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Original Article

Understanding and Using Patterns of Food Labeling Systems and their Determinants by Medical Students of Tabriz University of Medical Sciences, Iran

Neda Dolatkhah[1*], Dawood Aghamohammadi[2], Afsaneh Zakipour[3], Maryam Hashemian[4]

1- Physical Medicine and Rehabilitation Research Center, Aging Research Institute, Tabriz University of Medical Science, Tabriz, Iran.
2- Department of Anesthesiology, Faculty of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran
3- Faculty of Medicine, Tabriz University of Medical Science, Iran.
4- Department of Biology, School of Arts and Sciences, Utica College, Utica, United States

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ABSTRACT

Background and Objectives: Increased public knowledge concerning roles of nutrition in prevention of non-communicable diseases have urged people to select healthy foods. The aim of this study was to investigate levels of understanding and use of food labeling systems and their determinants by medical students of Tabriz University of Medical Sciences, Tabriz, Iran.

Materials and Methods: In a cross-sectional study on medical students of Tabriz University of Medical Sciences, 2018, 240 medical students were participated using stratified random sampling method. During the study, participants were asked about their use of nutritional value panel, ingredient list and serving size information of the food labels. To assess understanding levels of the food labeling, subjective and objective methods were used.

Results: Based on the findings, 41.2% of the participants always/most often read food labels when purchasing foods, while 34.2% of them read food labels occasionally. The most common reason for non-using food labels included lack of time to read the food labels (40.8%). A relative majority of the participants (42.5%) occasionally used food labels for diet planning. A majority of the participants (74.6%) reported that they somewhat were aware of food label information. Moreover, 70 to 90.4% of the participants chose the right label as the healthiest from three pairs of labels. Understanding and use of food labels were higher in females than males ($p = 0.046$ and $p = 0.038$, respectively).

Conclusions: Less than half of the medical students always/most often used food label information when buying food products. Further studies on other populations are needed to suggest recommendations for an effectual food labelling.

Keywords: Medical student; Understanding; Using; Food label

Introduction

The fast growing trend of non-communicable Diseases (NCDs) has urged public health officials and international organizations to take urgent actions for the prevention of these diseases (1). Nowadays, increasing knowledge and awareness, concerning roles of appropriate nutrition in prevention and management of NCDs, have increased attention of the general public to appropriate food selections and essential information about nutritional values of the food products (2). Decreased home-made foods and increased ready-to-eat foods have led to a greater dependence of people on food labels containing key facts about the ingredients of the products (3). Food labeling, as a population-based strategy, can potentially change individual behaviors and consequently improve population health. This effect depends on the consumers' ability to appropriate understand and use of nutrition labels (4). Appropriate selection and consumption of foods can solve the problem of excessive eating and nutritional imbalances and are good approaches to control global metabolic epidemics by involving people in maintaining their health statutes (5). The current World Health Organization (WHO) approach is to decrease the risk of death from NCDs up to 25% by 2025 (5). In Iran, national documents for the prevention and control of NCDs have several goals for decreasing rates of these diseases between 1394 and 1404, including 30% decreases in average salt intake, zero trans fatty acid contents in edible oils and food products replacing with monounsaturated fats (MUFAs) and prevention of diabetes and obesity spreads (6).

***Address for correspondence:** Neda Dolatkhah, Physical Medicine and Rehabilitation Research Center, Emam Reza Hospital, Golgasht, Azadi Ave., Tabriz, Iran. E-mail address: neda_dolatkhah@yahoo.com

Various factors affect personal food choices, including economic considerations, social and demographic factors, lifestyle and concerns about health and food safety (7). In several societies, nutrition labeling containing essential nutritional information is currently one of the essential requirements for marketable food products. Studies have been carried out on knowledge and attitude of various populations about food labeling in various regions of the world. In a cross-sectional study by Jackey et al. (8), less than half of 60-year-old adults and those older in Delaware, USA, were able to interpret food label information correctly. Viola et al. (9) assessed knowledge and understanding of food labels in young adults mostly with higher education levels through an on-line survey and showed that they were generally able to identify healthier food products based on nutritional label information. Based on the finding by Haghighian et al. (10), knowledge insufficiency of interpreting colors of traffic light labels on packages, small sizes of the labels and no exchanges of food products with red-color traffic light signs were the major challenges of consumers using these labels. To the best of the authors' knowledge, no studies have assessed understanding and using patterns of food labels and their determinants by medical students of Tabriz University of Medical Sciences. Considering undeniable roles of physicians of the health systems in encouraging healthy nutritional choices, this study has been carried out.

