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Nutrition Labeling in Iran: Evolution, Outcomes, and Future Directions: A Comprehensive Narrative Review

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ABSTRACT

Background: Non-communicable diseases (NCDs) are the leading causes of mortality worldwide. As healthy nutrition significantly contributes to the prevention of NCDs, several nutritional policies have been implemented globally to improve dietary patterns, including nutrition labeling policies. In 2014, the Iranian government launched the traffic light labeling (TLL) policy, with the mandatory phase implemented in 2016. However, no comprehensive review has been conducted to examine the TLL policymaking process in Iran, its effectiveness, and potential improvement strategies. **Methods:** This narrative review aims to explore the evolution, outcomes, and future directions of nutrition labeling in Iran. **Results:** The high prevalence of NCDs, alongside the government's commitment to controlling these diseases and addressing major dietary risk factors, served as a political driver for TLL implementation. International influences, such as the experiences of other countries with similar policies, also contributed. However, the policy has faced criticism, including the absence of sufficient educational programs, lack of an accurate monitoring system, limited evidence-based decision-making, and the use of back-of-package (BOP) rather than front-of-package (FOP) labeling. **Conclusion:** Despite the limitations, several studies indicate positive effects of TLL on food-related behaviors among the Iranian population. Nevertheless, large-scale research is required to more rigorously evaluate the effectiveness of TLL. Further improvements could include relocating TLL to the FOP, considering alternative labeling systems such as Nutri-Score, promoting educational initiatives, and establishing transparent and effective monitoring systems.

Introduction

Non-communicable diseases (NCDs) such as cardiovascular diseases, diabetes, and cancer are the leading causes of mortality, with approximately 43 million deaths in 2021, which is equivalent to 75 percent of all deaths globally (Elkomy and Jackson, 2024). Notably, in 2021, 73 percent of all global deaths were due to NCDs occurred in low- and middle-income countries (Elkomy and Jackson, 2024).

An extensive body of evidence highlights the

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role of nutrition and healthy food behavior in prevention of NCDs (Ruthsatz and Candeias, 2020). Therefore, different policies have been adopted to encourage individuals to make healthy food choices, such as food labeling, taxes, and subsidies (Hawkes *et al.*, 2013, Thow *et al.*, 2018). Nutrition information on food labels has been proposed as a cost-effective measure that can contribute to improved health behavior and eventually, prevention of NCDs. Previous studies have revealed that various types of food labels, including front-of-package (FOP) labels, back-of-package (BOP) labels, labels on restaurant menus, and labels in grocery stores, are strongly and positively associated with healthiness of the diets selected by consumers (Shangguan *et al.*, 2019, Temple, 2020). Therefore, many countries have implemented mandatory or voluntary nutrition labeling policies to improve public health and prevent NCDs (Cowburn and Stockley, 2005, Grunert and Wills, 2007).

FOP and BOP nutrition labels can be categorized into non-directive, semi-directive, and directive (**Figure 1**) (Hodgkins *et al.*, 2012, Ma and Zhuang, 2021). In this context, "directive" refers to the extent to which a food label infers a food's overall healthiness. In non-directive labeling, no information on the overall healthiness of foods is provided, and only the textual display of information on nutritional ingredients is provided. The traditional nutrition facts panel, a common non-directive labeling system, has evolved into the widely recognized Guidelines Daily Amount (GDA) system featured on the front of packages (Alonso-Dos-Santos *et al.*, 2019, Ares *et al.*, 2014). Furthermore, the semi-directive label systems, including the traffic light system, use salient features such as color to highlight the healthiness of key components in relation to recommended reference amounts (Hieke and Wilczynski, 2012, Ma and Zhuang, 2021). Nonetheless, the directive label systems use directive icons, such as "healthy choice" tick, smiley, stars, Nutri-Score, and nutrition warnings to directly indicate the overall healthiness of food (Borgmeier and Westenhoefer, 2009). Although many studies have compared different types of labeling, their findings were inconsistent (Temple, 2020, Temple and Fraser, 2014). Additionally, it is reported that the outcome of nutrition labeling policy could be affected by education, gender, and the age of individuals (Drichoutis *et al.*, 2006).

