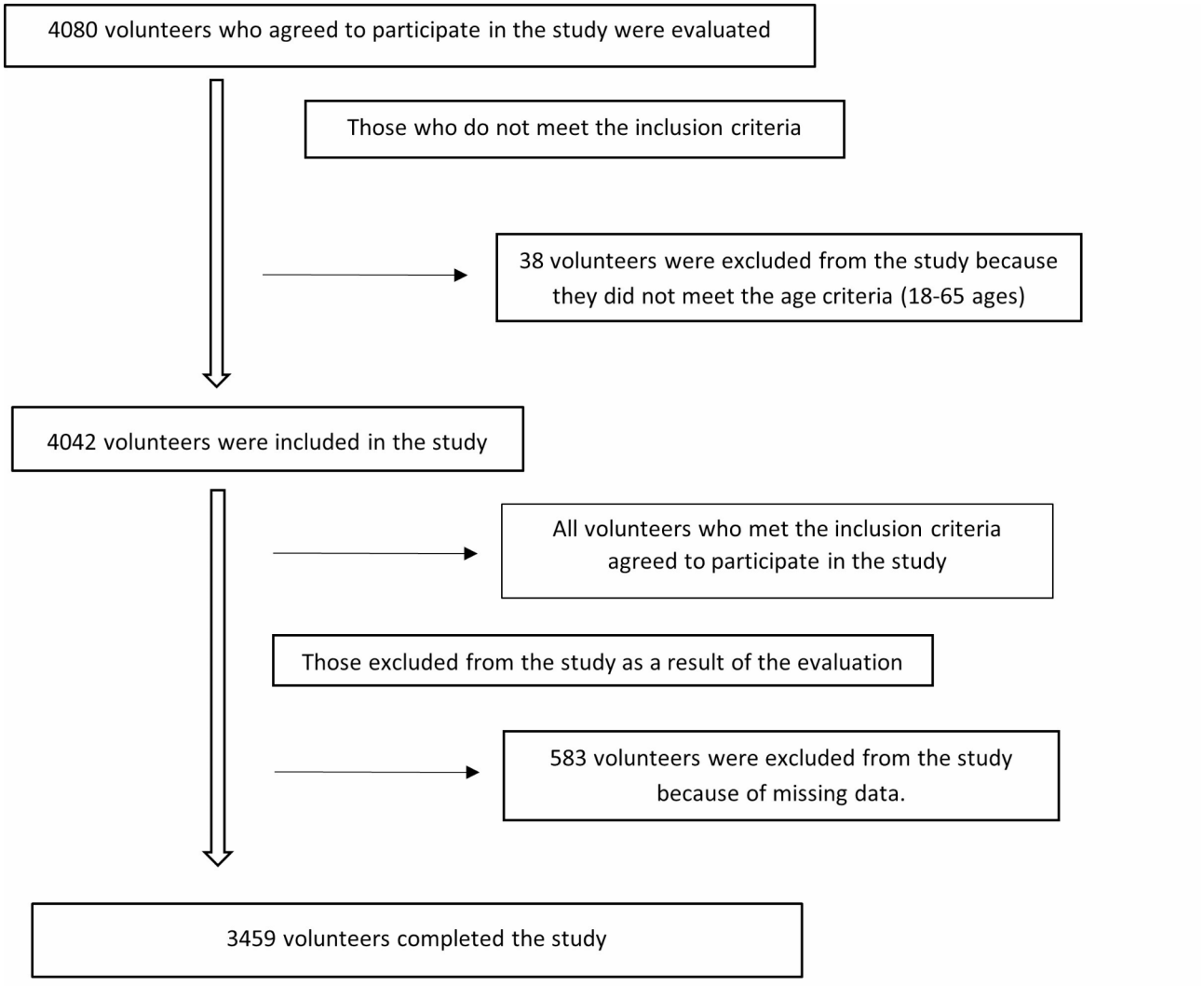

Fig. 1 Flow chart of the recruitment of the participants

In addition, anthropometric measurements of the participants, including height (cm), body weight (kg), waist circumference (cm), and hip circumference (cm), were taken. The waist-to-hip ratio and waist-to-height ratio were calculated for each participant. Body mass index (BMI) was evaluated by calculating with the formula "BMI = body weight (kg) / height (m^2)". The World Health Organization classification was used to assess BMI (underweight: <18.5 kg/m^2; normal: 18.5–24.9 kg/m^2; overweight: 25.0–29.9 kg/m^2; obese: >30.0 kg/m^2) [25].

