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The relationship between health literacy, digital diet literacy, and health behaviors: A cross-sectional study

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Abstract

Our objective was to investigate the association between health literacy (HL), digital diet health literacy (DDHL), and healthy behaviors among adults in Türkiye. This descriptive study investigates the association between HL, DDHL, and healthy behaviors in Türkiye. Participants (n=464) were selected from family health centers and filled out a structured questionnaire addressing health literacy, digital diet health literacy, and health behaviors. Data from 36.42±11.24-year-old participants (72% female) revealed that 83% of participants had no chronic illnesses, but 68.8% lacked regular physical activity. The study found a notable moderate positive association between HL and DDHL ($r=0.420$, $p<0.001$). Health literacy was a strong predictor of DDHL, and age was found to negatively affect DDHL. Older participants exhibited lower DDHL scores, while health behaviors like vitamin supplementation positively influenced DDHL. Alcohol consumption negatively impacted DDHL. The study confirms the significant relationship between HL and DDHL, with health literacy positively influencing digital literacy skills, especially regarding nutrition. Public health interventions should focus on enhancing these skills, particularly among older adults and individuals with low literacy levels.

Keywords: Health literacy, digital diet health literacy, health behaviors, Türkiye, adults

Introduction

Health literacy (HL), characterized as the competence to gather, analyze, and understand essential health information and services to support appropriate decision-making, is a key factor influencing health outcomes [1,2]. It encompasses abilities like reading, writing, listening, and interpreting health-related content, all of which are essential for people to take control of their health efficiently. Raising literacy rates and levels in a society is extremely important, as it has both direct and indirect connections to a spectrum of health-related results [3]. Inadequate health literacy has shown connections to unfavorable health consequences, such as mismanagement of chronic conditions, increased hospitalizations, and higher mortality rates [4]. In Türkiye, improving health literacy levels is essential for enhancing public health and reducing disparities in health behaviors and access to services, as demonstrated by national studies showing limited literacy across large segments of the population [5]. In a study conducted by the General Directorate of Health Promotion of the Ministry of Health (SGGM), data

from 6,228 households representative of the entire country were collected. The levels of health literacy observed in participants were identified as follows: 30.9% were insufficient, 38% were problematic-limited, 23.4% were sufficient, and 7.7% were excellent. According to the results of the study, it was found that the health literacy level is observed in nearly 7 out of 10 individuals in Türkiye was either insufficient or limited [6].

Over the past few years, digital diet health literacy (DDHL) has attracted significant attention due to the growing use of digital platforms to access health-related information, particularly about nutrition and diet. Digital diet health literacy is defined as the capacity of an individual to search for, understand, and use digital knowledge regarding diet and nutrition to guide informed choices [7-9]. With the rising popularity of online health resources and mobile applications, the skill to thoroughly analyze the accuracy and dependability of this data is crucial for maintaining healthy dietary habits [10]. This becomes especially important in countries like Türkiye, where digital literacy is rapidly increasing, yet digital health literacy skills are often limited [11].

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Health-promoting actions, including consistent physical activity, a balanced diet, and refraining from harmful habits like smoking, are essential for preventing chronic diseases and promoting long-term health [12]. These behaviors are influenced by various factors, such as personal health literacy, accessibility of healthcare services, and environmental as well as social influences [13]. Notably, individuals with greater health literacy are more inclined to embrace and maintain healthy habits, owing to their enhanced ability to navigate healthcare systems, comprehend health risks, and make well-informed lifestyle decisions [14]. Numerous studies have explored the association between health literacy, healthy behaviors, and digital diet health literacy. For instance, a study by Güner and Ekmekci (2019) highlighted the positive correlation linking health literacy with health-enhancing behaviors among Turkish adults [15]. Similarly, research by Baspinar (2023) found that higher digital health literacy was related with improved nutritional habits, particularly throughout the COVID-19 pandemic [16]. Moreover, a systematic review by Kim et al. (2023) suggested that digital diet health literacy plays a mediating role in adopting healthy behaviors, emphasizing the importance of digital skills in managing diet-related information [17]. These findings underscore the interconnectedness of health literacy, digital diet health literacy, and healthy behaviors, suggesting that interventions aimed at aiming to enhance literacy levels may profoundly influence public health outcomes. Despite the growing body of research, there is still an essential to explore the specific dynamics of how health literacy, digital diet health literacy, and healthy behaviors interact in the context of Türkiye. As digital platforms become more integral to daily life, understanding the extent to which adults in Türkiye can effectively navigate and use digital health information, particularly related to diet, is critical for developing targeted health interventions. This research seeks to address this gap by exploring the connection between health literacy, digital diet health literacy, and healthy actions amongst adults in Türkiye.

