Original Article
DOI: https://doi.org/10.70749/ijbr.v4i1.2556

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://ijbr.com.pk
ISSN: 2960-2793/ 2960-2807

Novel Nutrition Fact Panels: Innovation in Labeling Strategies and Their Impact on Consumer Purchasing Intentions and Decision-Making Processes in Packaged Food Products

Ammarah Baqir[1], Yasmeen Bano[1], Allah Rakha[2], Mahrukh Nadeem[1], Waleed Zafar[1], Naveed Hussain[1], Ayesha Syed[2], Sanabil Yaqoob[3], Muhammad Yousaf[4], Sabeen Gohar[5]

[1]Department of Food Science and Technology, UAF Sub-Campus, Burewala, Punjab, Pakistan.
[2]National Institute of Food Science and Technology, University of Agriculture, Faisalabad, Punjab, Pakistan.
[3]Department of Food Science & Bioengineering, Zhejiang Gongshang University, Hangzhou, China.
[4]Department of Food Science and Engineering, Shanghai Jiao Tong University, China.
[5]Graduate School of Medicine, Science, and Technology, Nano Fusion Technology Research Group, Institute for Fiber Engineering (IFES), Interdisciplinary Cluster for Cutting Edge Research (ICCER), Shinshu University, Tokida, Ueda, Nagano, Japan.

ARTICLE INFO

Keywords: Nutritional Labelling, Smart Packaging, Consumer Acceptance, Digital Labels.

Correspondence to: Yasmeen Bano, Department of Food Science and Technology, UAF Sub-Campus, Burewala, Punjab, Pakistan.
Email: yasmeen@uaf.edu.pk

Declaration
Authors' Contribution
All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History
Received: 18-07-2025 Revised: 28-12-2025
Accepted: 17-01-2026 Published: 30-01-2026

ABSTRACT

Unlike any other, this study investigated how possible innovative nutritional labeling techniques affected consumers' intentions to purchase packaged food products. These elements included; the effects of employing color markings, QR codes, sensors, smart expiration dates, halal emblems, clear disclaimers, and larger print sizes through which a study could identified key factors that boosted consumer confidence and transparency in the product. The study also ascertained how catchy cartoon characters or celebrities feature on labels would also tempted the young audience into resulting in purchasing decisions. According to results 59.9% consumers claimed they were willing to pay more for such products and 51.2% consumers say these changes affected their willingness to buy. Price was still a major determinant for some individuals, but because of demographic analysis, women and those educated to a higher level are ready to embrace these features. From these outcomes, it can be inferred that inclusive, clear, culturally appropriate, and personal labeling mechanisms had a substantial impact on consumer decisions. Therefore, this report calls for further research on regional differences and digital labeling technologies towards firm-targeted strategies.

INTRODUCTION

Priya et al. (2024) found that the primary factor influencing the relationship between using the Nutrition Facts Panel (NFP) labels and comprehending nutrition information was people's confidence in their ability to make appropriate dietary choices. Food labels provide information about food packaging that enables consumers to make knowledgeable decisions about the food they eat (Yang et al., 2020). Generally speaking, a nutrition label's purpose is to tell consumers about the nutritional value of pre-packaged meals so they can choose among healthy options (Kwabena et al., 2024). According to González-Vallejo et al. (2016), consumers make decisions and judgments based on their assessment of their ability to use the Nutrition Facts Panel (NFP, National Labeling and Education Act, 1990) to assess the nutritional content of food products (snacks and cereals). Food labels are becoming increasingly important to customers when deciding what to purchase because of increased awareness on nutrition-related health issues like obesity, diabetes, and cardiovascular diseases (Grunert et al., 2010). Evidence about food packaging-as health research was not studied very much among children with low health-awareness or adults having more concerns about obesity-were included in these studies (De Droog et al., 2011; Abrams et al., 2015; Ogle et al., 2017; Grummon & Hall, 2020; Hall et al., 2020; Taillie et al., 2020; Duffy et al., 2021; Stoltze et al., 2021; Musicus et al., 2022).

The Nutrition Labeling and Education Act of 1990 made standardized nutrition information available to consumers in the United States on most packaged foods. Nutrition labels, commonly referred to as "Nutrition Facts

labels," are now included on most packaged foods regulated by the US Food and Drug Administration (US FDA). These labels include serving size, calorie count, and minerals like calcium, fiber, and total fat, cholesterol and sodium. Customers can compare foods with the aid of this information and possibly choose healthier options. The US Food and Drug Administration (FDA) most recently revised the Nutrition Facts label, requiring added sugars to be listed in grams and as a percentage of Daily Value, updating the list of nutrients that must or may be included on the label, and updating footnotes to better explain percent Daily Value information (FDA, 2018). Additionally, the Nutrition Facts label now displays serving sizes and calories in a bolder and larger font.

Genetically modified (GM) food should be labeled properly so that people can make their choice on their own. People all around the world want transparent system for labeling. Labeling should be positive. Negative labeling (negative wording like "GM free") should be avoided (Haroon et al., 2016). Labeling nanotechnology consumer products may change the public perception of the products (Siegrist et al., 2011). Labeling is crucial to prevent harms to patient and consumers (Gerke et al., 2023). The addition of Trans Fatty Acid (TFA) to the nutrition label will lead to the prevention of 600 to 1200 cases of CHD and 240–480 deaths each year saving $900 million to

$1.8 billion per year in medical costs, lost productivity, and pain and suffering. It now appears that women, particularly those who used to consume very high amounts of trans fats, are now consuming less. This change is due to the fact that Canada has recently introduced labeling for foods containing trans fats and has also reduced the utilization of partially hydrogenated fats in products, such as breads, snacks, and fried foods (Friesen et al., 2006).