Materials and Methods

Study design and participants: This study was a cross-sectional study on medical students of Tabriz University of Medical Sciences, Tabriz, Iran, 2018. Trained statisticians listed students in various departments of the medical school and chose the study participants using stratified random sampling method. Study objectives were explained to the participants and informed consents were signed by them. Then, demographic questionnaires, concerning age, sex, education level, marital status and monthly household incomes, were completed by the participants. The monthly household incomes were categorized as less than 30, 30–50, 50–100 and more than100 million Iranian Rials per month.

Sample size: Based on the findings of Mirghotbi et al. (11), 0.25 and 0.06 were considered as estimates of the ratio and effect size, respectively. Using significance level of 0.05, power of 0.8 and two-sided test, the sample size was computed as 200. With a 20% probability of falling, the final sample size was estimated as 240 individuals. Inclusion criteria included being 18 years old and older and being a medical student in Tabriz University of Medical Sciences. Exclusion criteria included unwillingness to participate in the study, incomplete information and guest students from other medical universities.

Variables and measurements

During the study, food label samples were shown to the participants and asked them about their use of the nutritional value panel, ingredient list and serving size information when buying food products. Responses included "always", "most of the time", "sometimes", "rarely," "never" and "I've never seen it" (12). In each group, participants were asked about the reason for reading or non-reading using multiple-choice questions (13). Users were asked about the most important part of the nutritional data in food labels. To assess understanding levels of food labeling, subjective (asking the question "Do you have information on food labels?" and weighing it on a Likert scale as 1 = poor, 2 = somewhat and 3= largely) and objective (providing three pairs of hypothetical food labels and asking participants to choose the healthiest food label and expressing the cause of choice) methods were used (14). The questionnaire content validity data were achieved based on Delphi expert enquiry method. Ten nutritionists reviewed the questionnaires concerning the writing and grammar errors and the questionnaire appropriateness. Then, content validity index (CVI) and content validity ratio (CVR) were computed (15). The smallest admissible value of CVI to acknowledge each item in the questionnaires was considered as 0.78 (16) and because of the number of experts ($n = 10$), the lowest satisfactory value of CVR was considered as 0.62.

Statistical analysis: Data were presented as mean ±SD (standard deviation) and frequency (%) for quantitative and qualitative variables, respectively. Data analysis was carried out using SPSS software v.17 (IBM Analytics, USA). Chi-square test was used to show relationships between the categorical variables. The *p*-values less than 0.05 were considered as significant.

Table 1. Descriptive characteristics of the study participants

Variables	Category	Frequency	Percent (%)
Age	<20	23	9.6
	20-22	101	42.1
	23-25	66	27.5
	>25	50	20.8
Sex	Male	126	52.5
	Female	114	47.5
Educational year	1st	44	18.3
	2nd	49	20.4
	3rd	39	16.3
	4th	36	15.0
	5th	34	14.2
	6th	38	15.8
Marital status	Single	196	81.7
	Married	36	15.0
	Divorce	8	3.3
Household income (million Rial/month)	<30	29	12.1
	30-50	120	50.0
	50-100	72	30.0
	>100	19	7.9

