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Impact of an education intervention on consumer understanding and usage of food labels: A Systematic Review

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Prepackaged food labels or sign labels are broadly discussed as a way to aid consumers in making known and healthy food choices. Hopefully, more conscious food choices result in a healthier diet overall. Limited evidence is available on which format of a label is best for consumers to understand, which aids them better distinguish between healthier foods and less healthy foods, and these changes in perceived health lead to changes in food selection. This study aimed to determine how educational programs would enhance the understanding and usage of nutrition labels. A total of 10 studies were selected for review, were based on 2 cross-sectional, 3 cohorts, and 5 randomized studies. Database searches like Pubmed, Embase, Biomed central, Medline, CrossRef were used to explore information from 2015-2020. Participants included school-going children, adults to intervene in the understanding and usage of food labels. The research showed that apart from health-related claims, using food labels is associated with healthier diets and should continue to be promoted through policies and education programs. The prospect of nutrition labels to impact people's health and make healthy food choices depends on the consumer's ability to understand and use nutrition labels. People ability to make healthy food choices is directly dependent on people ability to understand and use food labels. Label users also tend to report more healthful dietary practices than non-users. The purpose of this study to examine the understanding and use of nutrition labeling among consumers.

Keywords: Nutrition Label, Food Packaging, Nutrition Knowledge, Food Labels, Education Intervention

INTRODUCTION

Nutrition labels exhibit in order to healthy food choices and nutrient content of the drink and food products. Food labels also improve the dietary health of consumers (Moore et al. 2018). Food labelling is increasingly considered a fundamental element of a broad approach to engaging in unhealthy and related chronic diseases. Nutrition labels are staring as a potential instrument to allow patrons and to assist healthy food choices.

Different studies suggest that with the intention of nutrition labelling would be coupled with a healthy nutritional regime and be a gainful intrusion (Cecchini & Warin, 2016). Food labels usually have in the sequence of calories, serving size, amounts, and DV (Daily Value) of numerous micronutrients, vitamins, macronutrients, and minerals (carbohydrate, calcium, fats). In the content of the Nutrition Facts Panel (NFP)

government, serving size, calories, nutrients, and percentage of daily values must be included keeping rapidly in the US. Food healthfulness of consumer's evaluation can contribute to important nutrition information containing an ingredient list and non-nutrition information. The primary purpose of the ingredients list explained that a food or beverage contains solid fat, added sugar, synthetic trans-fats, whole grains, refined grains, and describes ingredients weight within foodstuff in descending order. Food labels could be a cost-effective technique to communicate with consumers about nutrition information (Miller & Cassady, 2015). Different age set, sex, and instructive achievement altitude has been contrasted to across understanding of nutrition label information. The capability to understand and use information is dependent on nutrition labels to contact the inhabitants' health (Faulkner et al. 2016). Despite this diverse distinction, the stipulations "serving size" as well as "portion size" be habitually used compatible, which can go ahead patrons to consider that customers signify the same thing. Originally intended to guide food selection and portion sizes, the misunderstanding has led to confusion related to serving sizes on labels. Serving size accuracy is associated with nutrition knowledge, higher numeracy, and self-reported food label use and superior by providing information, even different affiliations in per serving and per package were incompatible (Faulkner et al. 2016).

Understanding of consumers about food labels

The study showed the factors that may influence consumers' thoughts related to food labels. The studies showed that diet and health related concerns, diet status, importance of product attributes like ease of preparation and nutrition, gender, income, race, and body mass index are valuable factors affecting consumers' attitudes and thoughts related to using food labels. Knowing the type of consumers who have these thoughts and beliefs, as well as the factors that influence these beliefs and perceptions is critical for making effective nutrition education campaigns and marketing (Miller et al. 2017). Congress intended that the NLEA (Nutrition Labeling and Education Act) include a public education component. As the law's topic shows, the overall benefit of educational efforts since 1993 has been limited, despite showing that consumers are more interested in these programs. Comparing with previous reports, we