Purchase decisions are significantly and positively influenced by halal certification and halal awareness (Purnomo et al., 2024). A correct understanding and use by consumers of food nutrition labels are necessary conditions for acquiring a healthy diet (Priya et al., 2024). However, there are still some students who think that the nutrition label is not important and do not believe in its contents (Wei et al., 2022). Consumers not using nutrition labels regularly did not consider label information to be of very high importance (Koen et al., 2018). A correct understanding and use by consumers of food nutrition labels are necessary conditions for acquiring a healthy diet (Priya et al., 2024). However, there are still some students who think that the nutrition label is not important and do not believe in its contents (Wei et al., 2022). Consumers not using nutrition labels regularly did not consider label information to be of very high importance (Moss, 2006; Koen et al., 2018). The study found that the amount of trans fats in breast milk has gone down. People who read nutrition labels regularly, place more importance on health and healthy eating than those who do not (Andreas et al., 2005). People who read nutrition labels regularly eat more healthily than those who do not. Digital and physical food environments are interconnected and influencing one another (Granheim et al., 2022). Appearance, brand name, price, nutrition information, and convenience were the reported factors that influence purchasing decisions (Mahgoub et al., 2007). Nutrition labels usage had an impact on most purchasing decisions (Adesina et al. 2022). The TL label uses red, amber, and green colors to indicate nutrient levels (high, medium, and low, respectively) in food products (Sacks et al., 2009). The Traffic light (TL) labels can attract more consumer attention to the nutrients of food products (Chen et al., 2024) which increases the purchasing intention of consumers. With a greater knowledge of the function of novelty in nutritional labeling and its impact on consumer behavior, this study intends to explore how consumers' purchasing decisions for packaged food products are influenced by new nutrition fact panel designs and content.

MATERIALS AND METHODS RESEARCH QUESTIONS

The present study investigated the following research questions (RQ), (RQ1) and (RQ2) aims to investigate the Influence of innovative nutrition fact panel strategies and content on consumers' purchasing decisions for packaged food products. Because consumers see different prospects for making decision while purchasing packaged food products, every person thinking is different from each other while purchasing so these questions investigate which innovative content consumers prefer for making purchasing decision. Product labeling can affect consumers' purchasing decisions by raising customer knowledge of environmentally friendly items (Dangelico and Pujari, 2010; Ertz et al., 2017; Song et al., 2019; Rossi et al, .2023). The ease with which consumer behavior can also be influenced by the label's information, which customers can comprehend. Consumers may be more likely to purchase products with labeling that is easy to understand and provides clear information.(Nguyen et al., 2020; Amir Kavei and Savoldi, 2021) so, (RQ3) aim for understanding of the role of novelty in nutritional labeling and its impact on consumer behavior means to find which novelty consumers want in Nutritional labeling. (RQ4) is to knowing educated and health concerned people with which age range focuses more on Nutritional Fact Panel or not as customers could be worried about the possible health concerns connected to some products (Fenko et al., 2016) and the effectiveness of environmental labeling and customer behavior can also be influenced by factors including age, income, and education (Chekima et al., 2016; Relawati et al., 2020; Marchini et al., 2021). (RQ5) is to investigate that while buying people focuses on which factors and are they willing to pay more for innovative facilities. Consumers may be willing to pay more for products that are of higher quality, including those that are more durable and reliable (Zhao et al., 2022). But Price reductions can raise the perceived value of ecologically branded products and make them easier to reach (D'Souza et al., 2007; Aoki and Akai, 2013).

- **RQ1:** Addition of Digital technologies (QR code, Smart Expiration, Sensors), Color marks indicators, clear disclaimer, background color featuring favorite Character in NFP how much influence consumer purchasing intentions?
- **RQ2:** Determine the Need of Larger font size, Halal symbol with each ingredient or 1 halal symbol on the product, need of clearly mention GM food, need of clear labeling for mention technologies used for safety purpose according to consumers'

preferences?

RQ3: Would you Prefer labeling or not if yes for which type of product it is more necessary, in which language, how often do you check, which part do you primarily focus on, which elements hardest to understand, easily understand components on the nutritional panel, low trans fatty acid%?

RQ4: Are there significant demographic differences (e.g., age, gender, education, health concern) in how consumers perceive and respond to novel nutrition labels?

RQ5: How much people willing to pay more for these facilities & which factor mostly influence their purchasing decision?

Research Design

For this study I follows a cross-sectional research design to investigate the influence of innovative nutrition fact panel designs and content on consumers' purchasing decisions for packaged food products and better understanding of the role of novelty in nutritional labeling and its impact on consumer behavior at a single point in time. I choose cross-sectional design because of its efficiency and feasibility for data collection of consumer preferences, decision-making behavior and influence in purchasing intention due to Novelty NFP and Nutritional Labeling at the present moment, without requiring longitudinal data collection. The study does not aim to establish causality but rather to identify trends and associations between labeling strategies and consumer behavior.

Research Method

The study employed a quantitative survey method; the data collection method used in this study was a structured questionnaire consisting of 25 questions including 22 multiple choice questions and 3 checkbox questions. It aimed to capture consumer preferences, behaviors and purchasing intention towards innovation in NFP and novelty in Nutritional labeling. To present study data from have been gathered namely primary data. Original information gathered specifically for a study is known as primary data. Using a questionnaire, primary data was gathered for the current investigation. A structured, standardized questionnaire for the general public is the main tool used to gather data for study. This approach aids in getting accurate information from those surveyed.

Population

The target population for this study consisted of consumers (aged 18-35 years or above) in urban areas who regularly purchase packaged food products. Target population consisted of consumers with different level of education as to know about their purchasing intention and decision-making behavior at each level of education. A stratified random sampling technique was employed to ensure the sample was representative of key demographic groups (e.g., age, gender, education levels). Consumers were recruited through online platforms (social media, survey links) and the links were conveyed in college and university groups to capture a diverse range of perspectives.

For conducting this research, we made use of a structured questionnaire and analyzed survey data with the use of MS Excel. The data collection instrument used in this study was a structured questionnaire. It was reviewed by one expert in Labeling and 2 professors, and pre-tested on 20 participant and minor adjustments were made based on feedback regarding clarity and response time. The survey was administered online via Google Forms, with a total of 207 participants completing the questionnaire. The data collection took place over a three-week period, and participants were informed that their participation was voluntary and confidential, with all data stored securely.

Ethical Consideration

This study adhered to ethical guidelines by ensuring informed consent, where participants were fully briefed on the purpose of the research and their right to withdraw at any time without consequence. Confidentiality was maintained by anonymizing all responses, and data were securely stored and used solely for research purposes.

