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Perceptions towards gluten free products among consumers: A narrative review

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ABSTRACT

The number of individuals purchasing gluten-free products is increasing worldwide for various reasons, including celiac disease, gluten intolerance, or following food trends. Our objective was to conduct a review regarding the consumers' perception on the availability, price, quality, and knowledge about gluten free products. This narrative review screened the databases and identified 26 published research articles on the topic. These articles were analyzed to examine associated parameters, such as availability, price, quality, and consumer knowledge on gluten-free products. The findings highlight the ongoing challenges faced by consumers of gluten-free products, including limited availability, higher prices, issues with product quality, and gaps in knowledge. Addressing these challenges is essential to improve the overall experience of individuals with gluten-related concerns.

1. Introduction

Gluten, a protein found in wheat, barley, and rye, acts like a glue, giving dough its characteristic elasticity (Lebwohl et al., 2017). The FDA (Food and Drug Administration) defines "gluten-free" not as complete absence, but as containing less than 20 parts per million (ppm) of gluten, measured by validated scientific methods (Food & Drug Administration, 2023). Celiac disease, the most common form of gluten sensitivity affecting 1 % of the global population, is an autoimmune reaction in the small intestine triggered by gluten ingestion. This can lead to inflammation and potential complications if left untreated (Lebwohl et al., 2018). The global demand for gluten-free products has increased by approximately 16 % between the years of 2018 and 2022 making them one of the top 10 food trends existing nowadays. However, according to a study done in Santa Catarina State, Brazil, a total of 71 % of the participants in the study found it moderately to highly difficult to find gluten-free products; although there is increased awareness among the celiac disease patients', the challenge persists in its limited availability (Nascimento et al., 2014). Moreover, a survey done in Canada showed that purchasing gluten-free products has declined by 61.1 % because of the high cost of commercially prepared gluten-free products, revealing the effect that the increasing costs have on the purchasing ability of consumers in comparison to their gluten-containing counterparts (Kulai & Rashid, 2014). In this review, 27 published articles on gluten-free products were identified and analyzed in terms of availability, quality, price, knowledge about gluten-free products, and challenges faced by disease patients and gluten-free consumers. This review provides a comprehensive overview of the challenges faced by consumers when purchasing gluten-free products, emphasizing the critical need for affordable options for individuals with celiac disease or gluten sensitivity. It highlights the importance of assessing various substitutes and their costs for specific populations and calls for stakeholders and policymakers to consider adjusting regulations. Additionally, the review sheds light on market trends and consumer behavior, offering data that can help manufacturers and retailers better understand their customer base. This insight can inform pricing strategies that leverage economies of scale, making gluten-free products more accessible and affordable.

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2. Methods

This review aimed to comprehensively analyze existing research articles related to gluten-free products. The following inclusion and exclusion criteria were employed to identify relevant studies.

2.1. Inclusion criterion

- **Gluten-Free Products:** Articles that addressed perceptions towards gluten-free products among consumers

2.2. Exclusion criteria

- **Non-Gluten-Free Product Studies:** Articles that did not primarily focus on gluten-free products or did not include substantial information regarding such products.
- **Non-Peer-Reviewed Articles:** Non-peer-reviewed articles, conference abstracts, and other forms of literature that did not undergo a rigorous peer-review process.

2.3. Data extraction

26 articles were identified through literature searches conducted in electronic databases such as PubMed, Scopus, and Web of Science. The search strategy involved combining relevant keywords related to perceptions to gluten-free products.

2.4. Analysis

The selected articles were thoroughly reviewed, and relevant data were extracted for analysis. Factors such as the availability, pricing, quality, and consumer knowledge regarding gluten-free products were examined. The findings were synthesized to provide a comprehensive overview of the current state of gluten-free products, shedding light on challenges and potential areas for improvement.