Table 2. Use of food labels by the participants

Variables			Frequency	Percent(%)
Reading the food label when buying foodstuff	Always		25	10.4
	Most of the times		74	30.8
	Sometimes		82	34.2
	Rarely		46	19.2
	Never		10	4.2
	I've never seen it		3	1.2
Why non-reading the food label	I'm not interested in it		58	24.2
	I don't have enough time for this		98	40.8
	I can't read it		4	1.7
	I don't understand it		18	3.3
	Others		19	7.9
Reasons for considering food labels from the perspective of the participants	Learn about the production and expiry dates		224	95.3
	Learn about the license number from Ministry of Health		18	7.6
	Learn about the product type		53	22.5
	Learn about price		38	16.1
	Learn about the product weight		24	10.2
	Learn about the constituents of the food		86	36.5
	Learn about the nutritional information		39	16.5
	Having allergies / intolerance to some foods		12	5.1
	Suffering from other medical problems		1	0.4
	Learn about additives and artificial colors		18	7.6
	I do this to choose a healthier food		35	14.8
Understanding the meaning of food labels	Entirely		41	17.1
	Somewhat		186	77.5
	Not at all		4	1.7
	No idea		9	3.8
The part of nutritional data with the most attention	Additives		61	25.7
	Calories per serving		122	51.4
	Total fat		104	43.8
	Saturated fat		60	25.3
	Sugar		61	25.7
	Carbohydrate		34	14.3
	Protein		59	24.8
	Vitamin/Mineral		63	26.5
	Fibre		19	8.0
	Salt		35	14.7
	Other		4	5.9
Using nutrition label information for diet planning	Always		5	2.1
	Most of the times		29	12.1
	Sometimes		102	42.5
	Never		86	35.8
	No idea		18	7.5
Participants' opinion about food information provided in food labels	Legibility of production and expiration dates	Yes	183	76.2
		No	45	18.8
		No idea	12	5.0
	The suitability of the location of production and expiry date	Yes	140	58.3
		No	94	39.2
		No idea	6	2.5
	Nutrition information readability	Yes	191	79.6
		No	27	11.2
		No idea	22	9.2
	Understandable nutrition information	Yes	180	75.0
		No	26	10.8
		No idea	34	14.2
	The suitability of the location of nutrition information	Yes	180	75.0
		No	39	16.2
		No idea	21	8.8

Results

In this cross-sectional study, 240 medical students with the mean age of 22.4 ±2.2 years were studied, 2018. Demographic information of the participants are shown in Table 1. The average CVI of using and understanding questionnaires were respectively 0.791 and 0.855 and CVR were respectively 0.725 and 0.814. Data of using and understanding food labels are shown in Tables 2 and 3. Reading food labels when buying foods and using nutrition label information for diet planning were significantly higher in female students than male students (p = 0.046 and p = 0.038, respectively). No significant relationships were shown for other demographic variables (p-values > 0.05) (Tables 4, 5 and 6).

Table 3. Understanding of food labels by the participants

Variables		Frequency	Percent (%)
Self-declaration awareness of data presented in food labels	Poor	21	8.8
	Somewhat	179	74.6
	Largely	40	16.7
Choosing the right healthy label	First pair	217	90.4
	Second pair	168	70.0
	Third pair	183	76.2
Reason for selection	Unknown	3	1.2
	Protein	108	45.0
	Vitamins	8	3.3
	Others	44	18.3
	Fat	229	95.4
	Fiber	102	42.5
	Energy	94	39.1
	Calcium	1	0.4
	Cholesterol	70	29.1
	Carbohydrate	83	34.5

Table 4. Relationship between demographic characteristics with choosing the right healthy label (n=240)