RESULTS AND DISCUSSION

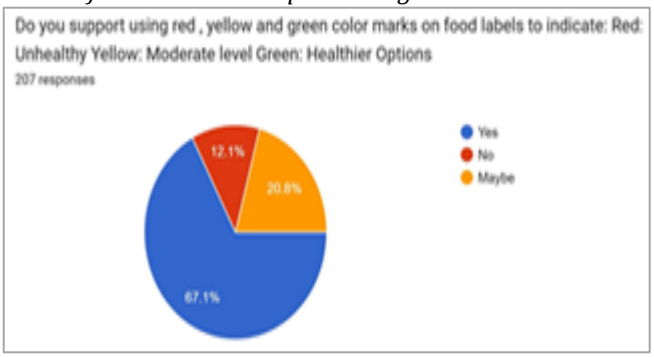
RQ1: Addition of Digital Technologies (QR code, Smart Expiration, Sensors), Color marks indicators, clear disclaimer, background color featuring Favorite character in NFP, how much influence consumer purchasing intentions?

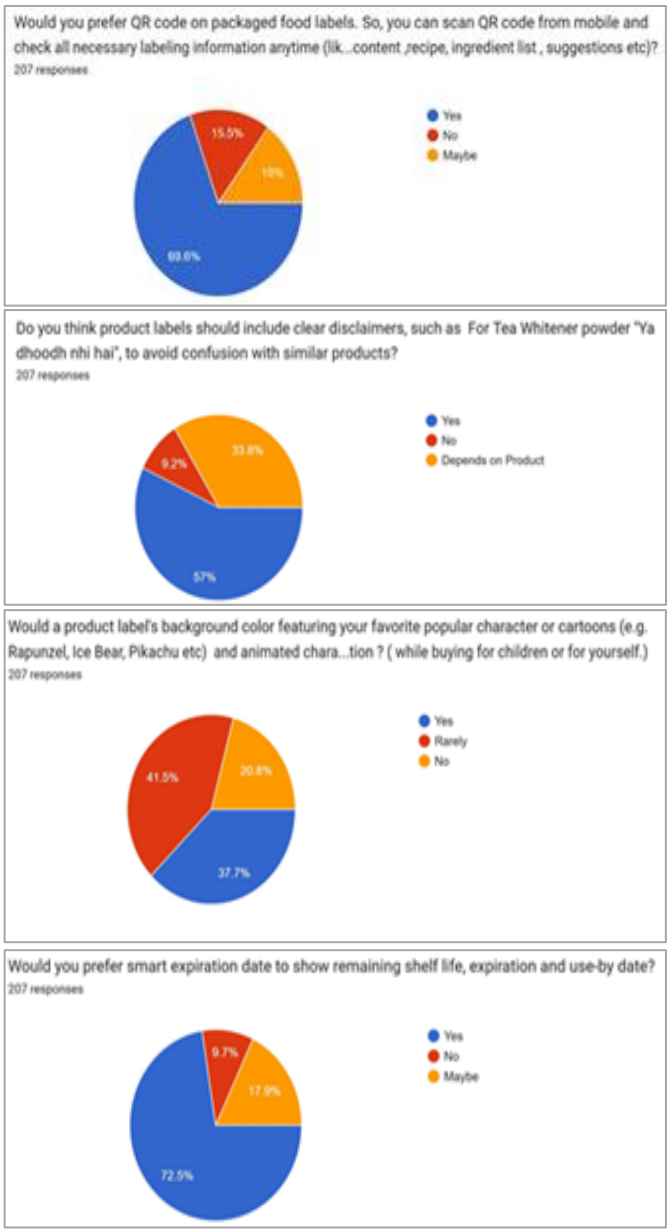
By investigating RQ1 here are some results for RQ1;

We get 57%, 67.1%, 69.6%, 72%, 59.9% positive response (YES) for clear disclaimer, color marks, QR code, smart expiration date, sensors for all categories respectively. From all over the world researchers are working on these innovations but here is something on which no one is working that is label's background color featuring consumers favorite popular character or cartoons (e.g. Rapunzel, Ice Bear, Pikachu etc.) and animated characters or something like these grab consumers attention or not. By investigation result shows that 37.7% consumers definitely. 41.5% consumers rarely (but they also sometimes attract),20.8% never attracts towards products featuring their favorite character. The color-coded NFP facilitated consumers' food purchasing decisions and encouraged them to choose healthier options for certain products (like chips) (Chen et al., 2024).

Figure 1

Addition of Digital Technologies (QR code, Smart Expiration, Sensors), Color marks indicators, clear disclaimer, background color featuring Favorite character in NFP, how much influence consumer purchasing intentions?





RQ2: Determine the Need of Larger font size, Halal symbol with each ingredient or 1 halal symbol on the product, need of clearly mention GM food, need of clear labeling for mention technologies used for safety purpose according to consumers' preferences?

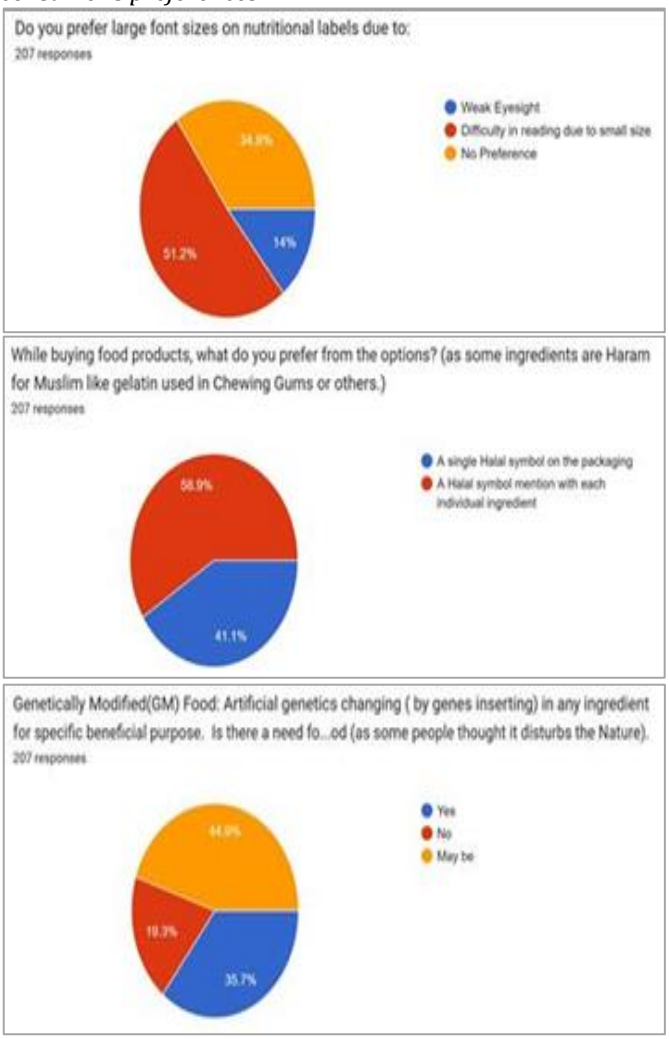
By investigating RQ2 here are some results for RQ2;

