

Front-of-Pack Nutrition Labelling: Evidence, Controversies and Policy Priorities for Healthier Food Environments

Dr. Amit Sachdeva^{1*}, Mr Nasim Ahmed², Mrs. Tamanna Rahman³, Dr. Anju Sachdeva⁴

¹Assistant Professor, Department of Community Medicine, Indira Gandhi Medical College, Shimla, Himachal Pradesh

²Independent Researcher, Guwahati Assam, India Email: nasim@iarcon.org

³MSc in Herbal Science and Technology, Anandaram Dhekial Phookan College under Guwahati University, Assam

⁴Physiotherapist, Shimla, Himachal Pradesh

Received: Jul. 03, 2025; Revised: Aug. 11, 2025; Accepted: Aug. 29, 2025; Published: Sep. 30, 2025

Under a Creative Commons license Doi: 10.47310/medlet.2025.v02i02.013

Abstract: Front-of-pack nutrition labelling (FOPL) presents simplified nutritional information on the most visible part of packaged foods to help consumers identify healthier products and discourage excessive consumption of nutrients associated with diet-related noncommunicable diseases. FOPL systems include nutrient-specific warning labels, multiple traffic-light labels, summary scores such as Nutri-Score, endorsement logos and numerical reference-intake formats. Evidence from experimental studies, systematic reviews and early policy evaluations indicates that interpretive labels improve the identification of less healthy products and can modestly shift purchasing towards products containing less sugar, sodium, saturated fat or energy. Nutrient-specific warnings generally perform particularly well when the policy objective is to alert consumers to products high in nutrients of concern, whereas summary indicators facilitate comparisons but may conceal important nutritional disadvantages through compensatory scoring. Population health effects remain difficult to quantify because most studies measure hypothetical choices or short-term purchases rather than dietary intake and disease outcomes. FOPL may also stimulate product reformulation, although reformulation can be strategically directed towards thresholds without improving overall food quality. In India, the Food Safety and Standards Authority of India proposed the Indian Nutrition Rating, a star-based summary label, in 2022; however, a comprehensive mandatory FOPL system has not yet been incorporated into the currently operative national labelling framework. Indian consumer research indicates that warning labels are more effective than several alternative formats in helping adults identify foods high in sugar, sodium and saturated fat. India requires a mandatory, government-led and independently evaluated system based on a transparent nutrient-profile model, prominent warnings, restrictions on contradictory health claims and safeguards against commercial interference. FOPL should be implemented as part of a broader food-policy package rather than as a stand-alone solution.

Keywords: front-of-pack labelling; nutrition labelling; warning labels; high-fat, sugar and salt foods; food policy; India.

INTRODUCTION

Unhealthy diets are major contributors to obesity, type 2 diabetes, cardiovascular disease, several cancers and premature mortality. Contemporary food environments make healthy choices difficult by ensuring that inexpensive, intensively marketed and highly palatable packaged foods are continuously available. Consumers are expected to make rapid decisions among products carrying ingredient lists, nutrient declarations, advertisements, health claims and promotional imagery. Conventional nutrition panels are usually positioned on the back or side of packages and require time, literacy and numerical interpretation. Front-of-pack nutrition labelling was developed to make the most decision-relevant nutritional information immediately visible.

The World Health Organization regards FOPL as an important policy instrument for promoting healthier food choices. It defines FOPL as simplified nutritional information displayed on the principal field of vision of a food package, complementing rather than replacing the detailed nutrient declaration.[1] WHO guidance emphasizes that development, implementation, monitoring and evaluation should be led by governments and adapted to national dietary priorities and consumer understanding.