found that most consumers do not understand the Serving Size information on labels. Efforts aimed at increasing understanding of the Serving Size information and consumer use are warranted (Haldeman et al. 2000). Another study describes how consumers use food labels in the United States. Survey respondents reported equal or more consideration of nutrition-label information for dietary choices than for shopping decisions in 2008 compared with prior survey years. Relying on the cluster analysis results from the Health and Diet Survey, eight nutrition label questions are divided into two categories of label usage: dietary decisions or shopping purposes. Female consumers, well-educated consumers aged 50 to 59, frequent label users, or consumers with any health issues were more likely to use food labels than others (Zhang et al. 2017). The former studies have also shown that food labelling is a good communication channel between consumers without face-to-face interaction and food processing companies. Food label understanding shows a vital role in examining good or healthy food among the showcased food products on the retail store's shelf (Tonkin et al. 2015).

Uses of Food Labels

Nutrition label use is related to three types of nutrition label information midway to convey nutrition and health information; ingredient lists, nutrition labels, and claims. Generally, nutrition label use studies mainly pay attention to nutrition labels; although, ingredient lists and health/nutrient profess also play essential roles in conveying the products' diet and health information to people and, for this purpose, are regulated in the United States by the Food and Drug Administration (FDA) (Tonkin et al. 2015).

Food Laws and Nutrition Intervention

Choose merchandise with a little or a variety of nutrients that might be a hobby to the consumer. Here, meal labels can help evaluate and pick merchandise greater without problems recognizing what ingredients; there has been no consistency with inside the effects of studies performed concerning the determinants of label use. However, a few indicated that they were making sure of their expertise in the facts provided. Other difficulties skilled with the aid of using purchasers while the use of vitamin labels covered the font length of the vitamin facts and the terminology used with inside the ingredients' list (Miller & Cassady, 2015). The vitamin facts on meal labels are an important supply of vitamin

facts; however, it is typically underutilized to use purchasers. Some research investigated know-how results at the utilization of aspect lists and claims compared to vitamin statistics labels (Duran et al. 2019). We also discovered an overreliance on comfort samples counting on more youthful adults, proscripting our expertise of how know-how helps meals label use later. Nutrition labels on the buying factor are endorsed to enhance meals desire, but meals desire does now no longer constantly translate into meal consumption. It is essential to recognize the connection between label use, meal selection, servings, and consumption (Miller & Cassady, 2015). Many human beings are privy to the meals label and studying it; the primary trouble is that they choose primarily based totally on the vitamin label. It is important to recognize the effect of vitamin labels on purchasers' buy selections. The diploma of vitamin label utilization is much less than the diploma of expertise of vitamin labels (Tonkin et al. 2015). Reviews on customer usage and comprehension on diet labels have repeatedly identified a lack of awareness as a significant obstacle to applying this information. Specific comprehension challenges involve the market perception of quantitative information and the interpretation of right serving sizes and quantities and the suggested proportion of regular requirements (percent DVs) (Xazela et al. 2019). However, much less are inclined to use percent information or serving length records to degree the regular diet contribution (Christoph & Ellison, 2017) As a result, the study emphasis was centered on how improvements in the structure of nutrition information may affect customer perception, including new Front pack labelling schemes. Public policy programs and Legislation have proposed improvements to the product label format to increase the comprehensibility of dietary facts and nutrition information to make healthier decisions simpler for customers (Miller & Cassady, 2015).

Education to encourage nutrient labelling usage is provided in the U.S. Nutritional Label and Health Act and the European Regulations on Food Information for Consumers (Philipson, 2018). The law made nutrient labelling compulsory for food items. Modelled estimates of the effect of having this necessary nutritional info should demonstrate the ability to lower the rate of overweight in Europe as far as 2.5 percent (Pelletier et al. 2004). given that customers are presented with informative details about how to interpret labels. A slight change in well-being is

expected with food label education as part of personal counselling by a mixture of dieticians and physicians. However, through a regulatory and scientific viewpoint, there is a substantial opportunity for education to improve diet labelling effectiveness in promoting well-being (Roberto & Khandpur, 2014).