Characteristics	First pair			Second pair			Third pair		
	True n=217	False n=23	p-value	True n=168	False n=72	p-value	True n=183	False n=57	p-value
Age									
<20	16(7.3%)	7(30.5%)	0.090	8(4.8)	15(20.8%)	0.123	17(9.2%)	6(10.5%)	0.634
20-22	95(43.8%)	6(26.1%)		76(45.2%)	25(34.8%)		76(41.5%)	25(43.8%)	
23-25	61(28.1%)	5(21.7%)		57(33.9%)	9(12.5%)		51(27.8%)	15(26.3%)	
>25	41(20.8)	5(21.7%)		27(16.1%)	23(31.9%)		39(21.5%)	11(19.4%)	
Sex									
Female	104(47.9%)	10(43.4%)	0.664	83(49.4%)	31(43.1%)	0.216	85(46.4%)	29(50.8%)	0.569
Mae	113(52.1%)	13(56.6%)		85(50.6%)	41(56.9%)		98(53.6%)	28(49.2%)	
Marital status									
Single	179(82.4%)	17(73.9%)	0.715	142(84.5%)	54(75.0%)	0.526	150(82.0%)	46(80.7%)	0.723
Married	31(14.3%)	5(21.7%)		21(12.5%)	15(20.8%)		27(14.7%)	9(15.8%)	
Other	7(3.3%)	1(4.5%)		5(3.0%)	3(4.2%)		6(3.3%)	2(3.5%)	
Household income									
<30	25(11.5%)	4(17.4%)	0.116	19(11.3%)	10(13.8%)	0.431	20(10.9%)	9(15.8%)	0.710
30-50	108(49.8%)	12(52.1%)		86(51.2%)	34(47.2%)		94(51.3%)	26(45.6%)	
50-100	67(30.8%)	5(21.7%)		52(30.9%)	20(27.7%)		56(30.6%)	16(28.1%)	
>100	17(7.9%)	2(8.8%)		11(6.6%)	8(11.3%)		13(7.2%)	6(10.5%)	

Table 5. Relationship between demographic characteristics with using of food labels (N=240)

Characteristics	Reading the food label when buying foodstuff							Understanding the meaning of food labels				
	Always n=25	Most of the times n=74	Sometimes n=82	Rarely n=46	Never n=10	I've never seen it n=3	p-value	Entirely n=41	Somewhat n=186	Not at all n=4	No idea n=9	p-value
Age												
<20	3(12.0%)	6(8.1%)	8(9.8%)	4(8.8%)	2(20.0%)	0(0.0%)	0.132	3(7.3%)	19(10.3%)	0(0.0%)	1(11.1%)	0.081
20-22	13(52.0%)	29(39.2%)	33(40.2%)	19(41.3)	5(50.0%)	2(66.7%)		22(53.6%)	73(39.2%)	2(50.0%)	4(44.4%)	
23-25	2(8.0%)	18(24.3%)	29(35.4%)	13(28.2%)	3(30.0%)	1(33.3%)		10(24.4%)	52(27.9%)	1(25.0%)	3(33.4%)	
>25	7(27.0%)	21(28.4%)	12(14.6%)	10(21.7%)	0(0.0%)	0(0.0%)		6(14.7%)	42(22.6%)	1(25.0%)	1(11.1%)	
Sex												
Female	17(68.0%)	58(78.4%)	21(20.1%)	15(32.6%)	3(30.0%)	0(0.0%)	0.046	17(41.5%)	93(50.0%)	1(25.0%)	3(33.3%)	0.072
Mae	8(32.0%)	16(21.6%)	61(74.9%)	31(67.4%)	7(70.0%)	3(100.0%)		24(58.5%)	93(50.0%)	3(75.0%)	6(66.7%)	
Marital status												
Single	18(72.0%)	61(82.4%)	66(80.4%)	39(84.8%)	10(100.0%)	2(66.7%)	0.231	24(58.5%)	163(87.7%)	3(75.0%)	6(66.7%)	0.092
Married	7(28.0%)	11(14.9%)	12(14.6%)	6(13.0%)	0(0.0%)	0(0.0%)		12(29.2%)	21(11.3%)	1(25.0%)	2(22.2%)	
Other	0(0.0%)	2(2.7%)	4(5.0%)	1(2.2%)	0(0.0%)	1(33.3%)		5(12.3%)	2(1.0%)	0(0.0%)	1(11.1%)	
Household income												
<30	4(16.0%)	15(20.3%)	9(10.9%)	1(2.2%)	0(0.0%)	0(0.0%)	0.403	6(14.7%)	15(8.1%)	2(50.0%)	6(66.7%)	0.104
30-50	12(48.0%)	34(46.0%)	39(47.6%)	28(60.9%)	7(70.0%)	0(0.0%)		22(53.6%)	93(50.0%)	2(50.0%)	3(33.3%)	
50-100	7(28.0%)	20(27.0%)	26(31.7%)	17(36.9%)	0(0.0%)	2(66.7%)		10(24.4%)	62(33.3%)	0(0.0%)	0(0.0%)	
>100	2(8.0%)	5(6.7%)	8(9.8%)	0(0.0%)	3(30.0%)	1(33.3%)		3(7.3%)	16(8.6%)	0(0.0%)	0(0.0%)	