Instrument of nutrition literacy on adults (EINLA)

The NL levels of the participants were assessed via the Evaluation Instrument of Nutrition Literacy on Adults (EINLA) developed by Cesur, Koçoğlu and Sümer in 2015 [17]. This categorical questionnaire consists of 5 sub-components and a total of 35 questions, that test the NL levels of the participants. Each correctly answered question is worth one point, while incorrectly answered and unanswered questions are worth zero points. In the questionnaire, 0–11 points are classified as inadequate NL, 12–23 points as borderline NL, and 24–35 points as adequate NL.

Mediterranean diet adherence screener (MEDAS)

Participants' adherence to the Mediterranean diet was examined via the 14-item Mediterranean Diet Adherence Screener (MEDAS), which is used as a diet quality assessment tool and was developed by Martinez-Gonzalez in 2012 [26, 27]. A validity and reliability study of the scale in Türkiye was conducted by Özkan Pehlivanoğlu and colleagues in 2020 [28]. In this scale, there are a total of 14 questions, 2 of which are related to food consumption habits and 12 to the frequency of food consumption. Each response is scored as either zero or one. Those who scored less than 7 points on this scale were considered

to have a low Mediterranean diet adherence level, those who scored 7–8 points were considered medium, and those who scored 9 points and above were considered high.

Quality of life test short form-36 (SF-36)

The participants' quality of life was examined via the Quality of Life Test Short Form-36 (SF-36), created by Ware and Sherbourne in 1992 [29]. A study of the validity and reliability of the questionnaire in Türkiye was conducted by Koçyiğit et al. in 1999 [30]. This questionnaire has two subheadings as the SF-36 physical component and the SF-36 mental component. This Likert-type scale consists of a total of 36 questions that assess physical function, physical role difficulty, emotional role difficulty, social function, pain, mental health, energy-vivacity-vitality, pain, and general health. The highest score is 100 and the lowest score is 0. It has been reported that quality of life increases as the score obtained from the questionnaire increases.

Table 1 Socio-demographic characteristics and anthropometric measurements

Characteristics	Frequency (*n*)	Percentage (%)
Gender		
Female	1754	50.7
Male	1705	49.3
Age ($\overline{X}$ ± SD) (year)	24.3 ± 10.5	
Education status		
Primary & middle school	292	17.6
High school	688	19.9
University degree	2147	62.9
Higher education (master or PhD)	305	8.8
Marital status		
Married	1797	52.0
Single	1662	48.0
Income status		
Low	120	3.5
Medium	2193	63.4
High	1146	33.1
Anthoropometric measurements		
BMI ($\overline{X}$ ± SD) (kg/m2)	24.9 ± 4.3	
Weight (kg)	72.8 ± 15.9	
Height (cm)	170.5 ± 9.3	
BMI category		
Underweight	149	4.3
Normal	1707	49.3
Overweight	1185	34.3
Obese	418	12.0
Waist circumference (cm) ($\overline{X}$ ± SD)	85.1 ± 15.1	
Hip circumference (cm) ($\overline{X}$ ± SD)	100.3 ± 10.8	
Waist/Hip ratio ($\overline{X}$ ± SD)	0.84 ± 0.11	
Waist/Height ratio ($\overline{X}$ ± SD)	0.49 ± 0.08	

Abbreviations: SD, standard deviation; BMI, body mass index

Descriptive values are expressed as frequency, percentage or mean ± standard deviation

The international physical activity questionnaire short form (IPAQ)

The International Physical Activity Questionnaire Short Form (IPAQ), created by Dr. Micheál Booth in 1996, was used to determine the participants' physical activity levels. Reliability and validity studies of the survey were conducted via the test-retest method in 12 countries and 14 research centers on 6 continents from 1998 to 1999. These studies indicate that the IPAQ scale is a reliable and valid method for determining physical activity levels [31]. The validity and reliability study of the questionnaire in Türkiye was conducted by Öztürk in 2005 [32]. This scale assesses the individual's three main activities performed in the past 7 days (walking, moderate-intensity activity, and vigorous activity), as well as their average daily sedentary time. The calculation is done using a different metabolic equivalent of task (MET) value for each level of activity. The MET value of the activity performed is multiplied by the number of days and minutes to find the "MET-minutes/week" score. The MET score was classified as follows: low (< 600 MET-minutes/week), moderate (600–3000 MET-minutes/week), or high (≥ 3000 MET-minutes/week) [31].