Consumer education improves labelling awareness derived from studies documenting the inconsistent and negative effect of merely putting nutrition labels on food items. For example, the analysis findings indicated a lack of effect on the actual purchasing actions of the diet labelling or health details shown on the time of purchasing (Buttriss, 2018) Also, an analysis of 9 studies exploring the effect of compulsory and different nutrition labelling on the pack's front side shows that this type of label has shown outcomes in many people choosing healthy products in experimental or reality-based trials. Moreover, a 3.5 percent decrease in calorie intake (Dumoitier et al. 2019). The degree to which education may maximize the usage of nutrition labelling is not yet precise. However, evolving research suggests that showing informative signs in-store can increase consumers' knowledge and usage towards healthy food choices (Van't Riet, 2013).

This research aimed at how consumer awareness can improve the efficacy of nutrition label knowledge. No study has yet explored the effect that instructional programs can have on customers' awareness and usage of diet labeling. The purpose of this study is to explain the impact of these interventions on the usage and interpretation of nutrition labels. It also seeks to include a literature analysis of these services' implementation aspects to provide future study and intervention evaluation.

MATERIALS AND METHODS

Google Scholar, Pub Med, Embase, Semantic Scholar, Biomed Central, Science Direct, Crossref, Medline, Psych Info online databases were used to explore the information published from 2015 to 2020. The age group in these studies was based on school-going children and adults. We collect data on research year, study design, and a significant focus on educational programs to intervene with the consumers about understanding and using food labels. The Preferred Reporting Items conducted this study for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for Systematic Reviews.

Search Strategy and Study Selection

To achieve this aim, we have researched, reviewed articles and reports published during the past five years Google Scholar, Pub Med, Embase, Semantic Scholar, Biomed Central, Science Direct, Crossref, Medline, Psych Info were used. There were two steps to the search strategy. The first was a preliminary search in databases using keywords and then evaluating the additional keywords to summarize the papers and titles and abstracts. The second point was to use both keywords and index terms across all studies sources to scan for researches conducted between 2015 and April 2020. The searching was done constraints of the English language. Then we collected data on the research year, study design, and the primary outcome of education programs on understanding and usage of food labels. Different research database was intended to evaluate interventions that provided nutrition label education with results that measured or used understanding aspects. The selected researches have been outlined, and non-reproducible researches were excluded. The collected obtained were shown in Table 1.

Inclusion Criteria

Inclusion criteria included studies examining whether consumers observed nutrition labels and their awareness, behaviors, expectations, understanding, desire to use, or how they utilized nutrition labelling. Articles representing various study designs, procedures, and outcome measures were selected for inclusion.

A preliminary screening of the topic and abstract was completed to confirm that incorporated articles reflected the study's scope and necessities. Inclusion criteria included researches examining whether participants viewed food labels and their awareness, behaviors, expectations, understanding or desire to use, or how they utilized nutrition labelling.

Data regarding each of the systematic review questions' fundamentals were taken out from the study and assembled in qualitative tables. Articles exposure awareness, consumers' expectations, study design, process, reflected on for inclusion.

Exclusion Criteria

An exclusion criterion includes the studies that have not adequately examined the usage and understanding of food labels through education programs, and complete text could not be accessed. The studies other than earlier than 2015 were excluded. No findings on the usage or

interpretation of diet labels, no research was omitted on the criteria of their geographical position, labelling type, target population, or study design. Twenty studies or papers were composed to assess the "impact of an education intervention on understanding and using food labels." From these twenty studies that meet the inclusion criteria, ten studies were based on the impact of understanding and the use of food labels. These studies are defined on the bases of outcome measures and explanations of nutrition label knowledge.

