Association between nutrition label reading status and the Healthy Diet Indicator-2015

ELIF ESRA OZTURK – LEYLA OZGEN

Summary

Nutrition labelling is a population-based approach for facilitating health-compatible nutrition choices through the provision of food nutrient content information to consumers. The Healthy Diet Indicator (HDI-2015), which is based on adherence to World Health Organization's (WHO) nutrition guideline is used as a priori measure of diet quality. This study aimed to examine the association between nutrition label reading and HDI-2015 in young adults. In this study, 106 adults aged 19–44 years were recruited. HDI-2015 and three-day food records were used to determine diet quality indices. In this study, 61.3 % of the participants read nutrition labels, and nutrition label readers had a greater fruits and vegetables as well as fibre and potassium intake. In addition, nutrition label readers had a higher HDI-2015 mean score than non-readers, and 56.9 % of nutrition label readers had moderate adherence to HDI-2015, while 58.5 % of non-readers had low adherence. The study results demonstrated the relationship between reading nutrition labels and dietary quality, and that nutrition label readers tended to eat healthier than non-readers. Therefore, nutrition labels are an invaluable motivational tool to achieve behavioural changes that can lead to improved health outcomes in combatting obesity and other non-chronic nutritional diseases.

Keywords

nutrition label; Healthy Diet Indicator-2015; label reading; diet quality

Nutrition labelling is a population-based approach for facilitating healthy nutrition choices through the provision of information on nutrient content of foods to consumers [1, 2]. The World Health Organization (WHO) defines nutrition labelling as quantitative listing of nutrition content on food packaging [3]. Nutrition labels are the most popular and accessible source of nutritional information [4].

Food labelling is mandatory in developed and undeveloped countries around the world but its application varies from country to country. Food labelling in Turkey is regulated by the Food Labelling Rules and Consumer Information of the Turkish Food Codex developed by the Ministry of Agriculture Food and Rural Affairs in accordance with European Union regulations [5]. Nutrition labelling is required by this law and must include information about the energy, fat, saturated fat, carbohydrate, sugar, protein, salt and trans-fat content of a product [5].

Nutrition facts presented on nutrition labels help consumers to make healthier food choices by conducing to their food purchasing decision through the provision of information about nutrition principles [4, 6–8]. Making nutrition labelling compulsory or more prevalent and using easy-to-understand nutrition labels contribute to making healthier food choices [9]. While early labels only comprised information relevant to purchasing (e.g. name, type), contemporary nutrition labels involve detailed nutritional facts and important dates as well as nutrition and health claims. There are numerous factors that affect reading of nutrition labels, the most prominent of which are the time available for reading, label format (size,

Elif Esra Ozturk, Department of Nutrition and Dietetics, Faculty of Health Sciences, Hacettepe University, 06100 Ankara, Turkey; Department of Nutrition and Dietetics, Yusuf Serefoglu Faculty of Health Sciences, Kilis 7 Aralik University, 7 Aralik Street, 79090 Kilis, Turkey.

Leyla Ozgen, Department of Social Services, Faculty of Health Sciences, Gazi University, Emek Street, 06490 Ankara, Turkey.

Correspondence author:

Elif Esra Ozturk, e-mail: elif.ozturk@hacettepe.edu.tr

fonts, language), consumer values and consumer attitude towards food production, distribution and preservation [10].

The change in eating behaviour have led to the preference of packaged foods containing more sugar, fat, saturated fat, trans-fat and sodium [4]. Unhealthy eating behaviour is associated with increased prevalence of cardiovascular disease, diabetes and other non-communicable diseases [10]. Nutrition labels are anticipated to pave the way for achieving societies of healthy individuals by increasing nutritional awareness and helping people attain healthier diets [11].

Research on nutrition label reading indicates involvement of various demographic factors such as gender, age, marital status, education and household size [12–14]. However, there are only a few studies on the relationship between the diet quality and nutrition label use [2, 15–18]. This study aimed to investigate the relationship between nutrition label reading and the Healthy Diet Indicator (HDI-2015) among young adults.

MATERIALS AND METHODS

Research design

The study adopted the screening survey model, a research approach that endeavours to characterize a past or current situation as is [19].