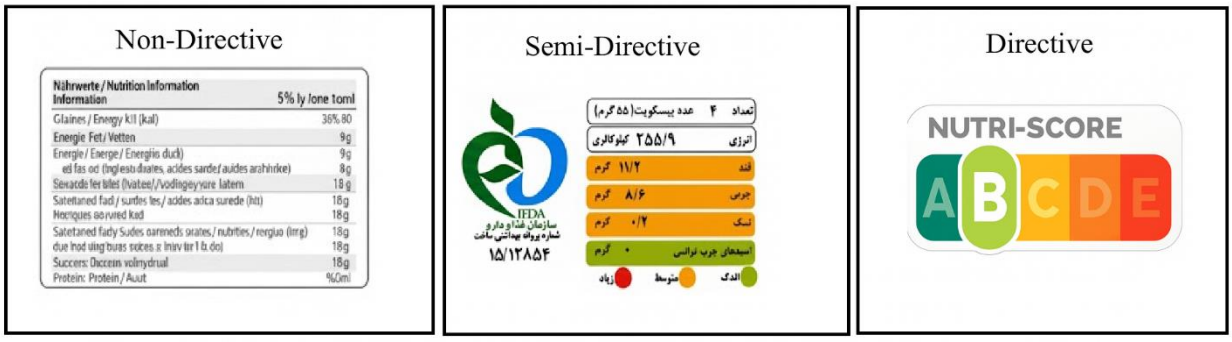

Figure 1. Categories of nutrition labels.

In the eastern Mediterranean region, Iran was the first country to implement mandatory nutrition labeling (Edalati *et al.*, 2020). In 2009, Iran's Ministry of Health and Medical Education (MOHME) launched a voluntary policy for using the nutrition facts label (NFL), a non-directive labeling system, with the objective of reducing sodium, trans fatty acids, and sugar intake in accordance with the national plan for control and prevention of NCDs (Seyedhamzeh *et al.*, 2020). However, since the prevalence of obesity and other NCDs continued to rise, and also due to the lack of consumer attention to the NFL, policymakers decided to implement the mandatory traffic light

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label (TLL) system on all food products (Seyedhamzeh *et al.*, 2020). This labeling system was first developed by the United Kingdom Food Standards Agency (FSA) in 2004/2005 and implemented in the United Kingdom on a voluntary basis in 2013 (Ayoub Al-Jawaldeh, 2023).

Since the implementation of the TLL policy in Iran, different studies have been conducted to investigate the process of policymaking (Edalati *et al.*, 2020, Seyedhamzeh *et al.*, 2020). However, no comprehensive review study has been conducted to investigate the process of TLL policymaking while exploring its effectiveness and improvement strategies. Therefore, the current narrative/literature review aims to explore the evolution, outcomes, and future direction of nutrition labelling in Iran.

History and policy process of nutrition labeling in Iran

In 1992, the first nutrition food labeling guidance was developed by the Institute of Standards and Industrial Research of Iran (ISIRI). Furthermore, in 2009, Iran's Food and Drug Administration Institute developed the first edition of nutrition food labeling as a voluntary act in the format of NFL. In 2014, the TLL policy was launched and in 2016, the mandatory phase of this policy was implemented for all imported and domestic foods, except for products that are not chemically processed or formulated, such as vegetables, spices, vinegar, lemon juice, tea, infusions, coffee, honey, dates, flour, and barberry (Edalati *et al.*, 2020, Moslemi *et al.*, 2020). TLL displays important dietary risk factors for NCDs, including total energy, sugar, fat, salt, and trans fatty acids (Ghazavi *et al.*, 2020).

The main contextual factors for the implementation of TLL in Iran were reported as follows: (A) health, (B) political factors, (C) previous national experiences of food labeling, and (D) international factors (Edalati *et al.*, 2020). Health factors included the epidemiological and nutritional transition in Iran, which raised significant concerns about public health in the country (Edalati *et al.*, 2020). Additionally, the commitment to controlling NCDs and addressing major dietary risk factors served as a political driver, supported by international influences such as the experiences of other countries in implementing similar policies, like the traffic light labeling system in the UK, and the WHO Global NCD Action Plan 2013-2020 (Edalati *et al.*, 2020, Sacks *et al.*, 2009, World Health Organization, 2013). Finally, Iran's prior experience in developing food labeling guidelines through ISIRI was another critical contextual factor that facilitated the implementation of the food labeling policy in 2009 (Edalati *et al.*, 2020).

Based on Knill and Tosun's Policy Cycle Model and Kingdon's Multiple Streams Framework (Hoefer, 2022, Knill and Tosun, 2008), the policy process for TLL in Iran encompassed key stages, including agenda setting, policy formulation, implementation, and evaluation.