Statistical analysis

IBM SPSS Statistics 21.0 was used to analyze the data [33]. For descriptive statistics, the mean ($\bar{X}$), and standard deviation (SD) were used. The normality of the distribution was tested with the Kolmogorov–Smirnov test. The chi-square test was used for categorical variables in comparisons between groups. For data that were not normally distributed, the Kruskal-Wallis test was used for comparisons between groups, and pairwise group comparisons were subsequently performed with the Mann-Whitney U test. The relationships between quantitative variables were evaluated via Spearman's correlation analysis, a non-parametric method suitable for data that do not meet normality assumptions. The correlation figure was created via the web-based algorithm in the R studio software. The significance level was accepted as $p < 0.05$. The acceptable error rate was 5% with a confidence level of 95%.

Results

This study included 3459 adults (50.7% female and 49.3% male) with a mean age of 24.3 ± 10.5 years. The sociodemographic characteristics and anthropometric measurements of the participants are presented in Table 1. The majority of the participants (71.7%) had a university or

postgraduate degree. When anthropometric measurements were evaluated, approximately half of the participants (49.3%) were found to have a normal BMI, while 46.3% were overweight or obese.

Table 2 shows the NL levels of individuals according to their demographic characteristics and anthropometric measurements. The NL levels of women were greater than those of men ($p<0.001$). Individuals with higher education and income levels had higher levels of adequate NL ($p<0.001$). The BMI (24.7±4.2 kg/m^2), waist circumference (84.8±14.9 cm) and waist/hip ratio (0.84±0.10) of individuals with borderline NL were greater than those of individuals with adequate NL (26.1±4.7 kg/m^2, 88.0±15.6 cm and 0.86±0.09, respectively) ($p<0.001$).

Compared with the other participants, the participants with an adequate level of NL had greater adherence to the MEDAS, with 36.3% achieving this adherence (moderate 35.3% and low 28.4%) ($p<0.001$). The SF-36 physical (77.27±16.26) and SF-36 mental (65.45±17.00) scores of the participants with adequate NL were significantly higher than those with borderline NL (71.15±18.69 and 60.52±17.51, respectively) ($p<0.001$). As a result of the physical activity evaluation, the majority of participants (75.4%) with sufficient NL levels were more active than the other groups were ($p<0.05$) (Table 3).

When the relationships among gender, marital status, and MEDAS score classifications were examined, it was found that men's MEDAS scores were lower than women's, and married individuals had higher MEDAS adherence than singles ($p<0.05$). Additionally, waist circumference (85.7±15.5 cm) and hip circumference (100.4±11.5 cm) were significantly higher in individuals with low MEDAS scores than in those with high MEDAS scores ($p=0.046$ and $p=0.002$, respectively) (Table 4).

Figure 2 shows the correlations between NL and other variables, including age, anthropometric measurements, quality of life (SF-36 physical and mental), physical

Table 2 Socio-demographic characteristics and anthropometric measurements according to NL levels

EINLA category	Inadequate NL ($n=5$)		Borderline NL ($n=270$)		Adequate NL ($n=3184$)		*p*-value
	n	%	*n*	%	*n*	%	
Gender							
Female	1	0.1	93	5.4	1660	94.6	<0.001*
Male	4	0.2	177	10.4	1524	89.4	
Education status							
Primary & Middle school	1	0.3	49	16.8	242	82.9	<0.001*
High school	2	0.3	98	14.2	588	85.5	
University degree	2	0.1	114	5.2	2058	94.7	
Higher education (master or PhD)	-	-	9	3.0	296	97.0	
Marital status							
Married	3	0.2	142	7.9	1652	91.9	0.914
Single	2	0.1	128	7.7	1532	92.2	
Income status							
Low	1	0.8	20	16.7	99	82.5	<0.001*
Medium	3	0.1	178	8.1	2012	91.7	
High	1	0.1	72	6.3	1073	93.6	
BMI ($\overline{X}$ ± SD) (kg/m^2)	24.7±2.4		26.1±4.7[a]		24.7±4.2[a]		<0.001*
BMI Category							
Underweight	-	-	11	4.1	138	4.4	<0.001*
Normal	2	40	105	38.9	1600	50.3	
Overweight	3	60	98	36.3	1084	34.0	
Obese	-	-	56	20.7	362	11.4	
Waist circumference (cm) ($\overline{X}$ ± SD)	88.8±24.7		88.0±15.6[b]		84.8±14.9[b]		0.003*
Hip circumference (cm) ($\overline{X}$ ± SD)	106.8±19.6		101.2±12.8		100.2±10.5		0.466
Waist/Hip ratio ($\overline{X}$ ± SD)	0.82±0.12		0.86±0.09[c]		0.84±0.10[c]		0.001*
Waist/Height ratio ($\overline{X}$ ± SD)	0.502±0.107		0.509±0.085		0.497±0.080		0.079