Population and sample

The study population consisted of 19–44-year-old individuals who applied for health service at the Community Health Centers in the Çankaya and Yenimahalle districts of Ankara, the capital of Turkey, in 2019–2020. The sample size was calculated using the WHO calculator with 95% confidence interval, 5% absolute precision and 18.7% prevalence [20]. The districts were specifically chosen for the high socio-economic status of the habitants. A number of 106 adults who visited the Çankaya and Yenimahalle Community Health Centers in Turkey were designated as the study sample with convenience sampling, which is sampling conducted on proximate, accessible, available and voluntary participants. Each participant signed a voluntary participation form and filled in the questionnaire in accordance with the declaration of Helsinki.

Data collection

The demographic information and nutrition label reading status (reading or non-reading), as well as anthropometric measures and three-day food records (2 weekdays and 1 weekend day) were utilized in data collection. The demographic information form was used to learn about participant gender, age, marital status, education, nutrition education history, height and weight. Anthropometric measurements including height (in centimetres) and weight (in kilograms) were taken by trained dietitian. The body composition analyser TBF 300 (Tanita, Tokyo, Japan) was used for body weight and composition measurement, while height was measured with a stadiometer. Body mass index (*BMI*) was computed by dividing individual‘s weight (in kilograms) by the square of height (in square metres) and WHO-recommended *BMI* cut-off values were adopted in *BMI* assessment [21].

For dietary intake evaluation, all subjects were trained by a dietitian on how to keep a 3-d food record. Participants were asked to keep dietary records for three consecutive days (2 weekdays and 1 weekend day). A photographic atlas of food portion sizes [22] and common household measures were used to facilitate the quantification of the amount of food consumed. If the food consumed was from a recipe, the subjects were asked to include the recipe in the record and to state how much of it they consumed (for example, all or a half). After receiving the 3-d food records, a trained dietitian reviewed the records and interviewed the participant to clarify any unclear or missing information. Dietary intake was calculated using the Nutrition Information Systems (BeBiS) dietary analysis computer program (EBISpro for Windows, Version 8.1; EBISpro, Stuttgart, Germany) mainly based on the national food composition database. Participants' intake of macronutrients, such as energy, protein or fat, and micronutrients, such as vitamins or minerals, was determined.

Results of food record analysis were used in evaluating adherence to HDI-2015. HDI-2015 [23] measure dietary quality on the basis of nutrient intake from three-day dietary records. It adheres to the 2015 WHO nutrition guideline. HDI-2015 evaluates 7 components: fruits and vegetables (the recommended range is ≥ 400 g per day), fat for total energy (< 30 %), saturated fatty acid for total energy (< 10 %), polyunsaturated fatty acids for total energy (6–11 %), free sugar for total energy (< 10 %), dietary fibre (≥ 25 g per day) and potassium (≥ 3 500 mg per day). Scoring is based on whether the amount of nutrient intake is within the recommended range (1) or not (0). The HDI-2015 overall score comprising the 7 subscales is categorized as low adherence (0–3), moderate adherence (4–5) and high adherence (6–7) [23].

Data analysis

SPSS 23.0 software package (SPSS, Chicago, Illinois, USA) was used for statistical analysis of the study data, and questionnaire responses were analysed by descriptive statistics. BeBIS 8.1 software (EBISpro, Stuttgart, Germany) was adopted for food record analysis. For continuous variables (age, anthropometric measures, nutrient intake amounts), mean (X) ± standard deviation (SD), minimum and maximum values were employed as descriptive statistics. Number (n) and percentage distributions were used to analyse categorical variables (gender, marital status, age and *BMI* categorization, education, nutrition education history and nutrition label reading status). Intergroup differences were investigated by chi-squared (χ^2) test. An independent sample *t*-test was carried out to investigate differences in nutrition label reading status with respect to age, *BMI* and intake of HDI-2015 components. Nutrient intake was based on food records.