Table 6. Relationship between demographic characteristics with using nutrition label information for diet planning (N=240)

Characteristics	Using nutrition label information for diet planning					
	Always n=5	Most of the times n=29	Sometimes n=102	Never n=86	No idea n=18	p-value
Age						
<20	0(12.2%)	1(3.5%)	9(8.9%)	11(12.9%)	2(11.1%)	0.213
20-22	4(80.0%)	18(62.1%)	35(34.3%)	42(48.8%)	2(11.1%)	
23-25	1(20.0%)	7(24.1%)	29(28.4%)	21(24.4%)	8(44.4%)	
>25	0(28.0%)	3(10.3%)	29(28.4%)	12(13.9%)	6(33.4%)	
Sex						
Female	5(100.0%)	19(65.5%)	76(74.5%)	10(11.6%)	4(22.2%)	0.038
Mae	0(0.0%)	10(34.5%)	26(25.5%)	76(88.4%)	14(77.8%)	
Marital status						
	4(80.0%)	18(62.1%)	86(84.3%)	74(86.1%)	14(77.8%)	0.417
Single	0(0.0%)	10(34.4%)	12(11.8%)	12(13.9%)	2(11.1%)	
Married	1(20.0%)	1(3.5%)	4(3.9%)	0(0.0%)	2(11.1%)	
Other						
Household income						
<30	0(0.0%)	4(13.8%)	19(18.6%)	4(4.8%)	2(11.1%)	0.361
30-50	0(0.0%)	19(65.05%)	53(52.0%)	40(46.5%)	8(44.4%)	
50-100	1(20.0%)	5(17.2%)	26(25.5%)	35(40.6%)	5(27.8%)	
>100	4(80.0%)	1(3.5%)	4(3.9%)	7(8.1%)	3(16.7%)	

Discussion

Food labeling is a standard food guide developed by the Codex Alimentarius Commission and approved by the Food and Agriculture Organization (FAO) and world health organization (WHO) (17). Food labels provide consumers with information on packaged foods such as serving size, number of servings per package and nutritional facts such as calories per serving, total protein, carbohydrates, sugars, fats, cholesterol and sodium. This nutritional information helps consumers choose the most appropriate food (9). Labeling is one of the essential steps in informing people when purchasing foods because a full awareness of the food ingredients is an absolute right of the buyers. In fact, it is essential that nutritional data are labeled in simple ways and be understandable to everyone. People are mostly capable to recognize simple nutritional data on food labels (18, 19). Labeling policy in various societies has shown that nutritional label information are useful to consumers in purchasing healthy products and making right decisions, helping people prevent and manage metabolic diseases and obesity (20). In fact, providing these information to consumers encourages food manufacturers to improve nutritional profiles of their products (21). Type and presence of the information provided on the food labels vary from country to country (22).

According to the findings of this study, 41.2% of the participants always/most often read the food labels when buying foods, while 34.2% of the participants occasionally read the food labels. Reasons for reading food labels in 95.3% of the participants included production and expiry dates, while only 36.5% of them focused on food ingredients. In addition, 42.5% of the participants admitted that they only occasionally used nutritional label information for diet planning. In a study by Malekmahdavi et al. (23) on assessing knowledge, attitude and practice of 332 Iranian medical and non-medical students in five various study majors including nutrition, health, health services management, paramedical and engineering, 47.6% of the students reported that they often/always used food label information when buying food products. Of these students, only 32.3% used nutrition label information to modify their daily food intakes. Expiry date and storage condition were reported as the most important items in food labels. In the study of Ghanbari Ghozikali et al. (24), more than 75% of the people in Bostanabad, East Azarbaijan Province of Iran, paid attention to food labels when shopping. Similar to the results of the present study, most of these people were motivated to view production and expiry dates. A small percentage of the participants read the food labels for nutritional facts, product weight monitoring, additives and artificial colors. In a cross-sectional study on 542 adolescents in Sri Lanka, Talagala et al. (14) found that a majority of the participants (74.5%) always/often read the food labels. Of these participants, 75% focused on the brand names, 85% on the product prices and 81% on the nutritional facts.