Abbreviations: EINLA, Evaluation Instrument of Nutrition Literacy on Adults; NL, Nutrition Literacy; SD, Standard Deviation; BMI, Body Mass Index

Descriptive values are expressed as frequency, percentage, or mean±standard deviation

*$p<0.05$ obtained from Chi-square test for categorical variables or a Kruskal Wallis test for continuous variables

[a]The difference between the BMI values of those with borderline NL and adequate NL, $p<0.001$

[b]The difference between the waist circumference of those with borderline NL and adequate NL, $p=0.001$

[c]The difference between the waist/hip ratio of those with borderline NL and adequate NL, $p<0.001$

Table 3 MEDAS score, MEDAS adherence, SF-36 and MET scores according to NL levels

EINLA categories	Inadequate NL (*n* = 5)		Borderline NL (*n* = 270)		Adequate NL (*n* = 3184)		*p*-value
	n	%	*n*	%	*n*	%	
MEDAS Score ($\overline{X}$ ± SD)	9.20 ± 3.56		8.10 ± 3.25		7.79 ± 2.33		0.374
MEDAS Adherence							
Low	2	40.0	88	32.6	904	28.4	0.001*
Moderate	-	-	64	23.7	1125	35.3	
High	3	60.0	118	43.7	1155	36.3	
SF-36 physical ($\overline{X}$ ± SD)	64.0 ± 22.70		71.15 ± 18.69[a]		77.27 ± 16.26[a]		< 0.001*
SF-36 mental ($\overline{X}$ ± SD)	56.85 ± 23.71		60.52 ± 17.51[b]		65.45 ± 17.0[b]		< 0.001*
MET Score ($\overline{X}$ ± SD)	1469.60 ± 1712.10		2381.71 ± 3434.78[c]		2463.35 ± 3452.45[c]		0.060
MET Score Categories							
Low (< 600 MET-minutes/week)	2	40.0	92	34.1	784	24.6	0.003*
Moderate (≥ 600 to < 3000 MET-minutes/week)	2	40.0	109	40.4	1643	51.6	
High (≥ 3000 MET-minutes/week)	1	20	69	25.6	757	23.8	

Abbreviations: EINLA, Evaluation Instrument of Nutrition Literacy on Adults; NL, Nutrition Literacy; MEDAS, Mediterranean Diet Adherence Screener; MET, Metabolic Equivalent of Task; SD, Standard Deviation; SF-36, Quality of Life Test Short Form 36; BMI, Body Mass Index

Descriptive values are expressed as frequency, percentage, or mean ± standard deviation

*$p < 0.05$ obtained from Chi-square test for categorical variables or a Kruskal Wallis test for continuous variables

[a]The difference between the SF-36 physical scores of those with borderline NL and adequate NL, $p < 0.001$

[b]The difference between the SF-36 mental scores of those with borderline NL and adequate NL, $p < 0.001$

[c]The difference between the MET scores of those with borderline NL and adequate NL, $p = 0.026$

activity score (MET score), and adherence to the Mediterranean diet. Weak negative correlations were determined between the participants' EINLA scores and age (r=-0.042, p=0.014), BMI (r=-0.082, p<0.001), waist circumference (r=-0.072, p<0.001), hip circumference (r=-0.036, p=0.033), waist/hip ratio (r=-0.074, p<0.001) and waist/height ratio (r=-0.056, p=0.001). Additionally, a weak positive relationship was determined between the participants' EINLA scores and the SF-36 physical score (r=0.158, p<0.001), SF-36 mental score (r=0.088, p<0.00), and MET score (r=0.042, p=0.013).

Discussion

This study aimed to examine the relationships between NL levels and parameters such as anthropometric measurements, diet quality, quality of life, and physical activity level in white-collar workers across Türkiye. NL has become a frequently studied subject in recent years. There are many studies on NL in Türkiye [34–38]. While all these study results emphasize the importance of NL, to our knowledge, no studies have determined its relationship with diet quality by considering anthropometric measurements, quality of life, and physical activity levels in Turkish white-collar workers.

