Journal of Nutrition and Food Security
Shahid Sadoughi University of Medical Sciences
School of Public Health
Department of Nutrition
Nutrition & Food Security Research Center

eISSN: 2476-7425 pISSN: 2476-7417 JNFS 2022; 7(3): 398-406 Website: jnfs.ssu.ac.ir

Role of Traffic Light Labeling on Point of Purchase Behaviors: A Systematic Review

Arezoo Haghighian-Roudsari; PhD[1], Nazli Namazi; PhD[2], Pardis Irandoost; PhD[3], Fatemeh Mohammadi Nasarabadi; PhD[4], Mohammad Naemi Kermanshahi; BSc[5], Maryam Mohammadi Nasarabadi; PhD[6], Zahra Shahveghar; BSc[7], Mahdiyeh Khabbaz; BSc[8], Azizollaah Zargaraan; PhD[4], Ali Milani-Bonab; PhD[4] & Samira Pourmoradian; PhD* [9]

[1]*Department of Community Nutrition, National Nutrition and Food Technology Research Institute, School of Nutrition Sciences and Food Technology, Shahid Beheshti University of Medical Sciences, Tehran, Iran.*
[2] *Diabetes Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran.*
[3] *Department of Nutrition, School of Public Health, Iran University of Medical Sciences, Tehran, Iran.*
[4] *Department of Food and Nutrition Policy and Planning Research, School of Nutrition and Food Sciences, National Nutrition and Food Technology Research Institute, Shahid Beheshti University of Medical Sciences, Tehran, Iran.*
[5] *Department of Clinical Nutrition, School of Nutrition and Food Sciences, Tabriz University of Medical Sciences, Tabriz, Iran.*
[6] *Department of Education and Promotion, Tehran University of Medical Sciences, School of Public Health, Tehran, Iran.*
[7] *Department of Biochemistry and Dietetics, School of Nutrition and Food Sciences, Tabriz University of Medical Sciences, Tabriz, Iran.*
[8] *Department of Community Nutrition, School of Nutrition and Food Sciences, Tabriz University of Medical Sciences, Tabriz, Iran.*
[9] *Nutrition Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.*

ARTICLE INFO

SYSTEMATIC REVIEW

Article history:
Received: 11 Mar 2022
Revised: 7 May 2022
Accepted: 7 Jun 2022

Corresponding author:
Samira.Pourmoradian@gmail.com
Attar Neyshabouri Ave, Tabriz University of Medical Sciences and Health Services, Tabriz, Iran.

Postal code: *5166614711*
Tel: +98-4133352292

ABSTRACT

Background: Traffic Light Labeling (TLL) system is a simple tool to communicate information regarding the nutrients content of food products and has been widely applied to promote public health. However, evidence on the effectiveness of the TLL system on consumers' choices is conflicting. The present study aims to systematically summarize the effects of TLL on consumers' point of purchase behaviors. **Methods:** Five electronic databases, including PubMed/Medline, Scopus, Web of knowledge, the Cochrane library, and Science direct were searched from 2000/01/01 to 2021/11/01. Randomized-controlled trials, in English or Farsi languages, investigating the effects of TLL on choosing healthier foodstuffs or beverages were examined for eligibility and included in the review. Of 6408 potentially relevant publications (including 1255 duplicates), five clinical trials were finally included in the study. **Results:** The duration of the interventions ranged from 4 to 12 weeks and all studies except one had high methodological quality. Out of 5, three clinical trials did not show positive effects of TLL on customers' choices to purchase healthier food products. **Conclusions:** The present review showed that TLL without other public health-promoting interventions may have no substantial effects on consumer's food choice.

Keywords: *Food Labeling; Consumer's behavior; Choice behavior*

Introduction

Non-communicable diseases (NCDs) are dramatically growing across the world (World Health Organization, 2018). Reducing key risk factors of NCDs, such as physical inactivity,

This paper should be cited as: Haghighian-Roudsari A, Namazi N, Irandoost P, Mohammadi Nasarabadi F, Naemi Kermanshahi M, Mohammadi Nasarabadi M, et al. ***Role of Traffic Light Labeling on Point of Purchase Behaviors: A Systematic Review.*** *Journal of Nutrition and Food Security (JNFS)*, 2022; 7(3): 398-406.