2.5. Literature review

2.5.1. Availability

Gluten-free consumers face a growing challenge as they strive to adhere to their strict dietary requirements (Dimassi et al., 2020). This limited availability is evidenced by studies utilizing questionnaires that surveyed consumer experiences (Nascimento et al., 2014; Pereira & Tavares, 2019). One major cause of the gluten-free consumers' struggle is the limited availability of an array of gluten-free products in the supermarkets. A study done by Nascimento et al. (2014) assessed the availability of different varieties of gluten-free products in Brazil. Out of the 91 respondents, 71 % had moderate to high difficulty in locating the gluten-free products that they wanted to purchase. The questionnaire revealed that dissatisfaction with the products was highly correlated with their limited variability and availability along with their increasing prices (Nascimento et al., 2014). A study conducted by Pereira and Tavares in 2019 has also further discussed the difficulties gluten-free consumers face. The study indicated that there was low availability of gluten-free products in local stores and supermarkets in comparison to glutenous products (Pereira & Tavares, 2019). An additional example is a study conducted in the UK by Potter et al. in 2014; it revealed within their findings that bread, which is an important staple, was rarely available in retail stores and was only accessible through a prescription. Another study by Alencar et al. (2021) examined satisfaction with the gluten-free products found in supermarkets in relation to their availability. The participants expressed their frustration with having to resort to ready-made gluten-free products due to their availability. The unavailability of gluten-free products meeting the quality standards made them resort to ready-to-eat products that naturally do not contain gluten. Nevertheless, the limited availability of gluten-free products, especially products of appropriate sensory characteristics and quality standards was observed. Additionally, it was also seen that limited availability ranks as one of the most important factors in affecting adherence to gluten-free (GF) especially in Iran (Taghdir et al., 2016). In reference to the study, 65 diagnosed celiac disease (CD) individuals were assessed based on their adherence to GF diet and it was found that almost 100 % of participants reported poor or complete unavailability of GF products. Similar results were observed in another study that was conducted in Brazil in the Federal District by Araújo and Araújo (2011) which included 105 participants diagnosed as celiac patients. Unlike tropical sprue, celiac disease usually spares the terminal ileum rather than involving the entire length of the small intestine (Sharma et al., 2019). The study results revealed that 74.49 % of the participants expressed dissatisfaction with the variety and availability of the gluten-free products. Also, differences in GF products availability between rural and urban areas have been observed. A study conducted in the Rural Maritime Provinces revealed the impact of the location of the consumer on the availability of the products (Jamieson et al., 2018). The study reported that the average number of gluten-free products per store was four times greater in urban areas compared to rural areas (Jamieson et al., 2018). However, the growing trend of gluten-free products, especially those marketed with nutritional claims, has had a positive impact. According to a study conducted by Jamieson et al. (2018) showed how this trend has improved accessibility for consumers who need gluten-free products due to health issues or sensitivities. In other words, the increased availability and marketing of gluten-free products with nutritional benefits have been beneficial for individuals with gluten-related concerns. Limited availability was also revealed in e-commerce platforms. A study conducted in Morocco by Guennouni et al. (2020) was able to assess the availability and cost of the GF products across supermarkets and e-commerce platforms in two cities: Marrakesh and Casa Blanca. The study's results disclose the viewpoint of the consumers that declared facing difficulty finding GF products due to its limited availability across both cities and high cost. These findings reveal that consumers face challenges related to both limited availability and high costs of GF products. To address these issues, several recommendations can be considered. Firstly, introducing an availability index that quantifies the proportion of GF products within the overall bread variety would be beneficial. For instance, designating 10 % of the bread assortment as GF could serve as a "limited availability" threshold. By tracking this index, it becomes easier to assess the presence of GF options in the market. Secondly, strategic allocation plays a crucial role. Allocating a specific portion of shelf space or product offerings exclusively for GF items can enhance their visibility. Dedicated sections within supermarkets or bakeries would help consumers identify and access GF options more readily. Thirdly, collaboration with food manufacturers and retailers is essential. By promoting the production and availability of GF alternatives, consumers will have a wider range of choices. Collaborating with local suppliers can further expand the availability of GF products. Lastly, exploring ways to make GF items more affordable, such as negotiating with suppliers or advocating for subsidies, can improve accessibility.