Existing literature suggests that NL levels are associated with demographic parameters such as gender, income status, and educational level [39–43]. In a study conducted with university students in Türkiye, the percentage of women with adequate NL was found to be significantly higher than that of men [37]. A study in Norway revealed that males had lower odds of achieving a high NL score [44]. A Brazilian study revealed that females have significantly higher NL levels than males do. Additionally, the study revealed a positive correlation between socioeconomic level and NL level [45]. The European Health Literacy Survey (HLS-EU), which was conducted with a total of 7795 participants from eight different European countries, revealed that the rate of inadequate NL in people with low socioeconomic status and education level was higher than that in other individuals [46]. In the study conducted by Natour et al. with adults, the NL level of the group with a high-income level was found to be higher than that of other groups [47]. Similarly, Lassetter et al., in their study with 354 adults, reported that a high level of NL was associated with higher income and higher education levels [48]. Our study revealed that NL levels were higher in women than in men and that individuals with higher education and income levels had higher levels of adequate NL. These results align with the literature in demonstrating a positive association between income level, educational level, and NL. Socioeconomic inequalities (lower education and income levels) play a significant role in dietary behaviors and NL. Recognizing and addressing problems of inadequate NL levels in participants could facilitate the reduction of possible long-term negative health outcomes. Moreover, food insecurity has been linked to poorer diet quality and sustainable eating behaviors. A recent study found that individuals facing food insecurity were less likely to engage in sustainable eating practices, such as consuming organic or low-fat foods and reducing food waste, which can impact long-term health [49].

Table 4 Socio-demographic characteristics and anthoropometric measurements according to MEDAS adherence

MEDAS adherence	Low ($n=994$)		Moderate ($n=1189$)		High ($n=1276$)		*p*-value
	n	%	*n*	%	*n*	%	
Gender							
Female	463	26.4	618	35.2	673	38.4	0.008*
Male	531	31.1	571	33.5	603	35.4	
Education status							
Primary & Middle school	91	31.2	101	34.6	100	34.2	0.468
High School	206	29.9	222	32.3	260	37.8	
University Degree	615	28.3	768	35.3	791	36.4	
Higher Education (Master or PhD)	82	26.9	98	32.1	125	41.0	
Marital status							
Married	483	26.9	622	34.6	692	38.5	0.027*
Single	511	30.7	567	34.1	584	35.1	
Income status							
Low	44	36.7	31	25.8	45	37.5	0.008*
Medium	651	29.7	770	35.1	772	35.2	
High	299	26.1	388	33.9	459	40.1	
BMI ($\overline{X}$ ± SD) (kg/m^2)	24.96 ± 4.39		24.88 ± 4.28		24.86 ± 4.30		0.789
BMI Category							
Underweight	45	4.5	52	4.4	52	4.1	0.109
Normal	467	47.0	579	48.7	661	51.8	
Overweight	358	36.0	428	36.0	399	31.3	
Obese	124	12.5	130	10.9	164	12.9	
Waist circumference (cm) ($\overline{X}$ ± SD)	85.7 ± 15.5[a]		85.3 ± 14.6[b]		84.3 ± 15.0[a, b]		0.046*
Hip circumference (cm) ($\overline{X}$ ± SD)	100.4 ± 11.5[c]		100.8 ± 10.1[d]		99.6 ± 10.7[c, d]		0.002*
Waist/Hip ratio ($\overline{X}$ ± SD)	0.85 ± 0.10		0.84 ± 0.11		0.84 ± 0.11		0.117
Waist/Height ratio ($\overline{X}$ ± SD)	0.501 ± 0.082		0.500 ± 0.079		0.495 ± 0.081		0.072

Abbreviations: MEDAS, Mediterranean Diet Adherence Screener; SD, Standard Deviation; BMI, Body Mass Index

Descriptive values are expressed as frequency, percentage, or mean ± standard deviation

*$p<0.05$ obtained from Chi-square test for categorical variables or a Kruskal Wallis test for continuous variables

[a]The difference between the waist circumference of those with low and high MEDAS scores, $p=0.025$

[b]The difference between the waist circumference of those with moderate and high MEDAS scores, $p=0.048$

[c]The difference between the hip circumference of those with low and high MEDAS scores, $p=0.023$

[d]The difference between the hip circumference of those with moderate and high MEDAS scores, $p=0.001$

This highlights the importance of addressing both food access and nutrition literacy, particularly for those in lower socioeconomic groups, to improve dietary habits and overall well-being.

Recent research has suggested a relationship between NL and various anthropometric measures, including BMI, waist circumference, and the waist-to-hip ratio [34, 35, 50]. In a study conducted by Soylar et al. with 626 adults in Türkiye, the rates of overweight and obese individuals were found to be significantly higher among those with insufficient NL levels [51]. Şanlıer et al. (2024) reported a positive association between BMI and NL in a study of 1600 adults. Participants with normal BMIs had the highest NL scores, whereas those with obesity had the lowest [36]. Supporting these findings, in a study conducted by Murakami et al. (2022) in Japan with 2231 adults among the data of the MINNADE (Ministry of Health, Labor and Welfare-Sponsored Nationwide Study on Dietary Intake Evaluation) social study, parameters related to food literacy were reported to be negatively and significantly related to BMI [52]. A study investigating the impact of NL on health in Portugal, reported a significantly greater BMI among individuals with inadequate NL than among other groups [53]. Another study conducted with adults in Türkiye, reported that there was a statistically significant and negative relationship between the NL score and BMI, body weight and the waist/hip ratio [35]. The findings of our study support the results of other studies and the BMI and waist circumference values of individuals with adequate NL were found to be significantly lower than those with borderline NL levels. These results suggest that there is a negative relationship between NL and anthropometric measurements. Several possible reasons for these results can be suggested. Owing to their busy word hours, white-collar workers may not have enough time to obtain nutritional