[Downloaded from jnfs.ssu.ac.ir on 2022-08-31]

[DOI: 10.18502/jnfs.v7i3.10206]

tobacco and alcohol use, as well as unhealthy diet are among the main World Health Organization (WHO) strategies to prevent NCDs and reduce premature mortality caused by the diseases (World Health Organization, 2017). An unhealthy diet is recognized as a modifiable risk factor considered for both prevention and treatment of NCDs (Wagner and Brath, 2012). Using effective strategies to improve dietary patterns should be a priority approach for global public health (Finley *et al.*, 2017). These strategies can be helpful to improve consumers' food choice, industry responses, and product reformulations (Shangguan *et al.*, 2019). However, most industry-based interventions may not be as effective as nutritional interventions to change unhealthy dietary patterns (Milani-Bonab *et al.*, 2020).

Food and nutrition policies, including nutritional interventions, advertising restrictions, and social marketing are mainly aimed at encouraging people to choose healthier food products and help them adhere to healthy dietary habits (Gorski and Roberto, 2015). Public education-based interventions and providing easy-to-read and understand nutrition information are of the main focus to create awareness and motivation to promote healthy food choice. However, sometimes consumers may face difficulties in understanding and interpreting nutrition information provided on food packaging or do not pay enough attention to using them for their food choice (Ikonen *et al.*, 2020, Madilo *et al.*, 2020).

Front of package (FOP) labeling is a simple policy tool designed to promote healthy and informed food choice that is expanding in different contexts (Miller and Cassady, 2015).

Providing basic nutrition information on the packages of food products is mandatory in many countries (Al-Jawaldeh *et al.*, 2020, Storcksdieck genannt Bonsmann *et al.*, 2010). This policy can lead food industries to adopt technical strategies aiming at formulating healthier products and cutting down the unhealthy ingredients content of the food products. In the USA, for instance, mandatory statement of *trans* fatty acid content in the Nutrition facts label of food products has resulted in food reformulation in favor of reducing the *trans* fatty acid content (L'Abbé *et al.*, 2009, Van Camp *et al.*, 2012).

FOP is divided into interpretive and non-interpretive categories. Interpretive labels include Nutri-Score (NS) label, Chile-style warning labels, Health star ratings (HSR) (Australia and New Zealand), and the Traffic light labeling (TLL), which used symbols, figures, or cautionary statements and declarations to show the overall healthfulness or nutrient content of a product. Non-interpretive labels, such as "Guideline Daily Amount", represent fat, sugar and energy content of the product which allows consumers to judge whether a product is healthy (Shangguan *et al.*, 2019, Song *et al.*, 2021). Meanwhile, TLL can provide easy-to-understand and simple information for consumers to improve their accuracy in the estimation of the healthiness of food products (Borgmeier and Westenhoefer, 2009). The TLL color-coding generally shows the amount of some key unhealthy food ingredients, including saturated fat, sugars, and sodium. Red color represents a high content of the ingredients, green a lower and yellow color falls in the middle (Findling *et al.*, 2018).

Although several studies have examined whether FOP can affect consumer's food choice (Julia *et al.*, 2016, Machín *et al.*, 2018, Ni Mhurchu *et al.*, 2017), the findings are inconsistent and the effectiveness of the FOP has remained unclear. To the best of the authors' knowledge, no systematic review has been conducted to clearly show the effects of the TLL on consumers' food choice. In a meta-analysis performed by Shangguan *et al.*, FOP regardless of its type reduced the intake of energy and other unhealthy dietary choices by 6.6% and 13.0%, respectively. As an effect on industry responses, FOP has decreased the contents of sodium by 8.9% and artificial trans fatty acids by 64.3% in food products (Shangguan *et al.*, 2019). Another systematic review and meta-analysis revealed that FOP cannot significantly decrease calorie intake/choice (3.6%). Based on this meta-analysis, TLL can marginally improve the healthier food

[Downloaded from jnfs.ssu.ac.ir on 2022-08-31]

[DOI: 10.18502/jnfs.v7i3.10206]

choice. It is assumed that among different food labels, interpretive labels, such as TLL might be more effective than other labeling methods in improving the food choice. However, in this category studies were limited (Cecchini and Warin, 2016). Given it is not clear enough to what extent FOP procedures can improve healthier food choice, examining the effect of the type of FOP on customers' behavior and choice is necessary to decide on the way of implementation and possible reforms of the policy. The present study aims to systematically summarize the evidence on the effects of TLL labeling on consumers' food choice.