FOPL has expanded from voluntary industry-led schemes to mandatory interpretive labels in several countries. Chile, Mexico, Argentina, Peru, Uruguay and Israel have adopted nutrient-warning approaches, while France and several European countries use Nutri-Score. The United Kingdom applies multiple traffic-light labelling, Nordic countries use the Keyhole endorsement symbol, and Australia and New Zealand use the Health Star Rating. Canada introduced mandatory front-of-package symbols for products meeting defined thresholds for sodium, sugars or saturated fat, with implementation requirements taking effect after the transition period.[2]

This diversity reflects both different policy objectives and unresolved scientific debates. A label may be designed to identify healthier products, warn against unhealthy ones, encourage comparison within a category or stimulate reformulation. No design performs all these functions equally well. The choice of label should therefore follow a clearly defined public health purpose rather than visual preference or political compromise.

Major FOPL Models

FOPL systems can be grouped into non-interpretive and interpretive formats.

Non-interpretive labels reproduce numerical information, such as energy, grams of nutrients or percentages of reference intake. Although factually detailed, they require consumers to understand serving sizes, recommended intakes and whether a displayed number is high or low. Their effects are generally weaker under time pressure or among people with limited nutrition literacy.

Interpretive labels add an evaluative element. Nutrient-specific traffic-light labels classify individual nutrients using colours, commonly green, amber and red. Warning labels display a prominent symbol or statement when a product exceeds thresholds for sugar, sodium, saturated fat, total fat or energy. Summary indicators combine positive and negative attributes into an overall grade, colour, score or star rating. Endorsement logos appear only on products meeting defined healthier-product criteria.

Nutrient-specific warning labels answer a direct question: does this product contain excessive amounts of a nutrient of concern? They are simple and difficult to misinterpret but provide limited differentiation among products carrying the same warnings. Summary scores support product comparison and allow ranking across a continuum. However, aggregation may permit favourable ingredients or added nutrients to compensate for high sugar, sodium or saturated fat, creating a “health halo.” The algorithm and product categories therefore determine whether the final rating reflects public health priorities.

How FOPL May Influence Behaviour

FOPL operates through several pathways. The first is **attention**. Prominent symbols are more likely to be noticed than back-of-pack panels. The second is **comprehension**, through which complex nutrient data are converted into an easily interpreted judgement. The third is **risk perception**: warnings can increase recognition that frequent consumption of a product may be harmful. The fourth is **choice**, as consumers compare alternatives or decide not to purchase a product. A fifth pathway operates through producers, who may reformulate products to avoid an unfavourable label.

These mechanisms are influenced by visual salience, colour, size, wording, package placement, familiarity and the time available for decision-making. Food choices are also shaped by price, taste, habit, availability, advertising and household preferences. FOPL can improve information but cannot remove these structural influences.

Warning labels may work partly because they communicate an unambiguous negative evaluation. Summary labels require more interpretation but may be useful when consumers wish to compare products. Endorsement symbols identify healthier options but provide no warning on products that do not qualify. Their absence can also be overlooked, particularly when packages contain attractive nutrition or wellness claims.

Evidence on Consumer Understanding and Food Choice

Systematic reviews consistently show that interpretive labels outperform no label and generally outperform purely numerical formats in directing attention and improving nutritional understanding. A systematic review and meta-analysis by Croker and colleagues concluded that FOPL encouraged healthier purchasing in experimental and real-world studies, although effects were heterogeneous and the evidence base contained relatively few long-term evaluations.[3]

A 2023 systematic review of randomized and quasi-experimental studies found that different FOPL systems could improve identification of healthier products and influence purchasing, but effects differed by format, population and outcome.[4] Labels tended to have clearer effects on product selection than on objectively measured consumption, partly because consumption studies are more difficult and expensive. The most comprehensive recent synthesis concluded that FOPL can support healthier purchasing and encourage reformulation, while emphasizing that the certainty of evidence varies across outcomes.[5] Warning labels and interpretive colour-coded systems generally improve understanding, whereas evidence on sustained dietary intake, body weight and disease outcomes remains less developed.