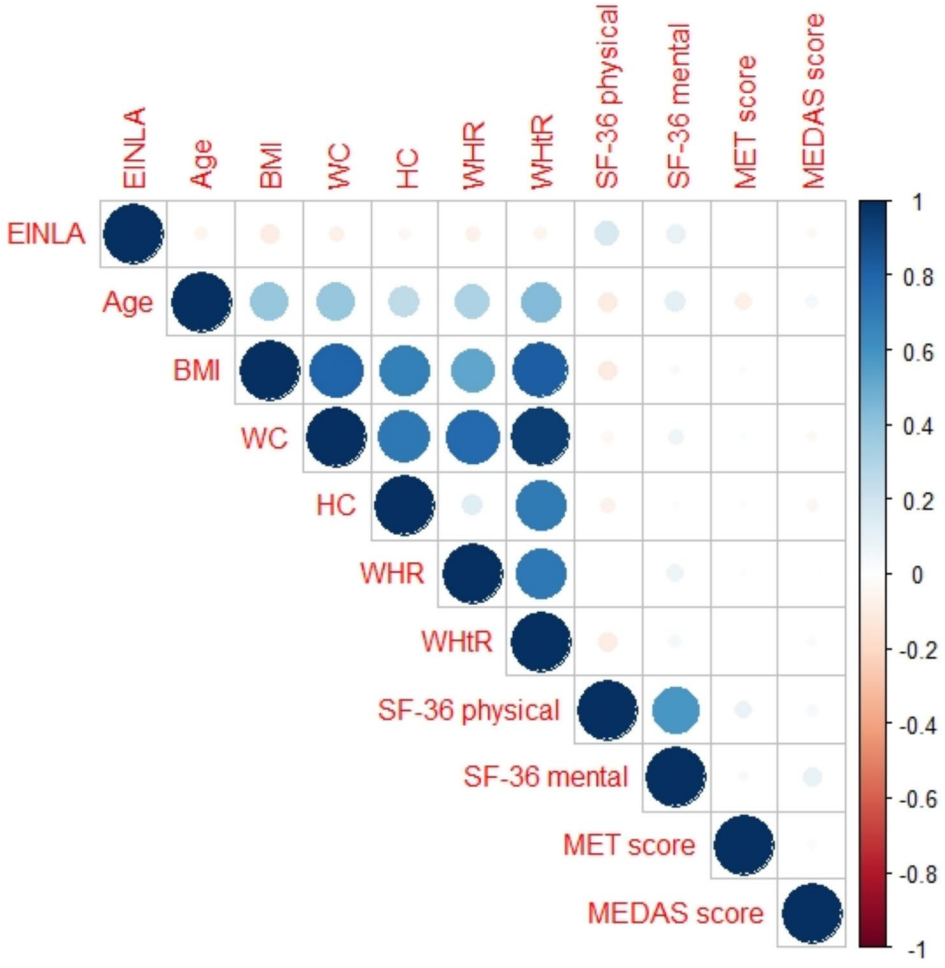

Fig. 2 The correlation between EINLA and age, anthropometric measures, SF-36 physical and mental scores, MEDAS, and MET scores

information. Additionally, a study revealed that nutritional knowledge alone is not sufficient to change individual nutritional preferences [54]. Basic behavioral capabilities, environmental support, collaborative action, and partnerships at various levels of influence are required to achieve behavior change [55]. In our study, the BMI and waist circumference values of individuals with adequate NL were significantly lower than those of individuals with borderline NL. These results suggest that there is a negative relationship between NL and anthropometric measurements.