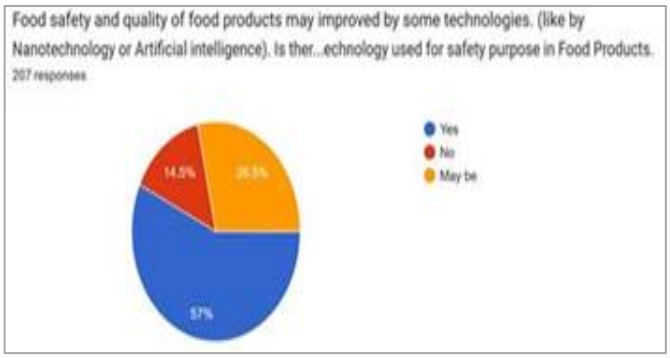
86% consumers prefer large font size 51.2% due to difficulty in reading and 34.8% due to weak Eyesight.58.9% consumers prefer halal symbol with each certified ingredient. Only 35.7% consumers prefer clear labeling for GM food. But 57% Consumers prefer clear labeling of technologies used for safety purpose. So, there is a need of larger font size, halal symbol with each certified ingredient, clear labeling of technologies but no need of GM food labeling. When a product was never "free-from" genetically modified organisms (GMOs), labels that make such claims can be deceptive. These labels have the potential to mislead customers and conflate legitimate science with false information. According to the rising demand for GMO-free labels, many. Consumers' propensity to buy a product can be increased by using health slogans and associated certification marks on labels to help them recognize the product's health benefits (X. Wang et al., 2024). Time constraints, small font size, and difficulty to understand were the reported barriers to the use of nutrition labels (Asouzu et al., 202]0). Higher purchasing of food products with labels that contains information such as halal logo, ingredients, and nutritive value (Abdul Latiff et al., 2016).

My study align with (Affram et al., 2015; Asouzu et al., 2020; Wang, et al., 2024) who also found that small font size prevent consumers from reading and act as barrier and reduce readability which is crucial factor affecting consumer behavior as my study found the demand of larger font size, align with (Abdul Latiff et al., 2016) who suggest that higher purchasing of food products with labels that contains information such as halal logo, ingredients, and nutritive value and my study reveal halal logo with each certified ingredient and nutritive value enhance consumers purchasing intention. My finding contradicts with (Affram et al., 2015) food label reading among participants did not necessarily influence their purchase of food but my finding suggests food label reading influence purchase of food.

Figure 2

Determine the Need of Larger font size, Halal symbol with each ingredient or 1 halal symbol on the product, Need of clearly mention GM food, need of clear labeling for mention technologies used for safety purpose according to consumer's preferences?





RQ3: Would you Prefer labeling or not if yes for which type of product it is more necessary, in which language, how often do you check, which part do you primarily focus on, which elements hardest to understand, easily understand components on the nutritional panel, low trans fatty acid%?

By investigating RQ3 here are some results for RQ3;

58% Consumers prefer both Urdu/National and English language for Nutritional labeling. Consumers focus on calories, fat content, sugar content, others 40.6%, 14%, 10.6%, 14% respectively and 20.8% consumers do not read labels mostly. 42% consumers easily understand all the components, 38.2% some of them, 9.7% not noticed, 10.1% don't read labels it means almost 20% consumers do not read labels. Daily value, serving size, added sugar are hardest to understand for 32.9%, 21.3%, 11.6% consumers respectively 24.2% consumers no element hardest to understand and some don't read labels. 35.7% consumers definitely prefer labeling of Trans Fatty Acid, 34.8 choose may be for their preference but 29.5% does not like to prefer labeling of Trans Fatty Acid.

The data presented in Figure 4 highlights a critical link between labeling quality and consumer value perception. A significant majority of respondents (59.9%) explicitly indicated a willingness to pay a higher price point for products featuring enhanced labeling facilities. This financial readiness suggests that consumers view detailed product information not merely as a bonus, but as a value-added service worth investing in. This sentiment is further reinforced by the impact on purchasing intention; when nutritional labeling factors align with consumer preferences, a substantial 79.2% of participants reported a positive shift in their buying behavior. Specifically, 51.2% of respondents stated their intention would 'increase significantly,' confirming that precise and well-structured labels act as a decisive driver in the final purchasing decision, effectively overriding price sensitivity for a large segment of the demographic.

Making nutritional information available is one thing but getting the final consumer to consider it when making decisions about what to buy is quite another. This has resulted in lengthy debates about the necessity of this information and the most effective way to present it so that the final consumer can consult it when making decisions (Modo et al., 2021).

Calorie labeling can enhance awareness, translating this into behavior change remains limited to shifting orders. To optimize the public health advantages of calorie labeling, further tactics could be needed (Essman et al., 2024).