Materials and Methods

The current systematic review was designed and provided based on the preferred reporting items of systematic reviews and meta-analysis (PRISMA) statement (Moher *et al.*, 2011).

Search strategy: To find and collect eligible publications in which the effects of TLL policy on consumers' food choice were followed five electronic databases including PubMed/Medline, Scopus, Web of knowledge, Cochrane library, and Science direct. Systematic studies conducted from 2000/01/01 to 2021/11/01 were also checked in ProQuest dissertation & theses database Irandoc to find possible relevant dissertations. Search strategies were formulated considering both medical subject headings (MESH) and non-MESH keywords. Participants, Intervention, Comparison, Outcome (PICO) framework for the systematic review is provided in **Table 1**.

Randomized-controlled trials or quasi-randomized clinical trials with English or Farsi languages that examined the effects of TLL on consumers' food choice (e.g., containing less calorie, saturated fatty acids, *trans* fatty acid, salt, and sugar) were considered eligible ones. Studies on other types of standardized provision of nutrition content (e.g., nutrient content, nutrition and health-related claims, symbols, icons, and logos on packages) were not included in this study.

TLL or similar expressions was considered the primary intervention. This study also considered any change in food choice based on TLL policy as the primary outcome. Accordingly, improvements like the restriction of energy intake, replacement of unhealthy food products with less fat, *trans* fatty acids, sugar, and salt (sodium), and reduction in Sugar-sweetened beverages (SSBs) consumption were considered as the primary outcome. Regarding the secondary outcomes, any changes in health status were considered, including blood pressure, diabetes, hyperlipidemia, and obesity.

Two reviewers (Irandoost P, Milani-Bonab A) wrote the search strategy and performed the initial search. All possible relevant publications were collected in Endnote Library (PI) and two independent investigators (Kermanshahi MN, Mohammadi Nasarabadi F) checked the eligibility of each publication in two steps based on: (i) titles/ abstracts and (ii) the full texts of papers. If there were any controversies between the two reviewers, the principal investigators (Haghighian-Roudsari A, Pourmoradian S) checked the publication and made the final decision. To be sure to collect all relevant papers, the reference lists of all eligible papers were checked manually (Zargaraan A, Shahveghar Z).

Data extraction: Based on a pre-designed extraction table and considering the main items regarding the aims of the systematic review, two investigators (Mohammadi Nasarabadi M and Khabbaz M) extracted items. They included first author's name, location, demographic characteristics of participants (age, gender, and history of diseases), total sample size, the sample size in each study group, type and characteristics of the FOP, duration of the intervention, and the findings. Whenever necessary data were not reported in a paper, the corresponding author was contacted via email to obtain data. In case of any controversies between two investigators, a principal investigator (Pourmoradian S) checked and resolved the issue.

Quality assessment: Quality assessment of the included trials was carried out independently by the two researchers (Pourmoradian S and Namazi N), using the criteria outlined in the Jadad checklist (Halpern and Douglas, 2005). Jadad scale

[Downloaded from jnfs.ssu.ac.ir on 2022-08-31]

[DOI: 10.18502/jnfs.v7i3.10206]

provides three main criteria for assessing the methodological quality of papers, including (i) randomization, (ii) double-blinding, and (iii) description of withdrawals and follow up. Based on the scale, a maximum of two scores can be dedicated for the first two criteria and one score for the third one. In general, based on the Jadad, each paper can obtain a maximum of five scores as an indicator of the quality. In the present study, papers with three scores were considered high-quality ones and the lower-scored papers were categorized as low-quality. In this step, any discrepancy was resolved by making a discussion within the research team (**Table 2**).

Quantitative synthesis: Due to the high heterogeneity in the obtained results, doing a meta-analysis was not possible.

Results

A total of 6408 potentially relevant publications (including 1255 duplicates) were identified based on the search strategy in the five electronic databases. After removing duplications and screening publications based on titles and abstracts, full texts of 217 papers were further examined for their compliance with the inclusion and exclusion criteria. Then, 212 papers were excluded based on reasons: They include a) studies that did not focus on consumers' food choice or those that took marketing or psychological perspectives of the FOP, b) studies that evaluated menu labeling as well as non-colored types of food labeling and c) those studies that were not in English or Farsi. Finally, five trials (Acton *et al.*, 2019, Julia *et al.*, 2016, Machín *et al.*, 2018, Ni Mhurchu *et al.*, 2017) were included in the qualitative synthesis. PRISMA Flow chart of the included studies is presented in **Figure 1**.