Data Collection

The following details were derived from each study: Name of author, publication date, sample size, characteristics, research design, study setting, impact, and outcomes regarding usage and understanding of food labels.

Data Analysis

For the proper analysis of results, abstracts were screened for articles in English reporting interventions that included nutrition label education or as a component of a more multi-component program. They evaluated outcomes that specifically included use or understanding of nutrition label information. Nutrition label education or a more comprehensive educational intervention and measured results explicitly involved the usage or interpretation of nutrition label knowledge. Data concerning each of the elements of the systematic review question was extracted from the study and collated in qualitative tables.

Data Extraction

An initial title and abstract screen were performed to ensure papers included represented the requirements, nature, and purpose of the study. This contained all English abstracts' full-text. If a title and description could not be dismissed, the paper was received for further review when it was unnecessary to refuse a title and summary. The full text of the paper was collected for further review. Resource limitations ensured that each reviewer reviewed their batch of tests, and no cross-checking was done between reviewers. Information from each research included was obtained using a standard method for collecting details.

Reference terms and techniques have been established using keywords from prior research and database-specific topic headings to classify research investigating the effect of food label

education programs on customer usage and its results and awareness. The search words were merged using three components of the research issue (for example, "nutrition label information" or

"nutrition facts panel" and "educational program" or "education initiative" and "understanding" or "application" or "knowledge").

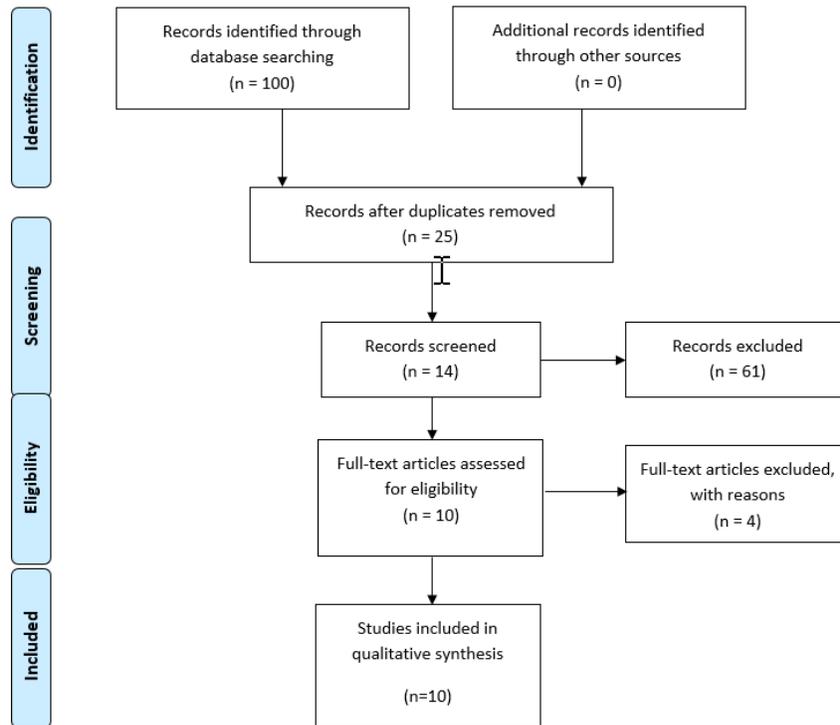


Figure 1: PRIMA flowcharts for study selection

In line with the study goals, the details collected from the studies provided the characteristics of the individual and intervention method, as well as the definition and effect of the outcome measures on the usage and interpretation of nutrition label knowledge.

Procedure for study Selection

The details of the research selection process, the number of papers received, and omitted at each point are seen in Figure 1. Of the 100 articles retrieved, 25 were excluded as duplicated, 61 were excluded as having no access to full text to the manuscript, most notably, because the articles studied usage and knowledge of food labels were only included. Four papers were also omitted if their study topic was irrelevant or did not report any relevant information. Ten papers are selected for recent data selection.