Figure 3

Would you Prefer labeling or not if yes for which type of product it is more necessary, in which language, how often do you check, which part do you primarily focus on, which elements hardest to understand, easily understand components on the nutritional

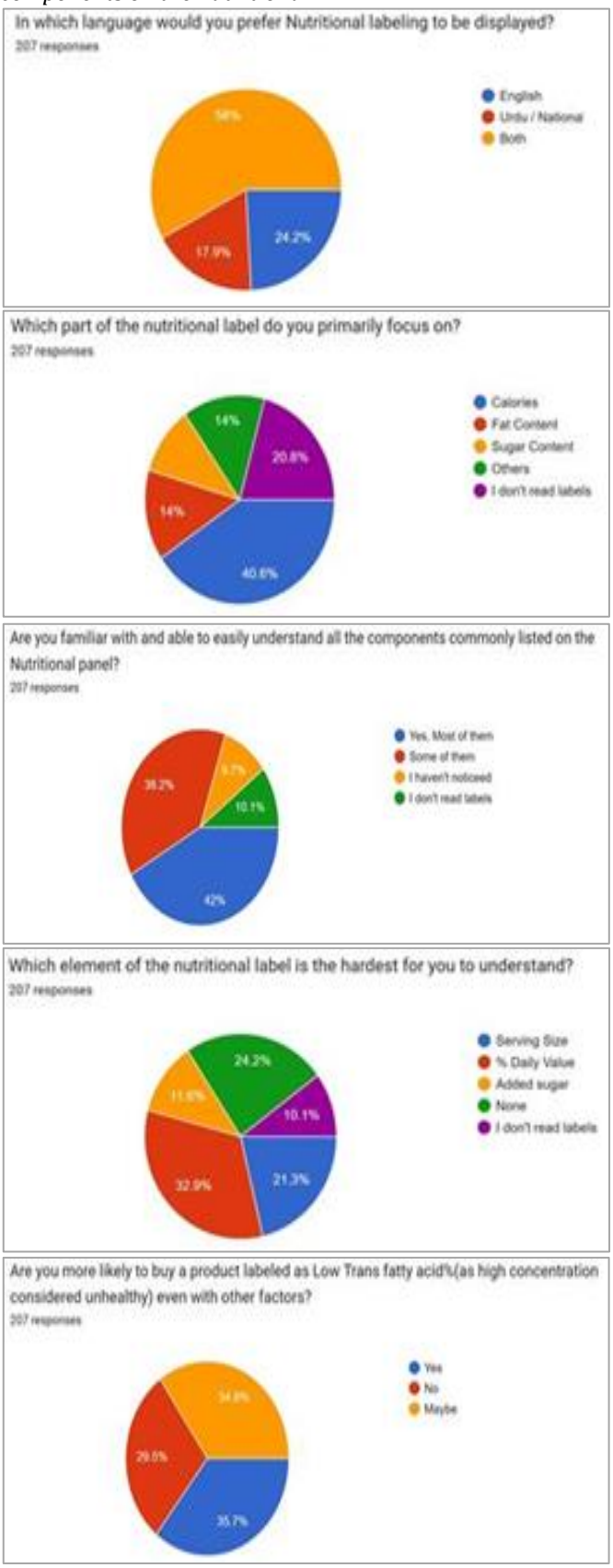
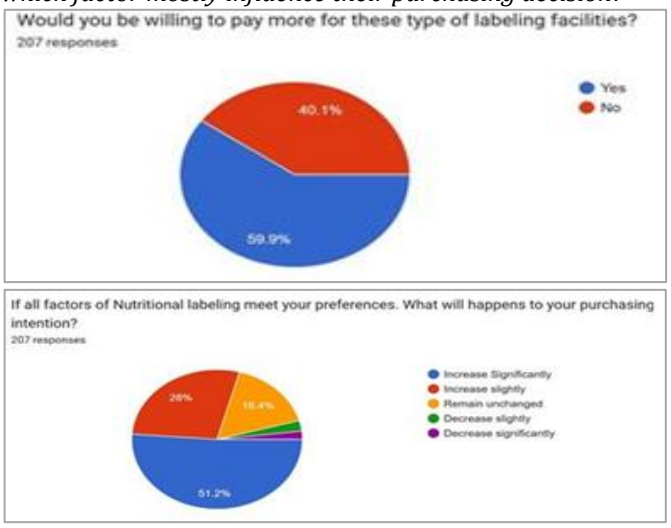


Figure 4

How much people willing to pay more for these facilities & which factor mostly influence their purchasing decision?



RQ 4: The results for RQ4 highlight a significant generational divide in the reception of novel nutritional labeling. The results suggest that the participants of the sample aged between 18–24 are the majority, with 86%, showing that the Generation Z people comprise the dominant section and are primarily interested in new food technologies. This corresponds to a recent paper by (Defta et al., 2025), where they note that young consumers aged between 18–34 years are remarkably interested in innovations in food products compared to other age groups. While the 18–24 group generated the highest volume of positive engagement, the 25–34 segment delivered the highest intensity of positive purchasing intention, with 65.22% showing a Significant Increase in their likelihood to purchase, versus 51.12% among the younger group. This implies that although the youngest group is interested, young professionals aged 25-34 may have the purchasing power and health consciousness to turn the information on the label into actual purchasing behavior. On the other hand, the low level of engagement from the Above 35 group (only 2.9% of the responses) reflects the findings that older people tend to find new label designs difficult to understand.

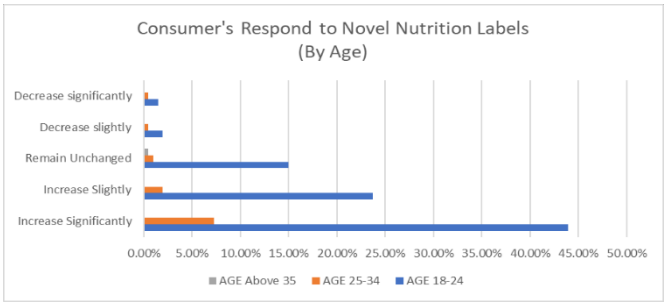
A gender paradox emerged in the results. Women dominated the sample (69.57%), consistent with the gatekeeper hypothesis that women guide food choices and nutrition in the household. However, the results of the sentiment analysis reveal a difference in engagement and optimism. In each case, 87% of men reported a positive increase in purchasing intention (Significant + Slight) compared to 75% of women. This goes against conventional wisdom but fits the data from 2024-2025, women are more likely to read the labels but are also more skeptical of the claims, while men who read the labels are more likely to believe the standard information. The reason for the women's skepticism could be that they have a higher level of nutritional knowledge, so something new is less persuasive (Defta et al., 2025).