The main characteristics of the included clinical trials are provided in **Table 3**. Included clinical trials were published between 2016 and 2019. All clinical trials were conducted on adult populations of both genders. The included trials were performed in Australia (n=1), the USA (n=2), and Europe (n=2). The duration of the interventions ranged from four to 12 weeks. The total sample sizes were between 600 to 1436. All studies except one (Julia *et al.*, 2016) had high methodological quality.

Julia *et al.* examined the effects of 5-colour nutrition labels (5-CNL) on three specific sections, including breakfast cereals, sweet biscuits, and appetizers alone and along with providing information to customers on the nutrition quality of purchases in France. They found that 5-CNL along with giving information only affects the nutritional quality of the purchased sweet biscuits category. The findings suggest that the 5-CNL label may have a little effect on purchases after 3 months of the intervention (Julia *et al.*, 2016).

Starlight randomized controlled trial by Ni Mhurchu et al. revealed that interpretive nutrition labels did not significantly affect food purchases after 4 weeks. However, shoppers found this type of label useful and easy to understand. In this clinical trial, the effects of two interpretive nutrition labels (TLL, HSR) were compared with a noninterpretive label [nutrition information panel (NIP)] on food purchases in New Zealand who owned smartphones (Ni Mhurchu *et al.*, 2017). Customers using smartphone technology scanned the barcodes on the packages of food products to obtain labels on their smartphone screens (Ni Mhurchu *et al.*, 2017).

Acton *et al.* reported that nutrient-specific front-of-package (high-in warning) may be more effective than other common food labeling systems (warning; multiple traffic light; HSR; nutrition grade) to reduce the consumption of calorie and some unhealthy nutrients (sodium, saturated fat, and sugar) (Acton *et al.*, 2019).

Harrington *et al.* also in a pilot randomized controlled trial assessed the effects of the front-of-pack food labels on consumer's choice through a digital behavior change intervention. In this study, participants accessed a website to get feedback on previous purchases of unhealthy foods, such as processed food, could set goals for changes in nutritional behaviors, and select models by which to follow healthy shopping behavior using traffic light labels. After a 6-week intervention, no significant effect was reached on healthy purchases

[Downloaded from jnfs.ssu.ac.ir on 2022-08-31]

[DOI: 10.18502/jnfs.v7i3.10206]

(Harrington *et al.*, 2019).

Based on the study by Machin *et al.*, no differences were observed in the total amount of calorie, saturated fat, sugar, and sodium content of purchased food between those allocated to the TLL group and the Chile-style warning lable group (Machín *et al.*, 2018).

Table 1. The Participants, Intervention, Comparison, Outcome (PICO) criteria used for the present systematic review.

PICO criteria	Description
Patients	Healthy subject
Intervention	Colored food labeling
Comparison	Control
Outcome	Consumer's food choice

Table 2. Methodological quality scores for the included studies using the Jadad scale.

Study	Randomization	Blinding	Description of withdrawal	Total score
Julia c et al,2016	0	1	1	2
Ni Mhurchu C, et al, 2017	2	1	2	5
Acton RB et al, 2019	2	0	1	3
Harrington RA et al, 2019	2	0	2	4
Machín L et al, 2018	2	0	2	4