Based on the results of the present study, the major reasons for non-using label information by the participants

included lack of time in 40.8% and lack of interest in 24.2% of the participants. Similar to the present study, Schupp et al. (25) showed that lack of time, lack of interest and motivation and prior knowledge of the food were the major reasons for not paying attention to food labels in Louisiana Americans. A 1997 study by Shine et al. (7) showed that lack of interest (22%), lack of time (13%) and inability to understand information (9%) were the major reasons for non-using food labels. Relatively, small text sizes were reported as the major reasons by older Irish people. In a study in USA, color- coded labels were reported more impressive than traditional food labels in attracting users' attentions (26). Color- coded labels are reported as the most impressive labels for helping consumers rank food items based on healthiness (27). In a UK study, consumers less consumed red labeled nutrients (28). Ability of 5- color food labels in helping consumers assess nutritional qualities of the breakfast cereals has been shown in French markets (29). Traffic Light labels are effective under time limitation as less time is needed to understand these labels, compared to guideline daily amount (GDA) labels (30). In addition, front-of-package (FOP) warning food labels with graphical design such as black & white stop signs are other choices to help users decide simpler and more understandable (31).

Regarding nutritional facts, 51.4% of the participants wanted to learn about the calories per serving, 43.8% noticed the total fat and 26.5% noticed the vitamin/minerals. Other items such as sugars and saturated fats were ranked lower. Additionally, satisfaction with readability and appropriateness of location of the manufacturing and expiry dates, , readability of nutritional facts, providing with understandable information and appropriateness of nutritional facts label locations included 76.2, 58.3, 79.6, 75 and 75%, respectively. In a study by Mirghotbi et al. (11) in Tehran, Iran, more than half of the surveyed individuals stated unreadability, inappropriate label location and incomprehensible nutritional information. These differences were seemingly linked to a research community involved in a recent study of ordinary customers in malls in Tehran. Based on the findings, 74.6% of the participants were somewhat aware of food label information. Correct choices of healthy food labels for the first, second and third label pairs included 90.4, 70.0 and 76.2%, respectively. Reasons for choosing healthier labels in 95.4, 65.0 and 45.0% of the respondents were based on the product fat, sodium and protein contents, respectively. However, other health items were ranked lower. In the study of Esfandiari et al. (32), most of the students (81.7%) from Isfahan University of Medical Sciences, Iran, had a sufficient knowledge about the choice of appropriate food products based on the nutritional color markers (guide light) of the food packages. This further increased by training. Levy and Fein showed that most American consumers (78%) correctly compared two food products and recognized nutrient alterations between them; however, only 20% were qualified enough to estimate contributions of a particular food to the entire daily intake (33).

In this study, no significant relationships were seen between demographic variables with understanding and using food labels except for sex. Reading and using nutrition label information for diet planning were significantly higher in women than men. This finding is similar to findings from previous studies (34-38). This might occur because women were more expected to comply with the efficiency of nutrition data on food labels and generally had more concerns in health and nutrition topics in comparison to men (39). In contrast to findings from the current study, a study by Jackey et al. in Delaware, USA (8), showed that food label awareness was associated with monthly income. In another study by Miller et al. (40) in California, USA, 2013–2014, accuracy and attention to food labels decreased with increasing age. These differences could be due to the youngness of the participants in the present study. However, the present study included limitations that must be considered when interpreting results. These limitations included a relatively low sample size, self-reported questionnaire and observational nature of the study.