Ordinal logistic regression (OLR) was utilized to determine the variables affecting the adherence of the participants to HDI-2015. The relationship between nutrition label reading status, gender, age and *BMI* was examined by the developed OLR model. Then, the -2LL value obtained after 9 iterations (171.114), as well as the Cox and Snell R^2 (0.29) and Nagelkerke R^2 (0.34) values were computed for the variance ratios explained by the model. The -2LL value estimated for the base model containing only the constant term was found to be 207.55, while that for the model constructed with four variables (nutrition label reading, gender, age and *BMI*) was calculated as 171.14. The findings showed that the four variables included into the model had a positive contribution to the -2LL value. In addition, this difference was statistically significant ($\chi^2 = 36.44$; $p < 0.05$). All analyses considered a significance level of 5 % and 1 % ($p < 0.01, p < 0.05$).

RESULTS

The study examined the relationship between nutrition label reading status and HDI-2015, and the results from the analysis of participant responses are presented in Tab. 1–4.

A share of 61.3 % of the participants read nutrition labels. With respect to *BMI*, the percentages of the participants who were underweight, normal weight, overweight and obese class I were 18.9 %, 23.6 %, 30.2 % and 27.4 %, respectively. A share of 73.8 % of the participants who read nutrition labels were female and there was a statistically significant difference in nutrition label reading status by gender ($p < 0.05$). The results also revealed a statistically significant difference in nutrition label reading status with respect to age ($p < 0.05$). In addition, 29.2 % and 35.4 % of the participants who read nutrition labels were normal weight and overweight in terms of *BMI*, respectively, with a statistically significant difference in nutrition label reading by *BMI* category ($p < 0.05$). However, the relationship of nutrition label reading status with marital status, education or nutrition education history was found to be statistically non-significant ($p < 0.05$, Tab. 1).

Mean daily fruit and vegetable intake of the participants was 532.33 ± 246.00 g, with a significant difference in favour of nutrition label readers ($p < 0.05$). There was no statistically significant difference in total energy intake from fats, trans-fat and polyunsaturated fatty acid (PUFA) according to the nutrition label reading status ($p > 0.05$). Mean daily energy intake from free sugar among nutrition label readers and non-readers was 5.49 ± 2.99 and 6.82 ± 3.30, respectively, with a statistically significant difference in the proportion of free sugar in the diet with respect to nutrition label reading status ($p < 0.05$). The mean daily dietary fibre (29.98 ± 8.15 g) and potassium (3 746.11 ± 830.68 mg) intake among nutrition label readers was higher than among non-readers. The results revealed a statistically significant difference in daily dietary fibre and potassium intake according to nutrition label reading status ($p < 0.05$). The participants had a HDI-2015 mean score of 3.75 ± 1.66, where nutrition label readers scored higher (4.18 ± 1.34) in comparison to non-readers (3.07 ± 1.90; $p < 0.05$) (Tab. 2).

The percentages of low, moderate and high adherence to HDI-2015 in nutrition label readers were 30.8 %, 56.9 % and 12.3 %, respectively (Tab. 3). Whereas 56.9 % of nutrition label readers had moderate adherence to HDI-2015, 58.5 % of non-readers had low HDI-2015 adherence. Furthermore, HDI-2015 adherence was higher among nutrition label readers than non-readers, with a statistically significant difference ($p < 0.05$).

Tab. 4 indicates a significant difference in HDI-2015 adherence level with respect to nutrition label reading status ($p < 0.05$). The odds ratio shows that the adherence of nutrition label readers to HDI-2015 was 3.64 times greater than that of non-readers (Exp(β)=3.64). HDI-2015 adherence probability of nutrition label readers was also found to be higher than that of non-readers. There was a statistically non-significant difference in HDI-2015 adherence level by gender ($p > 0.05$)

Tab. 1. Relationship between nutrition label reading status and participant demographics.