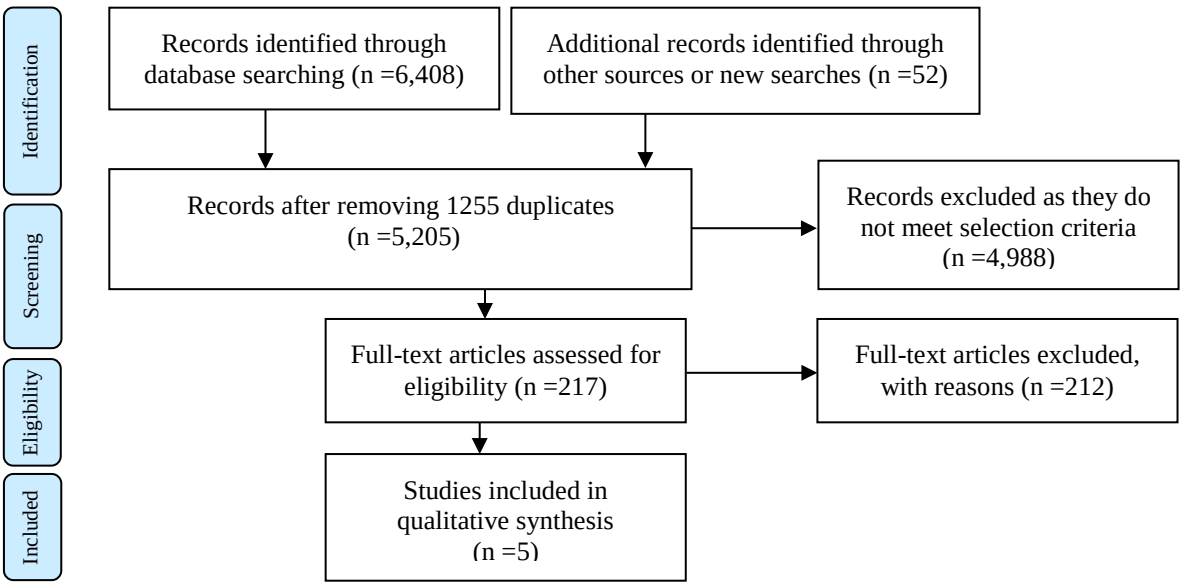

Figure 1. PRISMA flow diagram in a systematic review on the effect of using colored food labeling on consumer's food choice

[Downloaded from jnfs.ssu.ac.ir on 2022-08-31]

[DOI: 10.18502/jnfs.v7i3.10206]

Table 3. Characteristics of the included studies

Author/date	Country	Subject (gender)	Sample size	Age (year)	Type of label	Duration (WK)	Findings
Julia c et al., 2016	France	Male and female	C:300 5CNl* (5-Colour Nutrition Label):301 %CNL+comunication:300	18 <	1) Control situation; 2) Application of the 5-CNL on breakfast cereals, sweet biscuits and appetizers; 3) Introduction of the 5-CNL accompanied by consumer information on use and understanding of the label	12	Significantly higher mean the nutritional quality of the purchased items per section were observed for the sweet biscuits category in the intervention combining the label + communication
Ni Mhurchu C, et al.,2017	New Zealand	Male and female	TLL** (n = 459) HSR*** (n = 443) NIP**** (n = 455) labels	18 <	1) Receive either TLLs, 2)HSRs, 3) control [NIP]	4	There were no significant effects of TLLs or HSRs compared to NIPs on the nutrient content of packaged foods purchased
Acton RB et al., 2019	Canada	Male and female	FOP***** label :709 C:727	13 <	Marketplace study using 5 (FOP label condition) × 8 (tax condition). Participants received $5 and were presented with images of 20 beverages and 20 snack foods available for purchase	12	Participants who viewed the 'high in' symbol purchased less sugar (− 2.5 g), saturated fat (− 0.09 g), and calories (− 12.6 kcal) in the beverage purchasing tasks, and less sodium (− 13.5 mg) and calories (− 8.9 kcal) in the food tasks.
Harrington RA et al., 2019	United Kingdom	Male and female	496	18 <	University	6	There was no difference in the healthiness and total amount (measured in grams) of fat, saturated fat, sugar, and salt of purchased ready meals and pizzas between the intervention and control
Machín L et al., 2018	Uruguay	Male and female	TL:425 CWS:405 C:352	26-50	the influence of the 1) TLL and 2) the Chile-style warning label system 3)control on consumer food purchases	4	There was no difference in the total amount of calories, sugar, saturated fat and sodium included in the shopping cart of participants in the TLL in the Chile-style warning label system

* 5-Colour Nutrition Labels ** Traffic Light Labeling *** Health Star Rating labels **** Nutrition Information Panel ***** Front of Package Labeling

[Downloaded from jnfs.ssu.ac.ir on 2022-08-31]

[DOI: 10.18502/jnfs.v7i3.10206]

Discussion

Although different food labelings are widely used, most earlier studies have focused on their effect on consumer awareness and less have been paid to their effects on purchase or intake. To the best of the author's knowledge, no systematic review has focused on the effects of colored-food labeling on consumer's food choice so far. A recent systematic review and meta-analysis by Shangguan *et al.*, regarding the impact of food labeling on the dietary behaviors of customers, concluded that food labeling can effectively reduce the intake of total energy and fat and increase the intake of vegetables. However, in this study, all types of food labeling were considered. However, the effects of traffic-light labeling on customer choices remained uncovered (Shangguan *et al.*, 2019).