Conclusion

Findings of this study suggested that less than half of the medical students always/most often read the food labels when buying foods. In addition, less than half of the participants expressed that they occasionally used nutrition label information for diet planning, signifying that this labeling arrangement might not provide an extra guidance to users to choice healthier foods. The major reasons for non-using food labels by the participants included lack of time and interest. Color- coded labels, traffic light labels and FOP warning food labels with graphical design may practically help policy makers. Further studies on other populations are needed to provide recommendations for efficient labelling and verify accurate comprehension of the nutritional values.

Ethics approval

At the beginning of the study, goals and methods of the study were clearly explained in details to each participant. Participants were volunteers and informed consents were signed. Personal information of the participants were assumed private and secure. The project protocol was approved by the Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1396.1284).

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References

1. Gowshall M, Taylor-Robinson SD. The increasing prevalence of non-communicable diseases in low-middle income countries: The view from Malawi. International journal of general medicine. 2018;11:255.
2. Shahidi N, editor The importance of nutritional labeling. Proceeding of the 4th Congress of Nutrition 1997 Tehran University of Medical Sciences , [Persian]
3. Fund WCR, Research AIfC. Food, nutrition, physical activity, and the prevention of cancer: a global perspective: Amer Inst for Cancer Research; 2007.
4. Campos S, Doxey J, Hammond D. Nutrition labels on pre-packaged foods: a systematic review. Public health nutrition. 2011;14(8):1496-506.
5. Organization WH. Global status report on noncommunicable diseases 2014: World Health Organization; 2014.
6. Peykari N, Hashemi H, Dinarvand R, Haji-Aghajani M, Malekzadeh R, Sadrolsadat A, et al. National action plan for non-communicable diseases prevention and control in Iran; a response to emerging epidemic. Journal of diabetes and metabolic disorders. 2017;16:3.
7. Shine A, O'Reilly S, O'Sullivan K. Consumer use of nutrition labels. British Food Journal. 1997;99(8):290-6.
8. Jackey BA, Cotugna N, Orsega-Smith E. Food Label Knowledge, Usage and Attitudes of Older Adults. Journal of nutrition in gerontology and geriatrics. 2017;36(1):31-47.
9. Viola GC, Bianchi F, Croce E, Ceretti E. Are Food Labels Effective as a Means of Health Prevention? Journal of public health research. 2016;5(3):768.
10. Haghighian Roudsari A, Zargaran A, Milani Bonab A, Abdollah S. Consumers' perception of nutritional traffic light in food products: a qualitative study on new nutritional policy in Iran. Nutrition and Food Science Research 2018(special issue (5)):69.
11. Mirghotbi M, Bajan M, Amiri Z. Consumer awareness and practice on food labels [in Persian]. Payesh. 2012 4(11):505-10.
12. Cowburn G, Stockley L. Consumer understanding and use of nutrition labelling: a systematic review. Public health nutrition. 2005;8(01):21-8.
12. Prieto-Castillo L, Royo-Bordonada MA, Moya-Geromini A. Information search behaviour, understanding and use of nutrition labeling by residents of Madrid, Spain. Public health. 2015;129(3):226-36.
14. Talagala IA, Arambepola C. Use of food labels by adolescents to make healthier choices on snacks: a cross-sectional study from Sri Lanka. BMC public health. 2016;16:739.
15. Lynn MR. Determination and quantification of content validity. Nursing research. 1986;35(6):382-5.
16. Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? Critique and recommendations. Research in nursing & health. 2006;29(5):489-97.
17. Kanter R, Vanderlee L, Vandevijvere S. Front-of-package nutrition labelling policy: global progress and future directions. Public Health Nutrition. 2018;21(8):1399-408.
18. Graham DJ, Jeffery RWJJotADA. Location, location, location: eye-tracking evidence that consumers preferentially view prominently positioned nutrition information. 2011;111(11):1704-11.
19. Grunert KG, Wills JMJJoph. A review of European research on consumer response to nutrition information on food labels. 2007;15(5):385-99.
20. Freire WB, Waters WF, Rivas-Marino G, Nguyen T, Rivas P. A qualitative study of consumer perceptions and use of traffic light food labelling in Ecuador. Public health nutrition. 2017;20(5):805-13.
21. Sassi F, Cecchini M, Lauer J, Chisholm D. Improving lifestyles, tackling obesity: the health and economic impact of prevention strategies. OECD Health Working Papers; 2009.
22. Crockett RA, King SE, Marteau TM, Prevost AT, Bignardi G, Roberts NW, et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. The Cochrane database of systematic reviews. 2018;2:Cd009315.
23. Malek Mahdavi A, Abdolahi P, Reza M. Knowledge, Attitude and Practice between Medical and Non-Medical Sciences Students about Food Labeling. Health Promot Perspect. 2012;2(2):173-9.
24. Ghanbari Ghozikali M, Ghochani M, Amini Tabok F, Nowrouz P, Dehghanzadeh Reihani R, H. A. Assessing knowledge and practice of food producers, retailers and consumers of food labels in Bostanabad [in Persian]. Journal of Food Hygiene. 2014;4.
25. Schupp A, Gillespie J, Reed D. Consumer awareness and use of nutrition labels on packaged fresh meats: a pilot study. Journal of Food Distribution Research. 1998;29:24-30.
26. Becker MW, Bello NM, Sundar RP, Peltier C, Bix L. Front of Pack Labels Enhance Attention to Nutrition Information in Novel & Commercial Brands. Food policy. 2015;56:76-86.
27. Ducrot P, Méjean C, Julia C, Kesse-Guyot E, Touvier M, Fezeu LK, et al. Objective Understanding of Front-of-Package Nutrition Labels among Nutritionally At-Risk Individuals. Nutrients. 2015;7(8):7106-25.
28. Balcombe K, Fraser I, Di Falco S. Traffic lights and food choice: A choice experiment examining the relationship between nutritional food labels and price. Food policy. 2010;35(3):211-20.
29. Julia C, Kesse-Guyot E, Ducrot P, Péneau S, Touvier M, Méjean C, et al. Performance of a five category front-of-pack labelling system - the 5-colour nutrition label - to differentiate nutritional quality of breakfast cereals in France. BMC public health. 2015;15:179.