Material and Methods

Study Design and Participants

This descriptive cross-sectional research was carried out to examine the relationship between health literacy, digital diet health literacy, and healthy behaviors among adults in Türkiye. Participants were reached through family health centers. The eligibility criteria for participation in the study included having literacy skills and providing consent to participate in the study after the purpose of the study was explained, and being 18 years and older. The study included a sample size of determined using GPower 3.1 software, with 95% power and a small effect size, resulting in a required sample of 464 participants. The study involved a total of 464 participants.

Initially, a total of 511 individuals were approached for participation. Among them, 47 individuals declined to participate, and those who met the inclusion criteria and provided informed consent were enrolled in the study, resulting in 464 participants. After data verification, 12 participants were excluded due to missing or incorrect responses. To maintain the predetermined

sample size, an additional 12 participants were recruited and completed the survey. The overall response rate was 90.8%.

Data Collection Instruments

Data were gathered through a structured questionnaire comprising three sections: demographic details and healthy behaviors, health literacy and digital diet health literacy.

Personal Demographic Information Form: It consists of questions developed by the researcher to determine the socio-demographic features of individuals. The information form contained questions regarding socio-demographic factors, including age, marital status, and educational attainment. Healthy Behaviors were evaluated through self-reported adherence to guidelines for physical activity, dietary habits, and avoidance of harmful behaviors (such as smoking and alcohol consumption). These behaviors were measured using the World Health Organization's (WHO) Health Behavior Questionnaire [13].

Health Literacy Short Form: Originally titled the 'Short-Form Health Literacy Instrument,' this scale was developed by Tuyen V. Duong et al. in 2019 [18]. Its Turkish adaptation for validity and reliability was carried out by Karahan Yılmaz and Eskici in 2021. The evaluation of the scale is based on the formula ($\text{Index} = (\text{Mean} - 1) \times 50/3$), where the mean is obtained by dividing the total score by the number of items. The index value ranges from 0 to 50, with higher scores reflecting better health literacy. The scale employs a 4-point Likert-type response format, from 1 (very difficult) to 4 (very easy), and includes 12 items. In the 2021 study by Yılmaz and Eskici, the scale demonstrated a Cronbach's alpha reliability coefficient of 0.856 [19].

Digital Diet Health Literacy: The health literacy scale was adapted to include a four-item questionnaire titled 'Digital Healthy Diet Literacy,' developed by Tuyen V. Duong et al. in 2020 [20]. Its Turkish adaptation for validity and reliability was conducted by Karahan Yılmaz and Eskici in 2021. The evaluation formula is ($\text{Index} = (\text{Mean} - 1) \times 50/3$), where the index value ranges from 0 to 50, with higher scores reflecting better digital diet literacy. The scale uses a 4-point Likert-type response format, ranging from 1 (very difficult) to 4 (very easy), and comprises 4 items. In the 2021 study by Karahan Yılmaz and Eskici, the Cronbach's alpha reliability coefficient was reported as 0.785 [19].

Data Collection Procedure

Data were gathered between March and June 2024 through face-to-face interviews conducted by trained field researchers. The participants provided informed consent, and the study protocol received approval from the Firat University Non-Interventional Ethics Committee (No: 2022/09-29, Decision date: 06.07.2022). All data were anonymized to protect participant confidentiality. The questionnaire was administered in Turkish, and a pilot test was conducted to ensure clarity and cultural relevance.

Data Analysis

Descriptive statistics (means, standard deviations, frequencies) were utilized to summarize the participant characteristics and scale scores. Pearson correlation coefficients were computed to examine

the relationships among health literacy, digital diet health literacy, and healthy behaviors. Multiple linear regression models were employed to identify predictors of healthy behaviors, with health literacy and digital diet health literacy as independent variables. All statistical analyses were conducted using SPSS Version 26.0, with a significance level of $p<0.05$ established for all tests.

Results

Table 1 shows descriptive data for the study’s key variables, including demographic characteristics such as age, sex, and education level, as well as health behaviors, health literacy, and

digital diet health literacy scores. The mean age of participants was 36.42 ± 11.24 (Median:36.00; Min 18.00 – Max 84.00) years. Of the participants, 72% were female, 66.8% were married, and 54.3% had completed university education or higher. Most participants (56.5%) were unemployed, and the majority (46.1%) reported that their income was equal to their expenses.