In another meta-analysis, it was indicated that labeling systems increased choosing healthier food products, while total energy intake did not decreaseconsiderably (Cecchini and Warin, 2016). In the current study, due to heterogeneity in the methodology and providing outcomes pooling data and doing a meta-analysis was not possible. In addition, various outcomes were assessed in the present systematic review. Thus, deciding on the effects of this type of labeling on each component of traffic-light labeling was not possible.

Although the main aim of any food labeling is to help consumers to make healthier and informed choices, studies with this purpose are limited and show inconsistent findings. Thus, more clinical trials with high-quality methodology are required. The quality of all studies (Acton *et al.*, 2019, Harrington *et al.*, 2019, Machín *et al.*, 2018, Ni Mhurchu *et al.*, 2017) except one included in the present systematic review was high. Therefore, we can rely on their findings. However, differences in methodology, type of intervention, and study groups made it difficult to draw a fixed conclusion.

In general, it seems that focusing on only traffic-light labeling without other educational interventions and providing nutritional education and public awareness on the importance of healthy dietary habits in the prevention and controlling of NCDs cannot be an effective strategy (Haghighian-Roudsari *et al.*, 2020).

The present systematic review has some limitations that should be addressed. First, only the TLL method was assessed. The efficacy of this type of labeling compared with other nutrition labels on customer choices were not clarified. Furthermore, due to differences in outcomes, it is not clear which nutrient, ingredient, or food product of this type of labeling has the greatest effect on shopping. Moreover, the effects of this labeling on industry reformulation were not assessed. More high-quality clinical trials in which different food labelings alone or along with further educational interventions on a healthy diet are recommended for future studies.

The present systematic review revealed that TLLalone may have no considerable effects on healthy food choice by customers. However, due to limited studies and differences in the methodology and type of interventions, more clinical trials are required.

Conclusion

The present systematic review showed that TLL without other educational interventions may have no substantial effects on choosing healthier food products by customers. However, due to the limited clinical trials, methodology differences of the studies, the type of interventions, and diverse outcomes of the studies, more studies are needed to clarify the efficacy of the policy.

Acknowledgment

We kindly acknowledge the National Nutrition and Food Technology Research Institute, Faculty of Nutrition Sciences and Food Technology, Shahid Beheshti University of Medical Sciences for their financial support.

Authors' contributions

Irandoost P and Milani-Bonab A wrote search strategy and performed the initial search in databases. Mohammadi-Nasarabadi F and Naemi-Kermanshahi M checked the eligibility of each publication. The principal investigators, Haghighian-Roudsari A and Pourmoradian S checked the controversies between two reviewers,

[Downloaded from jnfs.ssu.ac.ir on 2022-08-31]

[DOI: 10.18502/jnfs.v7i3.10206]

and made the final decision. The reference lists of all eligible papers were checked manually by Zargaraan A and Shahveghar Z. The data extraction was done by Mohammadi- Nasarabadi M and Khabbaz Koche Ghazi M. Quality assessment of the included clinical trials was carried out by Pourmoradian S and Namazi N. All authors contributed to paper writing and Haghighian-Roudsari A and Pourmoradian S finalized the revision of the manuscript.

Conflict of interest

The authors declare that there is no conflict of interest.

References

Acton RB, Jones AC, Kirkpatrick SI, Roberto CA & Hammond D 2019. Taxes and front-of-package labels improve the healthiness of beverage and snack purchases: a randomized experimental marketplace. *International Journal of Behavioral Nutrition and Physical Activity*. **16 (1)**: 1-15.

Al-Jawaldeh A, et al. 2020. Improving nutrition information in the eastern Mediterranean region: implementation of front-of-pack nutrition labelling. *Nutrients*. **12 (2)**: 330.

Borgmeier I & Westenhoefer J 2009. Impact of different food label formats on healthiness evaluation and food choice of consumers: a randomized-controlled study. *BMC public health*. **9 (1)**: 1-12.

Cecchini M & Warin L 2016. Impact of food labelling systems on food choices and eating behaviours: a systematic review and meta-analysis of randomized studies. *Obesity reviews*. **17 (3)**: 201-210.

Findling MTG, et al. 2018. Comparing five front-of-pack nutrition labels' influence on consumers' perceptions and purchase intentions. *Preventive medicine*. **106**: 114-121.