30. Siegrist M, Leins-Hess R, Keller C. Which front-of-pack nutrition label is the most efficient one? The results of an eye-tracker study. Food Quality Preference. 2015;39:183-90.

31. Reyes M, Garmendia ML, Olivares S, Aqueveque C, Zacarías I, Corvalán C. Development of the Chilean front-of-package food warning label. BMC public health. 2019;19(1):906.

32. Esfandiari Z, Marasi MR, Estaki F, Sanati V, Panahi E, Akbari N, et al. Influence of education on knowledge, attitude and practices of students of Isfahan University of Medical Sciences to traffic light inserted on food labeling. 2019;77(1):54-62.

33. Levy AS, Fein SBJJoNE. Consumers' ability to perform tasks using nutrition labels. 1998;30(4):210-7.

34. Marietta AB, Welshimer KJ, Anderson SLJJotADA. Knowledge, attitudes, and behaviors of college students regarding the 1990 Nutrition Labeling Education Act food labels. 1999;99(4):445-9.

35. Kim SY, Nayga Jr RM, Capps Jr O. Food label use, self-selectivity, and diet quality. Journal of Consumer Affairs. 2001;35(2):346-63.

36. Kim S, Nayga R, Capps O. Health knowledge and consumer use of nutritional labels: The issue revisited. Agricultural resource Economics review. 2016;30:10-9.

37. Misra R. Knowledge, attitudes, and label use among college students. Journal of the American Dietetic Association. 2007;107(12):2130-4.

38. Guthrie JF, Fox JJ, Cleveland LE, Welsh S. Who uses nutrition labeling, and what effects does label use have on diet quality? Journal of Nutrition education. 1995;27(4):163-72.

39. Nayga J, Rodolfo M. Toward an understanding of consumers' perceptions of food labels. The International Food Agribusiness Management Review. 1999;2(1):29-45.

40. Miller LM, Applegate E, Beckett LA, Wilson MD, Gibson TN. Age differences in the use of serving size information on food labels: numeracy or attention? Public health nutrition. 2016:1-11.