Experimental studies of nutrient warnings show a relatively consistent sequence of effects: increased attention, improved recognition of products high in nutrients of concern, less favourable healthfulness perceptions and reduced purchase intentions.[6] Nevertheless, intention is not equivalent to behaviour. A participant selecting between products in an online experiment does not face the same price, brand loyalty, family demand or taste preferences encountered in a supermarket.

Real-world purchasing studies are therefore particularly important. Evidence from jurisdictions introducing mandatory warnings suggests reductions in purchases of selected unhealthy products and changes in product formulation. However, before-and-after evaluations can be affected by concurrent policies, economic changes, publicity and industry adaptation. Stronger interrupted time-series and controlled comparative designs are needed.

Indian Evidence and Consumer Testing

India faces a rapid nutrition transition characterized by the coexistence of undernutrition, micronutrient deficiencies, overweight, diabetes and cardiovascular disease. Packaged foods and sugar-sweetened beverages are increasingly available across urban and rural markets, while labels compete with brand imagery and claims such as “high fibre,” “multigrain,” “natural” or “immunity supporting.”

A randomized experiment involving adults in six Indian states compared warning labels, traffic lights, guideline daily amounts, Nutri-Score and a health-star rating. All interpretive formats improved some aspects of understanding compared with a control label, but nutrient-specific warnings performed best in helping participants identify products high in nutrients of concern and reduced purchase intentions most consistently.[7] This evidence is especially relevant because it was generated among Indian consumers rather than extrapolated from high-income countries.

Indian consumers vary substantially in literacy, language, food practices and familiarity with numerical nutrition information. A successful label should therefore require minimal calculation, remain understandable at a glance and work despite small package sizes. Symbols and concise text may need to be supported by public education, but the label should not depend on an extensive education campaign to become intelligible.

Table 1. Comparison of principal front-of-pack nutrition-labelling systems

FOPL model	Typical presentation	Main public health strength	Principal limitation	Evidence-informed use
Nutrient-specific warning label	Prominent symbol stating “high in” sugar, sodium, saturated fat or another nutrient	Rapidly identifies products containing excessive nutrients; strong effect on risk perception	Provides limited ranking among products carrying identical warnings	Most suitable when the primary objective is to discourage high-fat, sugar and salt products
Multiple traffic-light label	Green, amber or red coding for individual nutrients	Displays both favourable and unfavourable nutrient levels; supports comparison	Several colours may compete for attention and permit selective focus on green indicators	Useful for consumers comparing nutrient profiles within categories
Summary score or grade	Overall letter, colour, number or star rating	Simple overall comparison across products	Positive attributes may offset excessive nutrients; underlying algorithm may be poorly understood	Appropriate only with a transparent, validated and independently governed nutrient-profile model
Positive endorsement logo	Symbol displayed on products meeting healthier criteria	Quickly identifies recommended options	Absence is less salient than a warning and may not discourage unhealthy products	Useful as a complementary healthier-choice scheme, not as the sole FOPL
Reference-intake format	Grams and percentage of daily intake per serving	Provides quantitative information	Requires numeracy; serving sizes can be manipulated; weak interpretive guidance	Better suited as supplementary information than the principal public health label
Hybrid system	Nutrient warnings combined with selected positive guidance	Can communicate both excessive nutrients and healthier attributes	More complex design and risk of contradictory signals	Requires rigorous consumer testing and rules preventing positive claims from neutralizing warnings

Product Reformulation and Industry Response

FOPL can influence the food supply even when consumers do not consciously use the label. Manufacturers may reduce sodium, sugar or saturated fat to avoid warnings or improve scores. Reformulation is potentially one of the policy’s most important population-wide effects because it benefits consumers regardless of label literacy.

However, reformulation is not automatically beneficial. A company may reduce one nutrient just below a regulatory threshold while leaving the overall product nutritionally poor. Sugar may be replaced by non-sugar sweeteners, saturated fat by refined starch or sodium reduced only in selected products. Summary-score systems can encourage the addition of fibre, protein or micronutrients to offset high levels of nutrients of concern without meaningfully reducing the degree of processing.