Analysis reveals a positive correlation between education and the acceptance of new nutrition labels. Individuals with bachelor's and master's degrees were more positive, which contributed to the significant increase. This finding is consistent with the validated Knowledge-Attitude-Practice (KAP) model, which indicates that education enables individuals to make sense of nutritional information, giving them confidence to purchase new products. Participants with Matric/Intermediate education showed lower engagement and positivity. This indicates that too complex labels could alienate lower literacy groups and increase health disparities.

Analysis of the demographic data shows that new nutrition labels are most effective when targeted at young, educated individuals aged 25-34, who demonstrate high levels of responsiveness as well as the financial ability to make changes. While the younger generation aged 18-24 garners publicity and visibility, the slightly older group yields better conversion rates. Moreover, the high levels of responsiveness among males indicate an untapped market potential; marketing strategies that focus on the efficiency aspect of nutrition labels, rather than the health perspective, could tap into this growing market. Future versions of the nutrition label should focus on simplicity to improve engagement with individuals above 35 and those with lower educational levels, thus ensuring the label is inclusive rather than exclusive (Defta et al. 2025).

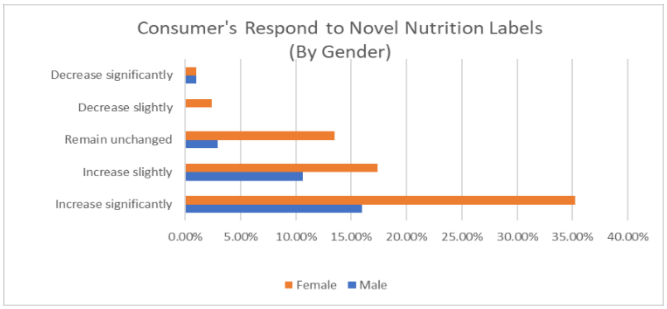
Graph 1

The age wise response of consumers to novel nutrition labels.



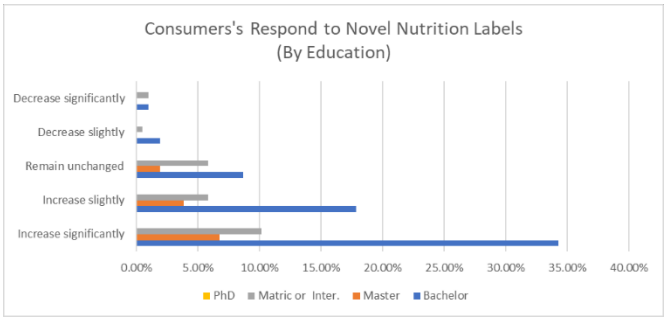
Graph 2

The gender wise response of consumers to novel nutrition labels.



Graph 3

The education-wise response of consumers to novel nutrition labels.



Conclusion:

Hence, this research provides some wonderful accounts on the role of creativity. The new nutritional fact panels and intelligent labeling play an important role in the choices made by customers in their purchases. Evidence reveals that straightforward, personalized labeling-includes important details like halal insignia, QR codes, or eye-catching images like animated characters-really pulls customers towards the products and increases their trust. Disparities in receptiveness to these innovations also result from demographic factors like gender, age, and education level. Even though 59.9% of consumers are willing to pay more for such improvements, price is still a major factor. In order to be effective at reaching various consumers, our results emphasize that the balance is required between innovation and price. Future research should center on integrating digital technologies, such as augmented reality, into labeling; studying regional preferences; and analyzing long-term consumer behavior toward changing labeling techniques. This kind of study would have an enormous impact on future product development and marketing in global food industries.

REFERENCES

Abdul Latiff, Z. A., Rezai, G., Mohamed, Z., & Amizi Ayob, M. (2015). Food labels' impact assessment on consumer purchasing behavior in Malaysia. *Journal of Food Products Marketing*, *22*(2), 137-146. https://doi.org/10.1080/10454446.2013.856053

Abrams, K. M., Evans, C., & Duff, B. R. (2015). Ignorance is bliss. How parents of preschool children make sense of front-of-package visuals and claims on food. *Appetite*, *87*, 20-29. https://doi.org/10.1016/j.appet.2014.12.100

Adesina, E., Ajayi, B., Amoo, E. O., Adeyeye, B., Ajayi, M. P., Olawande, T., Olawole-Isaac, A., & Udume, M. E. (2022). Consumers' knowledge and use of nutritional labelling information in Lagos, Nigeria. *Sustainability*, *14*(1), 578. https://doi.org/10.3390/su14010578

Affram, P. C., & Darkwa, S. (2015). Consumers' knowledge, understanding and use of food label information, and how it affects purchasing decision in ho, ghana. *Asian Journal of Empirical Research, 5*, 2224-4425.

Alotaibi, N. M., Alshammari, G. M., Alabdulkarem, K. B., Alotaibi, A. A., Mohammed, M. A., Alotaibi, A., & Yahya, M. A. (2023). A cross-sectional study of gender differences in calorie labeling policy among students: Dietary habits, nutritional knowledge and awareness. *Nutrients*, *15*(4), 879. https://doi.org/10.3390/nu15040879

Amir Kavei, F., & Savoldi, L. (2021). Recycling behaviour of Italian citizens in connection with the clarity of on-pack labels. A bottom-up survey. *Sustainability*, *13*(19), 10846. https://doi.org/10.3390/su131910846

Drichoutis, A. C. (2005). Nutrition knowledge and consumer use of nutritional food labels. *European Review of Agriculture Economics*, *32*(1), 93-118. https://doi.org/10.1093/erae/jbi003

Aoki, K., & Akai, K. (2013). Do consumers select food products based on carbon dioxide emissions?. In Advances in Production Management Systems. Competitive Manufacturing for Innovative Products and Services: IFIP WG 5.7 International Conference, APMS 2012, Rhodes, Greece, September 24-26, 2012, Revised Selected Papers, Part II (pp. 345-352). Springer Berlin Heidelberg.