The level of adherence to the Mediterranean diet serves as an index that determines the quality of a person's diet [27]. Depboylu et al. (2023) reported a positive association between NL and adherence to the Mediterranean diet in a study of 1074 Turkish adolescents [34]. Similarly, in a study conducted by Ashoori et al. (2023) with adolescents, higher food and NL scores were significantly associated with higher diet quality [56]. Aureli and Rossi (2022) reported a strong relationship between nutritional knowledge and adherence to the Mediterranean diet in a study of 2,869 adults in Italy. They further suggested a clear connection between a healthy nutritional model and NL [19]. A study conducted with pregnant Chinese women found that the group receiving the comprehensive nutrition intervention, which included NL consultations, began to consume a more diverse range of foods, with notable increases in the intake of dairy products, seafood, and nuts [57]. In support of these results, individuals following healthy diet models, which are similar to the Mediterranean diet, tend to have higher diet quality and NL [58]. A study conducted with 2231 adults in Japan revealed that the diet quality score was positively associated with the level of nutritional knowledge [59]. In this study, the Mediterranean diet adherence level of participants with sufficient NL was significantly higher than other participants. This finding is consistent with the results of previous studies. Based on these results in the literature, as the level of nutritional knowledge and NL increases, the quality of the diet al.so increases. The association between adherence to the Mediterranean diet and NL suggests that NL is an important predictor of

adherence to the Mediterranean diet among white-collar workers.

Recently, the relationship between overall health and quality of life and NL has become a crucial topic. Studies have shown that higher NL level is associated with better health outcomes, including improved physical and mental health [60, 61]. A study of Turkish adults revealed significant correlations between NL scores and various quality-of-life metrics such as general health ($r=0.220$), physical function ($r=0.351$), physical role difficulty ($r=0.088$), function ($r=0.253$), pain ($r=0.154$) and mental health ($r=0.213$) suggesting that improving NL can enhance quality of life [62]. Similarly, research on the Portuguese population highlighted that individuals with higher educational qualifications and those in health-related fields tend to have better NL, which is related to healthier dietary habits and reduced chronic disease incidence [63]. In addition to NL, general health literacy has been shown to significantly impact health outcomes and quality of life. A study by Alireza Jafari et al. (2021) in Iran revealed a significant positive correlation between mental health literacy and quality of life [64]. The study, which surveyed 1070 participants, revealed that higher levels of mental health literacy were associated with better quality of life scores ($p<0.001$). Similarly, research by Celalettin Cevik et al. (2021) on health literacy and quality of life among people in semiurban and urban areas showed that adequate HL levels were associated with better quality of life [65]. The study included 595 participants and revealed significant differences in HL and quality of life between semiurban and urban residents ($p<0.001$). Our findings indicate that individuals with higher NL scores tend to have better physical and mental health. Specifically, participants with sufficient NL reported significantly higher SF-36 physical and mental scores than those with borderline NL did.

Our study highlights the crucial role of NL in promoting physical activity and overall health. The literature shows that increased nutrition knowledge and physical activity significantly influence body composition and health outcomes [66]. In a study involving 720 adults, higher nutritional and physical activity knowledge was associated with better physical activity status [67]. A study suggested that increased nutritional awareness is not always related to physical activity due to the type of activity and educational intervention [68]. Additionally, NL was positively correlated with MET scores. The relationship between health literacy and physical activity has been extensively studied, with a systematic review finding that 18 out of 22 studies reported a significant positive association between high health literacy and high levels of physical activity [69]. Our findings revealed that participants with sufficient NL were more likely to engage in regular physical activity compared to those with lower NL levels. These findings suggest that improving health literacy can enable individuals to make more informed decisions about their physical activity, thereby preventing chronic noncommunicable diseases associated with a sedentary lifestyle. These results underscore the importance of comprehensive health education programs in promoting well-being and better health outcomes.

A systematic review of 50 studies revealed that Mediterranean countries have shown moderate adherence to the Mediterranean diet over the past decade, with most studies reporting low or moderate adherence levels across different sex and age groups [70]. Other studies in Türkiye by Demircioğlu (75.3%) and Metin (50.5%) also reported that a higher percentage of the participants had moderate to high adherence levels, indicating a trend toward moderate Mediterranean diet adherence in Türkiye [71, 72]. Most of the participants in our study were categorized into moderate and high adherence groups for the Mediterranean diet.

The relationship between diet quality, specifically adherence to the Mediterranean diet, and its impact on sociodemographic factors and anthropometric measurements has been extensively studied. Sociodemographic factors, including gender and marital status, play crucial roles in dietary behaviors and diet quality [73]. Previous research has shown that living with a partner is positively associated with increased adherence to the Mediterranean diet [74]. Additionally, a study by Hanna et al. (2015) revealed that individuals living alone were more likely to have lower intakes of healthy foods such as fruits, vegetables, and fish compared to those living with a partner [75]. Gender differences in adherence to the Mediterranean diet have been extensively studied, with inconclusive results. Some studies have reported better adherence to the Mediterranean diet in women, some have reported no significant difference between genders, and others have reported that women have lower adherence than men do [76–78]. Our findings suggest greater adherence to the Mediterranean diet in women and in married participants.