RESULTS AND DISCUSSION

There were 20 studies that evaluated the impact of their interventions on nutrition label "use" and "understanding" of labels. Of the 20 papers that met the inclusion criteria, 10 papers (50%) were identified that reported consumer understanding or use of nutrition labeling. These studies can improve the impact of information on dietary health by education to enhance the inclusive use of nutrition labels. The literature reviewed here fairly systematically shows that data is expounded to; however, well, shoppers are ready to use food labels. In eighteen studies, knowledgeable shoppers were a lot of probably to grasp nutrition labels higher than those with lower levels of information. Some of the findings, however, measure complicated behaviors.

Table 1: Summary of researches explaining the findings of "use" and "understanding" of food labels

Author & Year	Sample Size & characteristics	Study design	Study setting, duration	Nutrition label Usage Outcomes/ finding	Nutrition label Usage Impact	Nutrition label Understanding Outcomes/ findings	Nutrition label Understanding Impact
Nieto <i>et al.</i> , 2017	N=7159	Cross Sectional survey	N/A	Understanding and using the guideline daily amount (GDA) was similar to that of the Nutrition fact table (NFT).	Consumers Used GDAs less often than NFTs.	Whites describe the highest level of understanding of the nutrition labels about 95% understanding of white 34% in Latinos and Mexicans.	This study established that understanding and using the GDA was similar to that of the NFT, indicating that this labelling system may not give people much additional guidance to make healthy food choices.
Grunert <i>et al.</i> , 2019	N=921	questionnaires	N/A	Investigating usage and understanding of nutrition information on food labels.	27% of consumers were found to have looked at provided information on food labels.	The understanding was high, with up to 87.5% of respondents identifying the healthiest product in a set of three.	Regression analysis showed that the use of food labels related to interest in healthy eating, whereas understanding about nutrition information is related to nutrition knowledge.
Treu <i>et al.</i> , (2017)	School children in grade 3	Quasi-experimental 3 group design	School Range 8.7 yrs females	NP	NP	Label Nutrition Knowledge and food literacy experiment to assess knowledge of wholesome food choices.	Both groups increased label nutrition knowledge, and food literacy keeps count the students to baseline standards. No significant improvement has occurred.
Gavaravara pu <i>et al.</i> , 2016	N= 175 12-15 yr females	pre- post-intervention questionnaires	School and four sessions of 45 minutes	Evaluation of nutrition labels with five quizzing (self-assessment) "Do you read the sugar content when buying chocolate?"	The improvement was shown in one question that is related to the intervention of salt in snacks among comparison	Nutrition label knowledge was assessed by using nutrition information present on labels.	Compared to the control group, significant improvement should be given(p<0.05)

					groups ($p < 0.05$),		
Talati <i>et al.</i> , 2016	Adults N= 927	Cohort comprising 54% of FOOD centers	Community-based 1-2 hrs	Self-reported reading of nutrition information panel	At six week, it can significantly increase ($p, 0.05$)	Knowledge of food labels interprets by using three questions on the nutrition label of any one item.	Socioeconomic status has no significant differences. In this post-session survey, the response of the correct survey was in high proportion.
Zafar <i>et al.</i> , 2017	sample size : 365	Questionnaire method	systematic random sampling technique	This study shows the overall friendliness on packaged food product during purchasing	Research workers used personality traits to examine which personality traits strongly affect stable relations between packaged food consumption intention and friendly food labels.	-	-
Tórtora <i>et al.</i> , 2019	Sample size: 200 volunteers	Cross-sectional survey	N/A	Only 5 % of the total population have enough knowledge about reading food labels	People involving in the research were asked either the food labels information was useful or accurate. The majority (50 %) of the participants shows neutral answers, 15 % agreed that the nutrition information was useful.	These participants had a low level of knowledge about nutrition information mentioned on the food label.	Only 19% of the participators agreed about the information on the food label was important. This study also elaborates that ninety percent of the participants do not buy food products without reading food labels.
Harrington <i>et al.</i> , 2019	129 papers on nutritional food labelling	Cross-sectional study	Community setting in four years	We found that food labels usage is much higher but still needs more comprehensive measurements that propose that the nutritional panel's real usage while purchasing food is a bit low.	Present evidence shows that purchasers who see the food label while purchasing can understand it but are still confused by some of the terms used in it.	The Potential to interpret the nutrients label, as it should be, reduces because the complexity of the project increases.	Whether or now no longer purchasers can recognize and use nutrients labelling relies upon the reason for the project.