Agenda setting

Problem stream: As mentioned by most stakeholders, the nutrition transition and increased prevalence of NCDs attracted the attention of policymakers. It is reported that policymakers were concerned about epidemiological trends, which were confirmed by national evidence and also showed the role of dietary risk factors such as sugar, salt, and trans fatty acids in this crisis (Edalati *et al.*, 2020).

Policy stream: The TLL was proposed by MOHME due to its visual simplicity, ease of understanding, and faster usability compared to the previous NFL program. Additionally, it has been mentioned that the implementation of TLL in the UK had an effect on its proposal by MOHME (Edalati *et al.*, 2020).

Political stream and the window of opportunity:

Several factors have been mentioned as the key contributors to the development of TLL policy, including government commitment to prevent NCDs, administrative change, their interests, and key staff shifts in the MOHME (Edalati *et al.*, 2020). At the time, the MOHME was emphasizing prevention and nutrition, and also proposed the "Health Evolution Program" with the objective of

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NCD prevention. Therefore, the MOHME was solely responsible for pushing the policy within the government. No civil society organizations, NGOs, or consumer advocacy groups were involved in this process (Edalati *et al.*, 2020).

Policy formulation, implementation, and evaluation

In the World Food Ceremony Day in 2014, the TLL was introduced, and the national committee for the formulation of food labeling was established following two national conferences on food labeling in two provinces of Iran (Hamedan and Mazandaran), and the formulation of executive instruction revisions was done consequently. The TLL was a voluntary program encouraged by the government, but in 2016, the mandatory phase started. Before the mandatory implementation, several training sessions were held to educate food technicians of the Food and Drug Administration and also food manufacturers (Edalati *et al.*, 2020).

In response to the new TLL policy, several food producers changed their formulation using artificial sweeteners instead of sugar to comply with green labeling requirements (Edalati *et al.*, 2020).

It is mentioned that the government implemented this policy without any comprehensive and sufficient planning for public education on TLL, and only limited educational programs were used to address this issue, by the MOHME. The "Drin Drin" animation (in Persian) was an example of the MOHME's attempt to educate the public via social media. Several stakeholders stated that there were not sufficient investments in informing and educating the public on TLL and its interpretation (Edalati *et al.*, 2020).

There are several criticisms regarding the implementation of the TLL policy in Iran. First, the development and implementation of this policy happened rapidly, and there was an insufficient level of consultation with different stakeholders and sectors, as well as a low level of collaboration with non-health sectors during the formation and before the finalization of the TLL policy. For example, due to the low level of coordination, "Iran Broadcasting Organization" did not produce sufficient educational programs and advertisements to inform the public regarding the new TLL program (Edalati *et al.*, 2020). Furthermore, different stakeholders have mentioned a low level of evidence-informed decision making as a drawback to the implementation of TLL in Iran (Edalati *et al.*, 2020). It was mentioned that although TLL policy was a better strategy than the previous NFL, there were still other options that could have been considered (Edalati *et al.*, 2020). Finally, the lack of proper indicators for the assessment of outcomes, as well as the absence of a monitoring program, were also considered the two major limitations of this process (Edalati *et al.*, 2020).

Outcomes and effectiveness

Despite the low level of collaboration in the development and implementation of TLL policy, it was reported that by 2018, 80% of food production in Iran had TLL (Edalati *et al.*, 2020). However, currently, there is limited evidence regarding the effectiveness and outcomes of TLL in Iran. Some studies raised concerns about the accuracy of TLL on products. For example, Ghazavi *et al*. reported discrepancies in the experimentally measured trans-fatty acid values with TLL in more than 80% of Iranian traditional sweets (Ghazavi *et al.*, 2020). Similarly, in 2024, a study by Shirani *et al.* reported that 82% of their samples had discrepancies between the measured salt content and the values stated on the TLL (Shirani *et al.*, 2024).

Furthermore, in a qualitative study by Seyedhamzeh *et al.*, focus group discussions and interviews were used to assess the feedback of public and experts on the TLL policy. In this study, the representatives of the public (mothers) and nutritionists believed that the TLL were appropriate for the public to understand. However, the food quality control and food industry experts believed NFL was more suitable to understand. Additionally, mothers and food quality control experts believed that the TLL do not suit the governing culture. Furthermore, the multiplicity of colors in TLL was the most important weakness of

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TLL based on the nutritionists' and food industry experts' comments. Finally, all the stakeholders stated that further educational programs via media and especially television, community, and cultural buildings are required to improve the use and outcome of the nutrition labels (Seyedhamzeh *et al.*, 2020).