Nutrient-profile models must therefore be protected against gaming. Thresholds should be based on foods as sold, use standardized reference quantities and minimize reliance on manufacturer-defined

serving sizes. Independent monitoring should assess changes in the entire product composition rather than only movement across label categories.

FOPL may also affect marketing. Prominent warnings can counteract misleading package imagery and health claims, but companies may respond by emphasizing positive attributes more aggressively. Regulations should prevent a product carrying multiple warnings from simultaneously making prominent claims likely to create a contradictory impression of healthfulness.

Public Health Significance

FOPL is attractive because it can reach consumers repeatedly at the point of purchase without requiring individual clinical contact. It may be especially useful where shopping decisions are rapid and back-of-pack information is rarely consulted. Because the policy applies across the market, it can affect both consumer demand and manufacturer behaviour.

Its benefits may extend beyond individual choice. A clear government-endorsed label can establish a social norm that foods high in sugar, sodium or saturated fat are not suitable for unrestricted consumption. It can support school food standards, procurement policies, taxation, advertising restrictions and public education by creating a consistent definition of less healthy products.

Equity effects require careful assessment. Interpretive labels may reduce disparities in understanding because they demand less numerical literacy. At the same time, low-income households may be unable to choose healthier alternatives when these are unaffordable or unavailable. FOPL should therefore be paired with policies improving access to minimally processed foods, fruit, vegetables, pulses and other healthier staples.

FOPL also applies only to packaged products. It does not address unhealthy restaurant meals, street foods or home-prepared diets high in salt, sugar or fat. Nor does it distinguish every dimension of food quality. A label cannot replace dietary guidance emphasizing dietary patterns, diversity and degree of processing.

Global Policy Developments

By the middle of 2025, at least 40 countries had adopted some form of FOPL, ranging from voluntary endorsement schemes to mandatory nutrient warnings and overall scoring systems.[8] The 2021 Codex guidelines recognized the legitimacy of mandatory, government-led FOPL while allowing countries to select systems appropriate to their populations.

Canada's mandatory symbols identify foods high in sodium, sugars or saturated fat. The United States Food and Drug Administration proposed a mandatory front-of-package "Nutrition Info" box in 2025 displaying whether saturated fat, sodium and added sugars are low, medium or high.[9] These developments indicate continued movement towards interpretive information in countries that traditionally relied on detailed nutrient panels.

International experience also demonstrates substantial commercial opposition. Common strategies include promoting voluntary alternatives, questioning nutrient thresholds, emphasizing physical activity over food composition, seeking prolonged implementation periods and raising trade or legal objections. Governance should therefore separate scientific consultation from commercial decision-making and require disclosure of conflicts of interest.

India's Regulatory Position

India's Food Safety and Standards (Labelling and Display) Regulations, 2020 require nutrient declarations and other mandatory package information. In 2022, the Food Safety and Standards Authority of India proposed an amendment introducing the **Indian Nutrition Rating**, which would assign packaged foods from one-half star to five stars using an algorithm incorporating energy, saturated fat, total sugar and sodium alongside selected positive components.[10] More stars would indicate a more favourable overall rating.

The Indian Nutrition Rating remains a draft proposal rather than a comprehensively implemented mandatory national FOPL scheme in the current consolidated labelling regulations. This prolonged policy process has generated debate over whether a summary star rating sufficiently warns consumers about products high in individual nutrients.

The central concern is that consumers may interpret even one or two stars as an endorsement, while favourable components could partially compensate for high sugar, salt or saturated fat. The strongest Indian experimental evidence instead supports direct nutrient warnings.[7] A policy decision should therefore be grounded in independently conducted consumer research, public health objectives and transparent modelling rather than preference for a commercially acceptable compromise.