Moore <i>et al.</i> , 2018	Young adolescents Age 11 to 14 yrs. Female 47 %	A prospective cohort study.	Study participants include Children (school going), Adults (older), and diabetic patients.	Final results measurement was diversified; each study that is reported presents a statistical improvement in public knowledge outcomes or usage of food labelling.	NP	Pre posttests developed by the author assessed nutrition Facts Label knowledge.	Inclusive test results improve significantly. 38 to 74 %, gives the right answers to queries related to the nutrition label No discrimination in male or female scores
Talagala <i>et al.</i> , 2016	Young adults. 76% female. (n = 927)	Cohort comprising 54% of the FOOD centers, includes different program durations. Pre-post survey and six-week online follow-up (n = 97)	Community base. Session of 1 to 2 hours and can go up to eight sessions.	Considering and understanding of the nutritional food info panel.	Greatly higher after six weeks of sessions.	Knowledge of decoding nutritional labels used three questions consisting of one object, food labels.	The higher share of accurate responses in post-consultation surveys. No huge variations with the aid of using socioeconomic status

For instance, the consequences of information were found on a comprehension task requiring participants to use nutrition labels to see many healthful. However, information effects were not evident on a task requiring participants to gauge one label's wholesomeness. Nutrition information of labels was appraised by using nutrition label knowledge. Some studies show that 80 – 90% population does not buy products without checking the ingredient list present on labels. These studies can improve the impact of information on dietary health by education to enhance the inclusive use of nutrition labels. A good understanding of labels was greatly inked with high-level literacy and understanding skills.

A study conducted by Claudia Nieto investigated that understanding and using Guideline Daily Amounts (GDA) is similar to that of the Nutrition Facts Table (NFT), indicating that GDAs might not give extra guidance to people to make healthy food choices. Even in Mexico, where the execution of the GDA on the front of packages went along with an extensive media campaign, this labelling system was not more understood or used than the NFT. This study found that understanding and using the GDA was similar to that of the NFT, suggesting that this labelling format may not provide much additional guidance to consumers to make informed food choices. Whites investigated the broadest level of understanding of the nutrition labels system, about 95% than usage (Cecchini & Warin, 2016).

A research conducted by Klaus G was to systematically investigate the effect of educational interventions on consumer's use and understanding of food label information. All studies investigated here were effectual in improving one or more measures of use or understanding nutrition labels among consumers. In this study, N=129 participants on which questionnaires were used to investigate nutrition information on food labels and their understanding among participants. The results of this study showed that Understanding was up to 87.5 %, and 27% of consumers used the information on food labels (Graham et al. 2017). To assess the capability to use food labels and make beneficial alternatives, the study conducted in U.S. school children on "food label literacy." Different sessions, follow up, and a booster was given to the students. This study is based on nutrition label understanding among students, and they showed considerable pre-posttest improvements, and the score of booster sessions was greater than before

($p < 0.01$) (Nieto et al. 2019). The two studies were conducted based on "nutrition label use and understanding" by taking the survey, online follow-up, and questionnaires on school-going children and adults of community females (Treu et al. 2017).