Several studies have examined the effectiveness of TLL on food behavior and practices of the public before and after educational intervention. Consistently, all the studies reported significantly positive effects of educational intervention on food selection and preference (Esfandiari *et al.*, 2021, Faramarzizadeh *et al.*, 2024, Sadeghi *et al.*, 2024). For example, a study by Sadeghi *et al*. included 73 patients with acute coronary syndrome (Sadeghi *et al.*, 2024). The control group received basic nutritional training, while the intervention group received additional training for TLL by using an educational poster on TLL. Their results revealed no significant differences at the baseline between the control group and the intervention group in terms of selection, preference, and consumption of food. However, after the intervention, the intervention group showed significantly higher scores in all the measured outcomes (Sadeghi *et al.*, 2024). These studies highlight the importance of education on TLL in the Iranian population and the potential role of TLL in food behavior.

Discussion and future direction

The impact of nutrition labeling policy on food choice and behavior of the public has been explored extensively in different countries. Overall, several systematic reviews and meta-analyses reported a beneficial impact of nutrition labeling on food choice and eating behavior (Cecchini and Warin, 2016, Kelly *et al.*, 2024, Shangguan *et al.*, 2019, Song *et al.*, 2021). For example, a recent systematic literature review of 211 studies by Kelly et al. revealed that FOP labeling is likely to enhance consumers' awareness of the nutritional value of foods and promote healthier choices and purchases, specifically interpretive FOP labels (Kelly *et al.*, 2024). Notably, in the Iranian population, since the implementation of the TLL policy, no large-scale studies have been conducted that have examined the impact of TLL on food behavior and choice. Only few small interventions have been conducted, which found positive effects of TLL and education of TLL on food practices (Esfandiari *et al.*, 2021, Faramarzizadeh *et al.*, 2024, Sadeghi *et al.*, 2024). However, it is unclear whether or not these results would hold in a large-scale study over a long period of time. Therefore, to clearly understand the effectiveness of TLL in the Iranian context, further large-scale studies are required.

Moreover, shoppers tend to spend only a few seconds quickly scanning the labels on food products before making a decision (Sanjari *et al.*, 2017). Consequently, a simple and understandable FOP label plays an important role in the decision-making of most consumers rather than a BAP label with more details (Sanjari *et al.*, 2017). Therefore, well-designed labels that are maximally effective at enabling shoppers to identify healthy food products is an important step in implementation of food labeling policy (Temple, 2020). However, despite the statements of previous literature that mentioned TLL in Iran is attached to FOP (Ayoub Al-Jawaldeh, 2023, Edalati *et al.*, 2020), it is attached to the BOP and cannot be considered as FOP labels (**Figure 2**). Therefore, relocating labeling from BOP to FOP may contribute to the effectiveness of nutrition labeling in Iran. To support this, a study by Rønnow *et al*. found an increased overall dietary quality when using FOP nutritional labels. In contrast, they reported that the use of back-BOP nutritional tables did not influence the dietary quality of participants (Rønnow, 2020).

It has been mentioned by different studies that TLL can be confusing, specifically for those with limited nutritional knowledge and for when they are faced with trade-offs between nutrients (Ayoub Al-Jawaldeh, 2023, Seyedhamzeh *et al.*, 2020). For example, it can be challenging for consumers to choose between two products if one product has a high salt content but low levels of saturated fats, while another is high in saturated fats but contains little salt. This misleading situation can be compared with a person facing multiple traffic