Asouzu, N. C., & Iheme, G. O. (2020). Influence of consumers' food label knowledge and perception on utilization in Abakaliki local government area, Ebonyi State, Nigeria. *Journal of Dietitians Association of Nigeria*, *11*(1), 72-82. https://www.ajol.info/index.php/jdan/article/view/214197

Chekima, B., Syed Khalid Wafa, S. A., Igau, O. A., Chekima, S., & Sondoh, S. L. (2016). Examining green consumerism motivational drivers: Does premium price and demographics matter to green purchasing? *Journal of Cleaner Production*, *112*, 3436-3450. https://doi.org/10.1016/j.jclepro.2015.09.102

Chen, X., Gao, Z., House, L., & Gao, Y. (2024). Do color-coded nutrition facts panels nudge the use of nutrition information? *Food Policy*, *129*, 102730. https://doi.org/10.1016/j.foodpol.2024.102730

Chen, X., Gao, Z., House, L., & Gao, Y. (2024). Do color-coded nutrition facts panels nudge the use of nutrition information? *Food Policy*, *129*, 102730. https://doi.org/10.1016/j.foodpol.2024.102730

Dangelico, R. M., & Pujari, D. (2010). Mainstreaming green product innovation: Why and how companies integrate environmental sustainability. *Journal of Business Ethics*, *95*(3), 471-486. https://doi.org/10.1007/s10551-010-0434-0

De Droog, S. M., Valkenburg, P. M., & Buijzen, M. (2010). Using brand characters to promote young children's liking of and purchase requests for fruit. *Journal of Health Communication*, *16*(1), 79-89. https://doi.org/10.1080/10810730.2010.529487

Defta, N., Barbu, A., Ion, V. A., Pogurschi, E. N., Osman, A., Cune, L., & Bădulescu, L. A. (2025). Exploring the relationship between socio-demographic factors and consumers' perception of food promotions in Romania. *Foods*, *14*(4), 599. https://doi.org/10.3390/foods14040599

D'Souza, C., Taghian, M., & Khosla, R. (2007). Examination of environmental beliefs and its impact on the influence of price, quality and demographic characteristics with respect to green purchase intention. *Journal of Targeting, Measurement and Analysis for Marketing*, *15*(2), 69-78. https://doi.org/10.1057/palgrave.jt.5750039

Duffy, E. W., Hall, M. G., Dillman Carpentier, F. R., Musicus, A. A., Meyer, M. L., Rimm, E., & Smith Taillie, L. (2021). Nutrition claims on fruit drinks are inconsistent indicators of nutritional profile: A content analysis of fruit drinks purchased by households with young children. *Journal of the Academy of Nutrition and Dietetics*, *121*(1), 36-46.e4. https://doi.org/10.1016/j.jand.2020.08.009

Ertz, M., François, J., & Durif, F. (2017). How consumers react to environmental information: An experimental study. *Journal of International Consumer*

Marketing, *29*(3), 162-178. https://doi.org/10.1080/08961530.2016.1273813

Essman, M., Burgoine, T., Jones, A., Polden, M., Robinson, E., Sacks, G., Sharp, S. J., Smith, R., Vanderlee, L., White, C. M., White, M., Hammond, D., & Adams, J. (2024). Assessing the impact of a mandatory calorie labelling policy in out-of-home food outlets in England on consumer behaviour: A natural experimental study. https://doi.org/10.1101/2024.06.07.24308607

Fenko, A., Kersten, L., & Bialkova, S. (2016). Overcoming consumer scepticism toward food labels: The role of multisensory experience. *Food Quality and Preference*, *48*, 81-92. https://doi.org/10.1016/j.foodqual.2015.08.013

Feyisa, E., Wondimu, R., & Kaba, Z. (2021). Knowledge, reading practice and associated factors of nutrition labeling on packaged food among consumers in Addis Ababa, Ethiopia. *Journal of Food and Nutrition Sciences*, *9*(2), 48. https://doi.org/10.11648/j.jfns.20210902.13

Feyisa, E., Wondimu, R., & Kaba, Z. (2021). Knowledge, reading practice and associated factors of nutrition labeling on packaged food among consumers in Addis Ababa, Ethiopia. *Journal of Food and Nutrition Sciences*, *9*(2), 48. https://doi.org/10.11648/j.jfns.20210902.13

Friesen, R., & Innis, S. M. (2006). Trans fatty acids in human milk in Canada declined with the introduction of trans fat food labeling. *The Journal of Nutrition*, *136*(10), 2558-2561. https://doi.org/10.1093/jn/136.10.2558

Gerke, S. (2023). " Nutrition Facts Labels" for Artificial Intelligence/Machine Learning-Based Medical Devices-The Urgent Need for Labeling Standards. *Geo. Wash. L. Rev.*, *91*, 79.

González-Vallejo, C., Lavins, B. D., & Carter, K. A. (2016). Analysis of nutrition judgments using the nutrition facts panel. *Appetite*, *105*, 71-84. https://doi.org/10.1016/j.appet.2016.05.014

Granheim, S. I., Løvhaug, A. L., Terragni, L., Torheim, L. E., & Thurston, M. (2021). Mapping the digital food environment: A systematic scoping review. *Obesity Reviews*, *23*(1). https://doi.org/10.1111/obr.13356

Grummon, A. H., & Hall, M. G. (2020). Sugary drink warnings: A meta-analysis of experimental studies. *PLOS Medicine*, *17*(5), e1003120. https://doi.org/10.1371/journal.pmed.1003120

Grunert, K. G., Wills, J. M., & Fernández-Celemín, L. (2010). Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. *Appetite*, *55*(2), 177-189. https://doi.org/10.1016/j.appet.2010.05.045

Hall, M. G., Lazard, A. J., Grummon, A. H., Mendel, J. R., & Taillie, L. S. (2020). The impact of front-of-package claims, fruit images, and health warnings on consumers' perceptions of sugar-sweetened fruit drinks: Three randomized experiments. *Preventive Medicine*, *132*, 105998. https://doi.org/10.1016/j.ypmed.2020.105998

Haroon, F., & Ghazanfar, M. (2016). Applications of food biotechnology. *Journal of Ecosystem & Ecography*, *6*(4), 215.