2.5.2. Price

In reference to what was previously mentioned on high cost, gluten-free products like pasta cost more than double the price of conventional products (Rahi et al., 2022; Gorgitano & Sodano, 2019). Consumers of GF products are concerned about their costs. For example, in Australia, low–average income families cannot afford a GF healthy food basket because it is estimated to be 5.78 % to 16.67 % more expensive than a gluten-containing healthy food basket (Lambert & Ficken, 2016). Similarly in Canada, GF products are twice the price of 'regular' wheat-based products (Pinto-Sanchez et al., 2015). Following a gluten-free diet in Chile incurs an additional monthly expense of around €80.00 (Estévez et al., 2016). In some countries like Italy, to ensure the well-being of people diagnosed with Celiac disease, they provide them

with a monthly expense contribution to purchase gluten-free products included in the National Register (NR)'s list of foods suitable for celiac people drawn up by the Italian Ministry of Health (IMH);a luxury that consumers in Lebanon do not have (Gorgitano & Sodano, 2019). This financial support significantly alleviates the economic burden of maintaining a gluten-free diet, hence, it is recommended that policymakers in Lebanon consider implementing a subsidy program or financial assistance like that in Italy. Such a program could include a list of approved gluten-free products and provide monthly financial support to individuals diagnosed with Celiac disease. Additionally, unlike in developed countries, where the economic burden and accessibility of gluten-free products are well-documented, these factors remain unknown in many developing countries (Hassan et al., 2017; Karam et al., 2021; Dimassi et al., 2021; Arias-Gastelum et al., 2018).

2.5.3. Quality

As mentioned, not only are gluten-free products limited in terms of availability, but they also lack appropriate sensory characteristics and quality measures that consumers strive for. The primary areas of concern in the study when it came to the quality inquired were about the taste, texture, aroma, and overall quality (Potter et al., 2014). Although the popularity of gluten-free products is increasing, limited attention is addressed towards the opinions of the consumers on the gluten-free products and whether they are meeting the quality measures (Dimassi et al., 2021; Aljada et al., 2021; Elrahi et al., 2023). Various studies have highlighted significant nutritional deficiencies associated with a gluten-free diet (GFD). Aljada et al. (2021) reported that 70 % of children with celiac disease (CD) were vitamin D deficient at diagnosis, with only slight improvement after six months on a GFD. Additionally, women on a GFD consumed only 46 % of their daily fiber, 44 % of their iron, and 31 % of their calcium needs, while men consumed 88 % of their fiber, 100 % of their iron, and 63 % of their calcium requirements. The difference in quality leads to the general preference of consuming gluten-containing products rather than products that are gluten-free. For instance, a study showed that consumers favored the standard wheat breads over gluten-free counterparts regardless of the health and taste interests without knowing what products contained or did not contain gluten (Magano et al., 2022). The study found that people automatically found the aroma of gluten-free products less acceptable once they knew that they were gluten-free. The sensory characteristics were found to be the main influence on their purchasing choice; they believed that although gluten-free products are "healthier," they are also less tasty. Furthermore, a study by Alencar et al. (2021) identified several sensory parameters that should be taken into consideration when developing new gluten-free products; results show the consensus on the need to improve the texture of the bread to make it moister and softer as well as the need to improve the taste. A study done by Ike (2024) addressed how these challenges can be tackled from a manufacturer through experimentation with alternative ingredients and processing methods. For example, incorporating hydrocolloids, such as xanthan gum or guar gum, can enhance the moisture and elasticity of gluten-free bread, or using a combination of different gluten-free flours, such as rice, tapioca, and sorghum, to improve the overall texture and flavor (Ike, 2024)." These disturbances in the sensory characteristics of the gluten-free products are affecting the purchasing decisions that the consumers are taking (Potter et al., 2014). To elaborate more on the quality's impact, they investigated the perception and quality of gluten-free bread found in the UK market through multiple quality and sensory tests. The results indicated that the consumers' expectations of these gluten-free breads were constantly disappointing and did not meet the expectations desired (Potter et, al.,2014). Similarly, findings from a study done by Manzatti in 2021 revealed that taste and texture were the two main categories that the purchased gluten-free products lacked. This underscores the need to improve awareness about the health benefits of gluten-free products. However, the study further mentions that although gluten-free products lack these sensory characteristics, gluten-free consumers still rely on ready-to-go gluten-free meals rather than preparing them alone. This is related to its critical requirements for high quality and safe products. According to Manzatti et al. (2021), gluten-free products must meet stringent sensory and nutritional standards to be considered acceptable by consumers. The study highlights that gluten-free products often face challenges in achieving the desired texture, taste, and nutritional profile, which are critical for consumer acceptance. These products need to ensure not only the absence of gluten but also maintain a balance of essential nutrients such as fiber and protein, which are often found in lower quantities compared to gluten-containing products. Ensuring high quality and safety in gluten-free products is essential for meeting consumer expectations and dietary needs (Manzatti et al., 2021). They also contain higher amounts of saturated fat, carbohydrates, and salt. In terms of micronutrients, gluten-free products are not enriched with essential vitamins and minerals like folate, iron, niacin, thiamin, and riboflavin Kolai and Rashid (2014). Additionally, individuals who follow a gluten-free diet (GFD) have been found to exhibit elevated concentrations of heavy metals, specifically arsenic, and mercury, in their blood and urine compared to those who do not follow a GFD. Consequently, GFD has been associated with potential health risks, including micronutrient deficiencies, hyperlipidemia, hyperglycemia, and coronary artery disease (Gorgitano & Sodano, 2019). Hence, ensuring that gluten-free products are fortified and enriched with essential micronutrients should be prioritized.