The impact of the Mediterranean diet on body composition, including parameters such as BMI, waist circumference, and the waist-to-hip ratio, is well-documented and significant [79]. Studies have shown that adherence to the Mediterranean diet is significantly associated with better body composition outcomes [79–81]. A study on teaching and research staff at the University of Granada revealed that adherence to the Mediterranean diet was significantly correlated with better BMI outcomes, with higher Mediterranean diet adherence associated with lower BMI ($r=-0.179$) [82]. A study in the Greek population revealed that moderate adherence to the Mediterranean diet was associated with decreased waist-to-hip circumference and improved body composition,

highlighting the beneficial effects of the Mediterranean diet on anthropometric indices [83]. Additionally, previous findings linked the Mediterranean diet with lower body fat and a reduced risk of obesity [84]. Our findings revealed that individuals with high MEDAS scores had significantly lower waist circumference and hip circumference, indicating that greater adherence to the Mediterranean diet is associated with better anthropometric outcomes.

Strengths and Limitations

This study has several notable strengths that distinguish it in the field of dietary behavior research. To our knowledge, this is the first study to evaluate adherence to the Mediterranean diet in conjunction with NL among a sample of white-collar workers in Türkiye. This study provides unique and valuable insight into dietary patterns within this specific demographic group. The focus on individuals in the workforce, who typically have a higher level of education, offers a meaningful perspective on how educational attainment influences dietary choices. The exploratory nature of the study allows for an in-depth examination of a specific segment of the population, providing detailed insights that can inform targeted nutritional interventions and public health strategies.

However, the study also has several limitations that must be considered. The lack of diversity in job types among participants means that the findings may not fully represent the broader working population. The cross-sectional design of the study limits the ability to draw causal conclusions about the relationships observed. While the findings suggest associations, they cannot establish cause-and-effect relationships. Additionally, the focus on a specific social class with higher education and income levels limits the generalizability of the results to other socioeconomic groups. This specific sample was not intended to represent the national population, a conscious decision reflecting the exploratory aim of the research. The participants' high awareness of health-related issues and advanced nutritional knowledge could introduce bias toward healthier dietary choices, which may not accurately reflect the general population's eating habits. For instance, the dietary patterns, health awareness, and nutritional literacy observed in this sample may not reflect the behaviors and challenges of less-educated or lower-income populations, who may face different barriers to healthy eating. Future research should include more diverse samples to ensure broader applicability and explore how nutrition literacy varies across different occupational and socioeconomic groups.

Our findings revealed that participants with sufficient NL were more likely to engage in regular physical activity than those with lower NL levels. However, the relationship between physical activity and NL may not necessarily indicate a causal relationship as people with high NL are more likely to adapt to other aspects of healthy lifestyles. Future studies using longitudinal or experimental designs are necessary to clarify the nature of these relationships. There is a need for studies that examine the relationship between physical activity and nutrition literacy through correlation analyses.

Conclusion

In conclusion, this study highlights nutrition literacy as an important factor associated with anthropometric measurements and healthy lifestyle behaviors, including dietary habits, quality of life, and physical activity, among adults. The findings suggest that the white-collar workers included in this study demonstrated high levels of NL, likely attributable to their higher education and income levels. For this reason, future studies should be conducted in different groups of society, awareness should be increased, and nutritional education should be organized according to the results obtained. Nutrition literacy can enable individuals to make informed choices and thus contribute to the prevention of many noncommunicable chronic diseases.

Abbreviations

BMI	Body mass index
EINLA	Evaluation Instrument of Nutrition Literacy on Adults
IPAQ	International Physical Activity Questionnaire Short Form
MEDAS	Mediterranean Diet Adherence Screener
MET	Metabolic equivalent of task
NCDs	Noncommunicable diseases
NL	Nutrition literacy
SF-36	Quality of Life Test Short Form-36

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Author contributions

İAY and MGC led data curation and project administration. İAY, MGC, and NS contributed to the methodology of the study. FESK and EK led all the statistical analyses and interpreted the data. İAY, MGC, and NS contributed to the writing of the original manuscript draft. NS, FESK, and EK led the supervision process and contributed to the review and editing processes of the manuscript. All the authors contributed to the article and read and approved the final manuscript.

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Data availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

For this study, ethics committee approval was received from the Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee (dated 18.01.2024; numbered E-10840098-202.3.02-616; decision number 44). Informed consent was obtained from all adults who volunteered to participate in the study. This study was conducted in accordance with the principles of the Declaration of Helsinki ("World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects," 2014).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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