Siegrist, M., & Keller, C. (2011). Labeling of nanotechnology consumer products can influence risk and benefit perceptions. *Risk Analysis*, *31*(11), 1762-1769. https://doi.org/10.1111/j.1539-6924.2011.01720.x

Koen, N., Wentzel-Viljoen, E., Nel, D., & Blaauw, R. (2018). Consumer knowledge and use of food and nutrition labelling in South Africa: A cross-sectional descriptive study. *International Journal of Consumer Studies*, *42*(3), 335-346. https://doi.org/10.1111/ijcs.12422

Kwabena Osei, P., Ampong Domfe, C., & Kojo Anderson, A. (2024). Consumer awareness, knowledge, understanding, and use of nutrition labels in Africa: A systematic narrative review. *Sage Open*, *14*(2). https://doi.org/10.1177/21582440241241982

Mahgoub, S., Lesoli, P., & Gobotswang, K. (2007). Awareness and use of nutrition information on food packages among consumers in Maseru (Lesotho). *AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT*, *07*(06), 001-016. https://doi.org/10.18697/ajfand.17.2585

Marchini, A., Riganelli, C., Diotallevi, F., & Polenzani, B. (2021). Label information and consumer behaviour: Evidence on drinking milk sector. *Agricultural and Food Economics*, *9*(1). https://doi.org/10.1186/s40100-021-00177-5

Modo. Consumer Perception and Use of Nutritional Labeling during Purchase. https://www.academia.edu/9976739/Consumer_Perception_and_Use_of_Nutritional_Labeling_During_Purchase

Moss, J. (2006). Labeling of trans fatty acid content in food, regulations and limits—The FDA view. *Atherosclerosis Supplements*, *7*(2), 57-59. https://doi.org/10.1016/j.atherosclerosissup.2006.04.012

Musicus, A. A., Hua, S. V., Moran, A. J., Duffy, E. W., Hall, M. G., Roberto, C. A., Dillman Carpentier, F. R., Sorscher, S., Wootan, M. G., Smith Taillie, L., & Rimm, E. B. (2022). Front-of-package claims & imagery on fruit-flavored drinks and exposure by household demographics. *Appetite*, *171*, 105902. https://doi.org/10.1016/j.appet.2021.105902

Nguyen, A. T., Parker, L., Brennan, L., & Lockrey, S. (2020). A consumer definition of eco-friendly packaging. *Journal of Cleaner Production*, *252*, 119792. https://doi.org/10.1016/j.jclepro.2019.119792

Ogle, A. D., Graham, D. J., Lucas-Thompson, R. G., & Roberto, C. A. (2017). Influence of cartoon media characters on children's attention to and preference for food and beverage products. *Journal of the Academy of Nutrition and Dietetics*, *117*(2), 265-270.e2. https://doi.org/10.1016/j.jand.2016.08.012

Priya, K. M., & Alur, S. (2024). Examining nutrition label knowledge, self-efficacy, and nutrition facts panel usage. *IRJMS*, *5*, 251-262.

Purnomo, I. A., Pratikto, H., & Suharsono, N. (2024). The influence of halal certification and halal awareness on purchasing decisions. *East Asian Journal of Multidisciplinary Research*, *3*(4), 1567-1578. https://doi.org/10.55927/eajmr.v3i4.8861

Relawati, R., Ariadi, B. Y., & Purwono, B. S. A. (2020). The Factors Affecting Green Consumer Behavior: Evidence from Malang, East Java, Indonesia. *TEST Engineering & Management*, *82*(1-2), 7560-7570.

Rossi, C., & Rivetti, F. (2023). Young consumers' purchase behaviour of sustainably-labelled food products. What is the role of scepticism? *Food Quality and Preference*, *105*, 104772. https://doi.org/10.1016/j.foodqual.2022.104772

Ryan, C. D., Henggeler, E., Gilbert, S., Schaul, A. J., & Swarthout, J. T. (2024). Exploring the GMO narrative through labeling: Strategies, products, and politics. *GM Crops & Food*, *15*(1), 51-66. https://doi.org/10.1080/21645698.2024.2318027

Shamim, K., Khan, S. A., & Ahmad, S. (2020). Consumers' understanding of nutrition labels for ultra-processed food products. *Journal of Public Affairs*, *22*(1). https://doi.org/10.1002/pa.2398

Song, Y., Qin, Z., & Yuan, Q. (2019). The impact of eco-label on the young Chinese generation: The mediation role of environmental awareness and product attributes in green purchase. *Sustainability*, *11*(4), 973. https://doi.org/10.3390/su11040973

Stoltze, F. M., Busey, E., Taillie, L. S., & Dillman Carpentier, F. R. (2021). Impact of warning labels on reducing health halo effects of nutrient US Food and Drug Administration. Changes to the Nutrition Facts Label. 2022.

US Food and Drug Administration. The New and Improved Nutrition Facts Label-Key Changes. 2018. https://www.fda.gov/media/99331/download

Wang, X. (2024). The impact of food nutrition labels on consumer behavior: A cross-national survey and quantitative analysis. *International Journal of Public Health and Medical Research*, *1*(2), 18-27. https://doi.org/10.62051/ijphmr.v1n2.03

Wei, H., Jiang, K., Liu, B., Hu, Z., Zhao, Y., Xu, H., Sharma, M., & Pu, C. (2022). Understanding and use of nutrition labels of Prepackaged food by University students: A cross-sectional study in Chongqing, China. *Nutrients*, *14*(19), 4189. https://doi.org/10.3390/nu14194189

Yang, S., Suhandoko, A. A., & Chen, D. (2020). Impact of nutritional information on consumers' willingness to pay for meat products in traditional wet markets of Taiwan. *Foods*, *9*(8), 1086. https://doi.org/10.3390/foods9081086

Zafar, M. Z., Shi, X., Yang, H., Abbas, J., & Chen, J. (2022). The impact of interpretive packaged food labels on consumer purchase intention: The comparative analysis of efficacy and inefficiency of food labels. *International Journal of Environmental Research and Public Health*, *19*(22), 15098. https://doi.org/10.3390/ijerph192215098

Zhao, J., Butt, R. S., Murad, M., Mirza, F., & Saleh Al-Faryan, M. A. (2022). Untying the influence of advertisements on consumers buying behavior and brand loyalty through brand awareness: The moderating role of perceived quality. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.803348