India should also establish explicit rules for small packages, online food retail, imported products and products marketed to children. On digital shopping platforms, the label should be visible before purchase rather than only on an image of the back of the package.

Recent Advances

Recent FOPL research increasingly examines eye tracking, online supermarkets, household purchasing data and reformulation rather than relying solely on questionnaires. Eye-tracking studies help determine whether consumers actually notice a symbol, while simulated supermarkets reproduce price and product-comparison conditions more realistically.

Digital grocery platforms create both opportunities and risks. FOPL can be displayed beside every product, enlarged on demand and incorporated into filters. Conversely, online retailers may rank sponsored products, omit label images or display health claims more prominently than mandatory warnings. Regulation should require equivalent label visibility in physical and digital retail environments. Another advance is linking nutrient-profile models with food-composition databases to model effects on dietary intake and disease. Such modelling can estimate potential long-term benefits, but results depend heavily on assumptions about purchasing shifts, substitution and reformulation. They should inform policy without being presented as observed health effects.

There is also growing debate over whether nutrient-based FOPL should incorporate the degree of food processing. Nutrient composition and processing are related but not identical concepts. A product may achieve a favourable nutrient score while remaining ultra-processed. Combining these dimensions may improve public health relevance but risks creating an overly complex label. The immediate priority is a clear and scientifically defensible system, while algorithms should remain open to revision as evidence develops.

Challenges and Limitations

The most important evidence gap is the scarcity of long-term evaluations linking FOPL to actual dietary intake, obesity, diabetes or cardiovascular outcomes. Such effects are difficult to isolate because disease develops over years and multiple policies operate simultaneously.

Published studies use different labels, nutrient-profile models, products and outcomes. Many are conducted online or among convenience samples. Participants know they are taking part in nutrition research, which may exaggerate attention to labels. Real-world effects are likely to be smaller than effects on hypothetical choices.

Industry funding and conflicts of interest can affect study design and interpretation. Research on Nutri-Score has demonstrated a strong association between declared conflicts of interest and unfavourable study conclusions, illustrating the need to assess funding and author affiliations when reviewing evidence.[11]

No label eliminates the need for nutrition education. Consumers may misunderstand whether warnings apply per serving or per 100 g, assume that products without warnings are inherently healthy or compensate by consuming larger quantities. Monitoring should examine unintended consequences as well as benefits.

Future Directions and Policy Priorities

India should adopt a mandatory, interpretive and prominently displayed FOPL based on a nutrient-profile model developed and governed independently of commercial interests. The policy should prioritize nutrients strongly linked to diet-related disease, particularly added or total sugars as appropriate to the model, sodium and saturated fat.

Before national implementation, the design should undergo transparent testing across regions, languages, literacy levels, age groups and socioeconomic categories. Testing should assess objective understanding and purchasing, not merely consumer preference. A label that people say they like may not be the one that best identifies unhealthy foods.

Implementation should include:

- a fixed transition period without indefinite delay;
- mandatory visibility on physical and online products;
- restrictions on health and nutrition claims on products carrying warnings;
- public access to the nutrient-profile algorithm and product database;
- independent compliance monitoring and meaningful penalties;
- periodic review of thresholds and exemptions;
- evaluation of reformulation, purchases, dietary intake and equity.

FOPL should be linked with restrictions on marketing unhealthy foods to children, healthier school and institutional procurement, fiscal policies, limits on misleading claims and measures improving affordability of healthy foods. A label provides information; a comprehensive food policy changes the environment in which that information is used.

CONCLUSION

Front-of-pack nutrition labelling is a practical population-level measure for translating complex nutrient information into visible guidance at the point of purchase. The evidence is strongest for improved attention, understanding and identification of less healthy products, with modest but meaningful effects on purchasing and product reformulation. Evidence for long-term dietary and clinical outcomes remains limited, reflecting the difficulty of evaluating a policy operating within a complex food system.