In terms of health behaviors, 83% of participants did not have any chronic illness, and 25% did not regularly eat breakfast. Additionally, 68.8% of participants did not engage in regular physical activity. The mean health literacy score was 30.40 ± 10.71 , while the mean digital diet health literacy score was 26.21 ± 13.53 .

Table 1. The characteristics of participants and health behaviors

		Mean±SD	Median (min.-maks.)
Age		36.42±11.24	36.00 (18.00 - 84.00)
		n	(%)
Gender	Women	334	72
	Men	130	28
Marital Status	Married	310	66.8
	Single	130	28
	Divorced	24	5.2
Educational level	Illiterate	10	2.2
	Primary school	40	8.6
	Secondary school	33	7.1
	High school	129	27.8
	University and above	252	54.3
Occupation	Not working	262	56.5
	Self employed	91	19.6
	Civil servant	81	17.5
	Retired	30	6.5
Income level	Income less than expense	161	34.7
	Income equal to expenses	214	46.1
	Income more than expenses	89	19.2
Do you have a chronic disease?	Diabetes	1	1.3
	Heart Diesase	4	5.1
	Asthma	21	26.6
	Hypertension	13	16.5
	Other	40	50.6
Do you have a chronic disease?	No	385	83
	Yes	79	17
Is there any medication you use regularly?	Yes	120	25.9
	No	344	74.1
How many meals do you eat per day?	One meal	15	3.2
	2 meals	248	53.4
	3 meals	176	37.9
	More than 3	25	5.4

Table 1. The characteristics of participants and health behaviors

		n	(%)
Do you have a habit of eating regular breakfast?	No	116	25
	Yes	348	75
How often do you consume vegetables and fruits?	Everyday	171	36.9
	1-2 times a week	165	35.6
	3-4 times a week	128	27.6
Do you consume food supplements (such as propolis, turmeric, probiotics)?	I don't consume	325	70
	Consume	139	30
Do you take vitamin supplements (such as Vitamin C, Vitamin B12, Vitamin D)?	I don't take	267	57.5
	I take	197	42.5
Do you smoke?	Never smoked	268	57.8
	I quit smoking	51	11
	I smoke	145	31.3
Do you drink alcohol?	No	427	92
	Yes	37	8
Do you do regular physical activity?	No	319	68.8
	Yes	145	31.3
How many days a week do you do it?	1-3 days	84	57.9
	3-5 days	39	26.9
	5-7 days	22	15.2
How many minutes a day do you do?	Less than 30 minutes	48	33.1
	30 minutes-1 hour	72	49.7
	More than 1 hour	25	17.2
		Mean±SD	Median (min.-maks.)
Health literacy		30.40±10.71	30.56 (0.00 - 50.00)
Digital healthy diet literacy		26.21±13.53	29.17 (0.00 - 50.00)

Table 2 presents the association between health literacy and digital diet health literacy, showing a statistically significant moderate positive relationship ($r=0.420$, $p<0.001$). As health literacy increases, digital diet health literacy also tends to increase. This suggests that individuals with greater health literacy are more inclined to understand and utilize digital diet-related information effectively.

Table 2. The relationship between health literacy and digital healthy diet literacy

	Health literacy	
	r	p
Digital healthy diet literacy	0.420	<0.001
*Pearson correlation coefficient		

Table 3 presents a hierarchical regression analysis exploring the impacts of various independent variables on digital diet

health literacy. Model 1 shows that age negatively affects digital diet health literacy ($\beta=-0.241$, $p<0.001$), showing that older adults participants had lower digital diet health literacy scores. Model 2 adds variables for chronic illness and income level, but neither has a important effect on digital diet health literacy. Age continues to have a noteworthy negative result ($\beta=-0.236$, $p<0.001$). Model 3 includes health behaviors such as breakfast habits, vitamin supplementation, and alcohol consumption. Health literacy ($\beta=0.484$, $p<0.001$) and vitamin supplementation ($\beta=0.4073$, $p=0.001$) were clearly related with digital diet health literacy, while alcohol consumption had a negative impact ($\beta=-0.6687$, $p=0.002$). Age has a significant negative effect on digital diet health literacy. Health literacy and vitamin supplementation were strong positive predictors of digital diet health literacy, while alcohol consumption negatively influenced digital diet health literacy.