Participant demographics	Nutrition label reading status				Total (*n* = 106)		*P*
	Readers (*n* = 65)		Non-readers (*n* = 41)				
	n	[%]	*n*	[%]	*n*	[%]	
Gender							
Female	48	73.8	22	53.7	70	66.0	0.033*
Male	17	26.2	19	46.3	36	34.0	
Age							
19–24 years	13	20.0	5	12.2	18	17.0	0.030*
25–34 years	39	60.0	18	43.9	57	53.8	
35–44 years	13	20.0	18	43.9	31	29.2	
Mean age ($X \pm SD$)	29.00 ± 5.33		31.37 ± 0.85		29.92 ± 5.47		0.029**
Age Min–Max	19–38		19–38		19–38		
Body mass index							
Underweight (< 18.5 kg·m^{-2})	10	15.4	10	24.4	20	18.9	0.042*
Normal weight (18.5–24.9 kg·m^{-2})	19	29.2	6	14.6	25	23.6	
Overweight (25.0-29.9 kg·m^{-2})	23	35.4	9	22.0	32	30.2	
Obese class 1 (30.0–34.9 kg·m^{-2})	13	20.0	16	39.0	29	27.4	
Mean *BMI* ($X \pm SD$)	25.48 ± 4.50		26.52 ± 6.37		25.88 ± 5.30		0.367**
BMI Min–Max	16.11–34.06		16.62–34.28		16.11–34.28		
Marital status							
Married	48	73.8	34	82.9	82	77.4	0.441*
Single	17	26.2	7	17.1	24	22.6	
Educational status							
Middle school	6	9.2	6	14.6	12	11.3	0.078*
High school or equivalent	43	66.2	18	43.9	61	57.5	
Associate or university	16	24.6	17	41.5	33	31.1	
Nutrition education attendance							
Yes	15	23.1	9	22.0	24	22.6	0.893*
No	50	76.9	32	78.0	82	77.4	

* – Fisher's exact chi-squared test, ** – independent samples *t*-test ($X \pm SD$), *X* – mean, *SD* – standard deviation.

Tab. 2. Relationship between nutrition label reading status and HDI-2015 components.

HDI-2015 components	Nutrition label reading status		Total ($X \pm SD$)	*P*
	Readers ($X \pm SD$)	Non-readers ($X \pm SD$)		
Fruits and vegetables [g·d^{-1}]	577.46 ± 255.83	460.80 ± 213.52	532.33 ± 246.00	0.017
Total fat of total energy [%]	35.0 ± 6.8	36.1 ± 6.9	35.5 ± 6.8	0.416
Saturated fatty acid of total energy [%]	12.6 ± 3.3	13.2 ± 3.2	12.8 ± 3.2	0.391
PUFA of total energy [%]	7.7 ± 2.7	7.7 ± 3.4	7.7 ± 2.9	0.992
Free sugar of total energy [%]	5.5 ± 2.9	6.8 ± 3.3	6.0 ± 3.2	0.034
Dietary fibre [g·d^{-1}]	29.98 ± 8.15	26.25 ± 8.76	28.54 ± 8.55	0.028
Potassium [mg·d^{-1}]	3 746.11 ± 830.68	3 392.03 ± 940.74	3 609.15 ± 887.55	0.045
Total score	4.18 ± 1.34	3.07 ± 1.90	3.75 ± 1.66	0.002

Values represent results of independent samples *t*-test ($X \pm SD$).
X – mean, *SD* – standard deviation, PUFA –polyunsaturated fatty acid.

Tab. 3. Relationship between nutrition label reading status and Healthy Diet Indicator-2015 classification.

Healthy Diet Indicator-2015	Nutrition label reading status				*P*
	Readers		Non-readers		
	n	[%]	*n*	[%]	
Adherence level					
Low	20	30.8	24	58.5	
Moderate	37	56.9	12	29.3	0.012
High	8	12.3	5	12.2	

Fisher's exact chi-squared test.

Tab. 4. Ordinal logistic regression analysis for nutrition label reading, gender, age and body mass index.

	β	Wald	*SD*	*P*	Exp(β)	95% *CI*	
						Lower	Upper
Nutrition label reading status							
Yes	1.29	6.99	1	0.008	3.64	1.396	9.483
No					Ref.		
Gender							
Male	–0.23	0.26	1	0.611	0.79	0.326	1.932
Female					Ref.		
Age							
19–24 years	0.31	0.23	1	0.629	1.37	0.384	4.867
25–34 years	0.25	0.27	1	0.603	1.29	0.500	3.307
35–44 years					Ref.		
Body mass index	0.23	22.42	1	0.001	1.26	1.146	1.389

Adjusted variables – label reading status, gender, age and body mass index.
Ref. – reference category, β – unstandardized regression weight, Wald – the squared ratio of the estimate to the standard error of the respective predictor, *SD* – standard deviation, Exp(β) – exponentiation of the β coefficient, 95% *CI* – 95% confidence interval.

and age group. However, the results revealed a statistically significant difference in HDI-2015 adherence level with respect to *BMI* ($p < 0.05$). It was determined that a one-unit rise in *BMI* increased HDI-2015 adherence odds ratio 1.26 times in comparison to the other variables.