Label design matters. Numerical formats place excessive interpretive demands on consumers, while summary ratings can conceal high levels of individual nutrients through compensatory scoring. Nutrient-specific warning labels provide the clearest signal when the public health objective is to identify products high in sugar, sodium or saturated fat. Indian experimental evidence supports this approach.

India's pending FOPL policy presents an important opportunity. A weak, voluntary or ambiguous label could create an appearance of action without substantially improving consumer understanding. A mandatory, government-led warning system, supported by transparent nutrient profiling, strong enforcement and independent evaluation, would better align with the country's growing burden of diet-related disease.

FOPL should not be promoted as a complete solution to unhealthy diets. Its value lies in functioning as one visible component of a wider strategy addressing food formulation, marketing, pricing, procurement and availability. Properly designed and protected from commercial interference, FOPL can strengthen consumers' right to understandable information while helping reshape the food supply towards better population health.

REFERENCES

1. World Health Organization. *Guiding principles and framework manual for front-of-pack labelling for promoting healthy diets* [Internet]. Geneva: World Health Organization; 2019 [cited 2026 Aug 6]. Available from: <https://www.who.int/publications/m/item/guidingprinciples-labelling-promoting-healthydiet>

2. Health Canada. *Front-of-package nutrition symbol labelling guide for industry* [Internet]. Ottawa (ON): Health Canada; 2023 [cited 2026 Aug 6]. Available from: <https://www.canada.ca/en/health-canada/services/food-nutrition/legislation-guidelines/guidance-documents/front-package-nutrition-symbol-labelling-industry.html>
3. Croker H, Packer J, Russell SJ, Stansfield C, Viner RM. Front of pack nutritional labelling schemes: a systematic review and meta-analysis of recent evidence relating to objectively measured consumption and purchasing. *J Hum Nutr Diet*. 2020;33(4):518-537. doi:10.1111/jhn.12758.
4. White-Barrow V, Gomes FS, Eyre S, Jones A, Thow AM. Effects of front-of-package nutrition labelling systems on understanding and purchase intention in adults: a systematic review. *BMJ Open*. 2023;13(4):e065620. doi:10.1136/bmjopen-2022-065620.
5. Kelly B, Ng SH, Carrad A, Pettigrew S. The potential effectiveness of front-of-pack nutrition labeling for improving population diets. *Annu Rev Nutr*. 2024;44:405-440. doi:10.1146/annurev-nutr-011224-030917.
6. Taillie LS, Hall MG, Popkin BM, Ng SW, Murukutla N. Experimental studies of front-of-package nutrient warning labels on sugar-sweetened beverages and ultra-processed foods: a scoping review. *Nutrients*. 2020;12(2):569. doi:10.3390/nu12020569.
7. Singh SK, Taillie LS, Gupta A, Bercholz M, Popkin B, Murukutla N. Front-of-package labels on unhealthy packaged foods in India: evidence from a randomized field experiment. *Nutrients*. 2022;14(15):3128. doi:10.3390/nu14153128.
8. Jones A, Neal B, Reeve B, Ni Mhurchu C, Thow AM. Front-of-pack nutrition labelling to promote healthier diets: current practice and opportunities to strengthen regulation worldwide. *BMJ Glob Health*. 2019;4(6):e001882. doi:10.1136/bmjgh-2019-001882.
9. US Food and Drug Administration. *Food labeling: front-of-package nutrition information* [Internet]. Silver Spring (MD): US Food and Drug Administration; 2025 [cited 2026 Aug 6]. Available from: <https://www.fda.gov/food/food-labeling-nutrition>
10. Food Safety and Standards Authority of India. *Draft Food Safety and Standards (Labelling and Display) Amendment Regulations, 2022* [Internet]. New Delhi: Food Safety and Standards Authority of India; 2022 [cited 2026 Aug 6]. Available from: <https://www.fssai.gov.in/>