Finley JW, et al. 2017. Nutritional sustainability: Aligning priorities in nutrition and public health with agricultural production. *Advances in nutrition*. **8 (5)**: 780-788.

Gorski MT & Roberto CA 2015. Public health policies to encourage healthy eating habits: recent perspectives. *Journal of healthcare leadership*. **7**: 81.

Haghighian-Roudsari A, et al. 2020. Consumers' perception of nutritional facts table and nutritional traffic light in food products' labelling: A qualitative study. *International journal of health planning and management*. **36 (3)**: 628-642.

Halpern SH & Douglas MJ 2005. Appendix: Jadad scale for reporting randomized controlled trials. Evidence-based Obstetric Anesthesia. Oxford, UK: Blackwell Publishing Ltd.

Harrington RA, et al. 2019. A Pilot Randomized Controlled Trial of a Digital Intervention Aimed at Improving Food Purchasing Behavior: The Front-of-Pack Food Labels Impact on Consumer Choice Study. *JMIR formative research*. **3 (2)**: e9910.

Ikonen I, Sotgiu F, Aydinli A & Verlegh PW 2020. Consumer effects of front-of-package nutrition labeling: An interdisciplinary meta-analysis. *Journal of the academy of marketing science*. **48 (3)**: 360-383.

Julia C, et al. 2016. Impact of the front-of-pack 5-colour nutrition label (5-CNL) on the nutritional quality of purchases: an experimental study. *International journal of behavioral nutrition and physical activity*. **13 (1)**: 1-9.

L'Abbé MR, Stender S, Skeaff C & Tavella M 2009. Approaches to removing trans fats from the food supply in industrialized and developing countries. *European journal of clinical nutrition*. **63 (2)**: S50-S67.

Machín L, Aschemann-Witzel J, Curutchet MR, Giménez A & Ares G 2018. Does front-of-pack nutrition information improve consumer ability to make healthful choices? Performance of warnings and the traffic light system in a simulated shopping experiment. *Appetite*. **121**: 55-62.

Madilo FK, Owusu-Kwarteng J, Kunadu AP-H & Tano-Debrah K 2020. Self-reported use and understanding of food label information among

[Downloaded from jnfs.ssu.ac.ir on 2022-08-31]

[DOI: 10.18502/jnfs.v7i3.10206]

tertiary education students in Ghana. *Food control*. **108**: 106841.

Milani-Bonab A, Kalantari N, Zargaraan A, Roudsari AH & Pourmoradian S 2020. Can Food Reformulation Policy Reduce Calorie Intake and Tackle Childhood Obesity? *Iranian journal of pediatrics*. **30 (6)**: e98985.

Miller LMS & Cassady DL 2015. The effects of nutrition knowledge on food label use. A review of the literature. *Appetite*. **92**: 207-216.

Moher D, Altman DG, Liberati A & Tetzlaff J 2011. PRISMA statement. *Epidemiology*. **22 (1)**: 128.

Ni Mhurchu C, et al. 2017. Effects of interpretive nutrition labels on consumer food purchases: the Starlight randomized controlled trial. *American journal of clinical nutrition*. **105 (3)**: 695-704.

Shangguan S, et al. 2019. A meta-analysis of food labeling effects on consumer diet behaviors and industry practices. *American journal of preventive medicine*. **56 (2)**: 300-314.

Song J, et al. 2021. Impact of color-coded and warning nutrition labelling schemes: A systematic review and network meta-analysis. *PLoS medicine*. **18 (10)**: e1003765.

Storcksdieck genannt Bonsmann S, et al. 2010. Penetration of nutrition information on food labels across the EU-27 plus Turkey. *European journal of clinical nutrition*. **64 (12)**: 1379-1385.

Van Camp D, Hooker NH & Lin C-TJ 2012. Changes in fat contents of US snack foods in response to mandatory trans fat labelling. *Public health nutrition*. **15 (6)**: 1130-1137.

Wagner K-H & Brath H 2012. A global view on the development of non communicable diseases. *Preventive medicine*. **54**: S38-S41.

World Health Organization 2017. WHO global coordination mechanism on the prevention and control of non-communicable diseases: progress report 2014-2016.

World Health Organization 2018. Projections of mortality and causes of death, 2016 to 2060. World Health Organization: Geneva.

[Downloaded from jnfs.ssu.ac.ir on 2022-08-31]

[DOI: 10.18502/jnfs.v7i3.10206]