DISCUSSION

This study results revealed a statistically significant difference in nutrition label reading status by gender and age among the majority of the participants. Shares of 29.2 % and 35.4 % of nutrition label readers were normal weight and overweight in terms of *BMI*, respectively, with a statistically significant difference in nutrition label reading by *BMI* category. However, the relationship of nutrition label reading status with marital status, education or nutrition education history was statistically non-significant. Although the relationship between nutrition knowledge and use of food label was previously determined [6, 24], no relationship between nutrition label reading status and nutrition education was determined in this study. This may be due to the small number of individuals who received nutrition education in the study. Future studies with a large population are needed to clarify this relation.

In a previous study of Loureiro et al. [25], male nutrition label readers had by 0.12 lower mean *BMI* than male non-readers, and female nutrition label readers had by 1.49 lower mean *BMI* than female non-readers. Similarly, another study reported that people with normal weight were more attentive to reading nutrition labels than the overweight or obese individuals [26]. While the present study did not reveal a difference in mean *BMI* with respect to nutrition label reading status ($p > 0.05$), the majority of nutrition label readers were normal weight or overweight and half of non-readers were overweight or obese, according to *BMI* categorization ($p < 0.05$).

Examination of the relationship between nutrition label reading status and gender showed that nutrition label reading was more prevalent among women in comparison to men, which is consistent with past research findings [27, 28]. This might be due to women doing more food shopping than men [28]. Nutrition label reading status was also investigated by age. In a study of Trandafilović et al. [29], participants aged 31 or older read nutrition labels more often than younger age groups. Another study [30] reported greater attentiveness to reading nutrition labels among young adults or middle age individuals in comparison to older age groups. The present study similarly found that the participants in the 25–34 age group were more attentive to nutrition label reading, which might be attributed to greater awareness among this age group to nutrition information presented on nutrition labels.

Regarding the association of nutrition labels and nutrition intake with HDI-2015, the results showed lower amounts of energy and total fat consumption for nutrition label readers [18]. Another study reported lower percentages of energy intake from fats and saturated fats as well as generally healthier diets among nutrition label readers [31]. Cooke et al. [15] reported that people who always read nutrition labels consumed more fruits and vegetables, and less fat and free sugar. Fitzgerald et al. [32] found that nutrition label use in foods with high fibre content was associated with higher fruit and vegetable consumption. The literature indicates "healthier eating habits", such as increased fibre and vitamin C intake together with decreased fat, sodium, cholesterol and total energy intake, among people who read nutrition labels [16, 28, 29, 31–36]. According to the results of this study, there was a significant difference between the daily consumption of fruits and vegetables, free sugar intake, dietary fibre and potassium intake, which are the components of HDI-2015, according to the nutritional label reading status of the individuals ($p < 0.05$).

The study results demonstrated that reading nutrition labels is an effective tool in changing some dietary behaviour to improve dietary quality. Diet quality is broadly defined as a dietary pattern or an indicator of variety across key food groups relative to those recommended in dietary guidelines [12]. Diet quality can be influenced by several factors, including the cultural and food environment, socio-economic status, food preferences, together with age, sex and country of residence of the individual [14]. In this study, the majority of nutrition label readers displayed moderate or high levels of adherence to HDI-2015 and the results showed that reading nutrition labels is an effective tool in changing some dietary behaviour to improve dietary quality. When the effect of age, gender and *BMI*, which are factors acting on HDI-2015 adherence, were held constant, HDI-2015 adherence odds ratio of nutrition label readers was found to be 3.64 times greater than that of non-readers, which indicates awareness of nutrition label reading for a healthy quality of life.

CONCLUSIONS

The study results demonstrated a relationship between nutrition label reading and dietary quality, with nutrition label readers tending to eat healthier in comparison to non-readers. Individuals can make healthier choices by increasing their reading and understanding of food label information, thereby improving the quality of their diet. However, a better understanding of food labels is required for the use of food labels to be more effective. To this end, it should be ensured that nutrition label information is presented to consumers in a way that is easy to understand, reliable and easy to compare.

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