Sessions were given to both groups, and they were comprised of food label information such as ingredients, cooking instructions, expiry dates, etc. The nutrition label use was self-reported by the community, and they improved within the six-week follow-up. The impact of understanding was in a higher proportion of good or positive responses. The impact of nutrition label use was based on five questions, and the outcome of 1 question was optimistic ($p < 0.05$), and the understanding knowledge was drastically enhanced ($p < 0.05$) (Gavaravarapu et al. 2013).

The purpose of the recent research was to examine the effect of any food label's overall friendliness on packaged food consumption. The results of recent research have exposed that friendly food labels have a good effect on packaged food consumption. The results obtained from this research enhance value to previous literature by adding individuals' personality traits, which were suggested by the research workers, as mentioned earlier. The food label is based on two schemes, such as Front of Pack and Back of Pack labeling. This result is as resembles to past research. Researchers have found that consumers' positive self-reporting with questionnaires to consulting food labels and their positive interest toward friendly food labels shows interest in healthy packaged food selection (Pettigrew et al. 2016).

Similar studies worldwide have reported that consumers have not enough knowledge about the terminology on the food labels. Another study has elaborate that knowledge of prepackaged food labeling information was low among all consumers in Ernakulum and Coimbatore, India. It was also cleared that less than half of the total respondents frequently read the food labels (Zafar et al. 2017). While many researchers have been involved in the consumption and ingesting behaviors of younger teens, few research has tested their dietary labelling facts. The intention of this venture turned into to assess the knowledge of nutrients facts labels and their reaction to a training program on nutrients facts labels. 34 teens participated through answering a brief questionnaire and doing a pretest on nutrients labels and meals choices, which blanketed using

real nutrients record labels from ingredients normally fed on through teens. Subjects then participated in a brief education software on the way to examine the nutrients label. A very last check followed. The preliminary facts at the fundamental use of the nutrients label turned into marginal, best 6.65 (popular deviation = 2.23), or ~55% of the pretest questions have been replied correctly. However, the subjects' ratings increased after the education consultation to 8.32 (popular deviation = 2.01) or ~70% corrected post-check (Goyal & Suleria, 2019). The looking at the above-common analysis of dietary facts on meals labels with partial knowledge. Efforts need to be made to decide how it can be completed so that each one customer apprehend the dietary facts on food labels and use it efficiently in selection makings (Moore et al. 2018). Most sufferers (89%) pronounced the usage of meals labels. Simultaneously, 75% of sufferers pronounced at least excessive faculty training, 77% had 9th-grade literacy skills, and 37% had 9th-grade math skills. On common, sufferers replied 69% (popular deviation, 21%) of the meals-label questions correctly (Talagala & Arambepola, 2016).

CONCLUSION

These studies demonstrated that GDA had the lowest acceptability and understanding among the tested labels. Although these studies elaborate on the literature gaps, mainly surrounding the role of knowledge among older consumers, these results could suggest that increasing consumers' nutrition knowledge levels may improve nutrition communication through food labels. Patients showed lacking knowledge in understanding nutritional labels. Low understanding of labels was extensively linked with low-stage literacy and understanding, and even the public with better literacy might have difficulty deciphering labels. The nutritionist should see these factors while giving dietary advice. Understanding and use of food among consumers vary with different label designs. These studies can increase the use and acceptance of nutrition labels among school-going children and adults to assess the capability to use food labels and become healthy choices. These studies can improve dietary health by education to enhance the inclusive use of nutrition labels.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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As, it is a systematic review, no ethical consent is needed.

AUTHOR CONTRIBUTIONS

S.Z. and B.R. conceived of the presented idea. S.Z. developed the theory and performed the computations. F.A. and S.N. verified the analytical methods. Z.F, B.S, H.N., investigate the impact of education intervention on consumer understanding and usage of food labels. All authors discussed the results and contributed to the final manuscript.

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