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lights in a place and trying to decide whether to pass the street or not. Notably, both the experts and the public in Iran have criticized the confusing nature of TLL in different studies. For example, in the study by Seyedhamzeh *et al.*, the representatives of the public (mothers) mentioned that the TLLs are ambiguous and provide high amount of information as one of the major problems of TLL (Seyedhamzeh *et al.*, 2020). Similarly, the nutrition and food industry experts expressed that TLL was meaningless because of its multiple colors (Seyedhamzeh *et al.*, 2020). Additionally, in another study by Edalati *et al.*, representatives of academia mentioned the multiple color nature of TLL as a limitation and suggested alternative labeling systems such as nutrient profiling rating systems or the health star rating system, which indicate overall healthiness of the products (Edalati *et al.*, 2020). In contrast to the multi-color approach of TLL, the Nutri-Score is a voluntary, front-of-pack nutritional label that uses a simple, color-coded scale from dark green (A) to dark orange (E) to provide a single, summary rating of a product's overall nutritional quality. This score is derived from a calculation that weighs beneficial components (like fiber, protein, and fruit/vegetable content) against detrimental components (like energy, sugar, saturated fats, and salt) per 100 grams or milliliters, thereby resolving complex nutrient trade-offs into a single, easily digestible grade (Julia *et al.*, 2018). The most vulnerable group to NCDs are individuals with low education, income, or social class; thus, the implementation of a simpler directive food labeling such as Nutri-Score which indicates the overall healthiness of a food, or a combined system such as the health star rating used in Australia, may be a better option rather than the TLL, especially for people with lower educational backgrounds (Di Cesare *et al.*, 2013, Niessen *et al.*, 2018). Notably, in a recent study by Pettigrew et al., which analyzed the effectiveness of five FOP nutrition labels across 18 countries, they found Nutri-Score performed best in terms of both attraction and aversion results for understanding and simulated choice outcomes (Pettigrew *et al.*, 2023).

Figure 2. Back-of-package nutrition labeling in Iran.

Furthermore, in 2022, a systematic review by Haghighian-Roudsari *et al.* explored the literature and revealed that the TLL without other public health-promoting interventions, such as educational programs, may have no substantial effects on consumers' food choices (Haghighian-Roudsari *et al.*, 2022). This is aligned with the results of a recent Iranian clinical trial by Sadeghi *et al.*; it found a significantly better food behavior in terms of selection, preference, and food consumption only in individuals who were educated with an educational poster on traffic light

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labels and not within the control group that was only taught standard nutritional training (Sadeghi *et al.*, 2024). As the development and implementation of TLL policy happened rapidly in Iran and there was not sufficient education regarding this labeling system, it can substantially reduce the effectiveness of TLL policy (Sameni *et al.*, 2021, Tork *et al.*, 2021). Therefore, further educational programs are required to improve the impact of nutritional labeling on food behavior and choices and ultimately prevent NCDs.

Lack of an accurate monitoring system has been mentioned as one of the limitations of the TLL policy in Iran (Edalati *et al.*, 2020). As a result, studies have reported inaccurate nutrition labels, which raise questions about the reliability of TLL in Iran (Ghazavi *et al.*, 2020, Shirani *et al.*, 2024). Furthermore, the results of a qualitative study revealed that both the experts and the public in Iran have concerns regarding the reliability of TLL (Seyedhamzeh *et al.*, 2020). Therefore, future policies should consider a transparent and effective monitoring program for nutrition labeling in the country to ensure the reliability of the labels.

Due to the significance of climate change and the introduction of new sustainable dietary patterns, recent literature has proposed food labeling systems that account for both human health and the environment (Bunge *et al.*, 2021, Fresacher and Johnson, 2023). These food labeling systems not only consider the nutritional value of the product but also address its environmental impact by incorporating environmental indicators, with the most common being greenhouse gas emissions and water use (Bunge *et al.*, 2021). As climate change and its consequences, such as drought, pose major problems in Iran and can affect millions of lives, integrating new environmental indicators into TLL, in addition to the current items, may have a protective effect on the environment (Ebadi *et al.*, 2020).

Conclusion

Nutrition labeling has been suggested as an effective policy that impacts food behavior and purchasing decisions among individuals. Due to the high prevalence of NCDs in Iran and commitment of the Iranian government in prevention of NCDs in the last decade, policy makers implemented a mandatory TLL policy in 2016. However, due to the lack of collaboration between different stakeholders and also the fast adoption of this policy, several limitations have reduced its effectiveness including absence of sufficient educational programs, lack of accurate monitoring system, lack of evidence-based decision making, and implementation of BOP instead of FOP labeling. Despite these limitations, studies have revealed positive effects of TLL on food behavior among the Iranian population. However, large-scale and well-designed studies are needed to further assess the effectiveness of TLL in Iran. Furthermore, based on the literature, additional considerations could improve the effectiveness of nutrition labeling in Iran. These include relocating TLL to the FOP instead of the BOP, exploring the replacement of TLL with more directive labeling systems such as Nutri-Score, promoting educational programs, and implementing transparent and effective monitoring systems.

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