Table 3. The effect of independent variables on digital healthy diet literacy

Model	Independent variables	β1 (95% CI)	SE	β²	t	p	F; p	R²	Adjusted R²
Model 1	Constant	34.992 (30.885 - 39.099)	2.090	---	16.742	<0.001	F=19.322; p<0.001	0.040	0.038
	Age	-0.241 (-0.349 - -0.133)	0.055	-0.200	-4.396	<0.001			
	Constant	33.488 (29.088 - 37.889)	2.239	---	14.954	<0.001			
Model 2	Age	-0.236 (-0.345 - -0.127)	0.055	-0.197	-4.260	<0.001	F=6.031; p<0.001	0.050	0.042
	Do you have a chronic disease? (No Reference)	-1.439 (-4.706 - 1.828)	1.663	-0.040	-0.865	0.387			
	Income level (Reference: Income less than expense)								
	Income equal to expense	2.218 (-0.503 - 4.938)	1.384	0.082	1.602	0.110			
	Income more than expense	2.902 (-0.553 - 6.356)	1.758	0.085	1.651	0.099			
	Constant	17.582 (11.151 - 24.014)	3.273	---	5.372	<0.001			
	Age	-0.176 (-0.281 - -0.07)	0.054	-0.146	-3.282	0.001			
	Do you have a chronic disease? (No Reference)	-1.739 (-4.708 - 1.23)	1.511	-0.048	-1.151	0.250			
	Income level (Reference: Income less than expense)								
	Income equal to expense	0.391 (-2.113 - 2.895)	1.274	0.014	0.307	0.759			
Model 3	Income more than expense	0.439 (-2.762 - 3.641)	1.629	0.013	0.270	0.788	F=10.011; p<0.001	0.238	0.214
	Health Literacy	0.484 (0.376 - 0.591)	0.055	0.383	8.853	<0.001			
	Do you have a habit of eating regular breakfast? (No Reference)	-0.585 (-3.25 - 2.08)	1.356	-0.019	-0.431	0.666			
	Frequency of consumption of vegetables and fruits (Reference: Everyday)								
	1-2 times a week	0.197 (-2.501 - 2.895)	1.373	0.007	0.143	0.886			
	3-4 times a week	-1.812 (-4.617 - 0.993)	1.427	-0.060	-1.270	0.205			
	Do you take vitamin supplements (such as Vitamin C, Vitamin B12, Vitamin D)? (Reference: I don't take)	0.062 (-2.574 - 2.698)	1.341	0.002	0.046	0.963			
	I take	4.073 (1.606 - 6.54)	1.255	0.149	3.245	0.001			
	Do you smoke?								
	I quit smoking	0.897 (-2.776 - 4.57)	1.869	0.021	0.480	0.632			
	I smoke	0.075 (-2.497 - 2.647)	1.309	0.003	0.057	0.954			
	Do you drink alcohol? (No Reference)	-6.687 (-10.946 - -2.428)	2.167	-0.134	-3.085	0.002			
	Do you do regular physical activity? (No Reference)	-0.366 (-2.873 - 2.141)	1.276	-0.013	-0.287	0.774			
	β1 (95% CI): Unstandardized beta coefficient (95% Confidence interval), β2: Standardized beta coefficient								

Discussion

The present study provides important insights into the association between health literacy, digital diet health literacy, and healthy behaviors among adults in Türkiye. The findings recommend that digital diet health literacy is influenced by various factors, including age, health literacy, and precise health actions, such as vitamin supplementation and alcohol consumption.

The descriptive statistics indicate that a significant portion of the sample had insufficient levels of health literacy (30.9%) and digital diet health literacy (mean score 26.21 ± 13.53). These findings align with previous research in Türkiye, which has shown that health literacy remains a significant challenge, with approximately 70% of the population classified as having insufficient or problematic health literacy [6]. This highlights the ongoing need for public health interventions focused on enhancing health literacy within the country.

Digital diet literacy refers to accessing information about consuming all necessary nutrients in adequate, balanced, and varied ways at appropriate times through digital platforms, accurately assessing this information, and making informed dietary decisions. For individuals to follow dietary recommendations and guidelines available in digital spaces, they need both the ability to access and the skills to apply this information. Acquiring such knowledge and skills necessitates a high level of digital diet literacy. The correlation analysis identified a statistically important moderate positive association between health literacy and digital diet health literacy ($r=0.420$, $p<0.001$). This aligns with findings from previous studies, which have demonstrated that people with higher health literacy are adequately skilled to navigate digital health resources and apply dietary information in their daily lives [7,10]. Health literacy empowers individuals with the skills to critically assess and utilize digital information, which is increasingly important in the modern era of widespread online health resources [4]. Studies show that digital literacy enhances health literacy by offering more access to health and diet information through online platforms. Those who are proficient in using digital tools are better able to research and implement healthy eating behaviors. In this sense, DDL acts as an extension or a specialized form of HL, particularly in the area of dietary behaviors and nutritional education [21,22].

The regression analysis further underscores the influence of health literacy on digital diet health literacy. Specifically, health literacy emerged as a significant determinant of digital diet health literacy, with a one-point increase in health literacy associated with a 0.484-point increase in digital diet health literacy ($p<0.001$). This finding supports the notion that enhancing general health literacy can have a ripple effect on an individual's capacity to access and effectively use digital health information, particularly concerning diet and nutrition [14]. Age, on the other hand, was reported as having a negative

impact on digital diet health literacy, with older participants exhibiting lower scores ($\beta=-0.241$, $p<0.001$). This is along with existing literature suggesting that older adults may face more challenges when navigating digital platforms due to lower digital literacy and less familiarity with online health resources [23]. Several studies highlight that older adults with lower digital literacy are likely to have limited access to important health-related information online [24-26].

Interestingly, health behaviors such as vitamin supplementation and alcohol consumption were also significant predictors of digital diet health literacy. Participants who used vitamin supplements demonstrated higher digital diet health literacy scores than those who did not ($\beta=0.4073$, $p=0.001$), possibly reflecting a greater awareness of dietary health or a proactive approach to health maintenance. This finding aligns with prior research suggesting that individuals who engage in health-promoting behaviors tend to seek out and utilize digital health information more effectively [17]. Conversely, alcohol consumption had a negative correlation with digital diet health literacy ($\beta=-0.6687$, $p=0.002$), suggesting that individuals who consume alcohol may be less engaged with or less proficient at accessing diet-related health information. This aligns with findings that alcohol consumption is often associated with other unhealthy lifestyle choices, which may detract from an individual's engagement with health literacy [27].

The study also found no significant impact of income level or the presence of chronic illness on digital diet health literacy. While income level is often cited as a determinant of health literacy, it may be that in this sample, the effect of education or other socioeconomic factors overshadowed the role of income [13]. Similarly, the lack of a significant relationship between chronic illness and digital diet health literacy may indicate that chronic illness, on its own, does not necessarily lead to greater engagement with health information unless accompanied by other factors, such as motivation or digital skills [4].

Strengths and Limitations

One of the key powers of the study is its hierarchical regression analysis, which allowed for the assessment of multiple variables' effects on digital diet health literacy. After adjusting for variables such as age, income, chronic illness, and health behaviors, the analysis provided a clearer understanding of the independent contribution of health literacy to digital diet health literacy. This approach ensures that the findings are robust and reflective of multiple dimensions of health behavior and literacy.

Despite these strengths, the study has certain limitations. The cross-sectional design restricts the ability to determine causal relationships between the variables. While significant associations were found between health literacy, digital diet health literacy, and health behaviors, it is not possible to determine whether higher health literacy leads to improved digital diet health literacy or vice versa. Future research employing longitudinal designs could help clarify these relationships.

Conclusion

Overall, the findings of this study emphasize the critical importance of enhancing both health literacy and digital diet health literacy among adults in Türkiye. Public health interventions should prioritize on enhancing these skills, particularly among older adults and individuals with lower baseline literacy levels. Additionally, promoting health behaviors such as vitamin supplementation may serve as an effective strategy for increasing engagement with digital health resources, while addressing unhealthy behaviors like alcohol consumption could improve health literacy outcomes.

Relevance For Clinical Practice

This study underscores the critical role of health literacy and digital diet health literacy in enhancing patient care and promoting healthy behaviors. In nursing practice, these findings highlight the need for integrating literacy assessments into routine care to identify patients who may struggle with accessing and understanding health information, particularly regarding diet and nutrition. Nurses can leverage these insights to design tailored educational interventions, particularly for older adults and individuals with lower baseline literacy levels, to improve their ability to engage with digital health tools. By fostering skills in navigating digital resources, nurses can empower patients to make informed dietary choices, thereby enhancing their self-management capabilities. Additionally, promoting positive health behaviors such as regular vitamin supplementation and addressing barriers like alcohol consumption aligns with the holistic approach of nursing care. These strategies not only support healthier lifestyle choices but also contribute to improving patients' digital health literacy, enabling better use of technology in managing their health.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical Approval

The study was conducted in accordance with the guidelines of the Declaration of Helsinki and was approved by the Firat University Non-Interventional Ethics Committee (No: 2022/09-29, Decision date: 06.07.2022).

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