2.5.4. Knowledge

In addition, limited knowledge of gluten-free products also influences the consumer's perceptions towards the products (Magano et al., 2022). A study done in 2019 by Gastroenterology Nursing interpreted the adherence of gluten-free consumers based on assessing their knowledge resulted in appearance of significantly lack of awareness and education (Paganizza et al., 2019). For example, it was evident that limited knowledge played a vital role in consuming gluten-free products as it has been noticed that GF consumers perceive these products as "healthier;" unaware of how they have been proved to be nutritionally inferior to other products (Arslain et al. 2021). Similarly, a study by Prada et al. (2019) highlighted the limited knowledge on gluten-free products by assessing the perception of the consumers on the main scope of the gluten-free products. Prada et al. (2019) highlight image cues' influence on consumer perception of gluten-free products' health. However, for informed choices on increasing gluten-free intake, consumers need data on true nutritional value and debunking health myths. (Prada et al., 2019). Additionally, a study by Sylvester et al. (2016) assessed the relationship between the correct knowledge of gluten-free products and the adherence to a gluten-free diet. The study also showed that people tend to overestimate their adherence to the gluten-free diets due to limited knowledge causing them to ingest different amounts of gluten in various products; even if individuals believe they are strictly adherent, their limited knowledge of the products ultimately leads to the consumption of gluten that was uncalled for (Sylvester et al., 2016). The limited knowledge was linked to limited media coverages and health concerns among populations as stated by Taşkin and Savlak (2021). This study showed that a knowledge gap existed among comparing Turkish and other countries such as the UK validating the presence of different knowledge levels. This knowledge gap was unrelated to education level. Rather, it highlighted the participants' difficulty in identifying the meaning of the disease 'celiac' and the specific parameters, such as the 20-ppm threshold, that qualify a product for the 'gluten-free' label. Moreover, another study assessed how knowledge of consumers on GF products through verbal and non-verbal claims affected the consumers' purchasing choices. Due to the limited knowledge, consumers trusted verbal claims on the packaging more than non-verbal gluten-free symbols as they were able to recognize three out of eight of them by excluding the rest of the symbols from the gluten-free batch. Their restricted knowledge of gluten-free labels affected their decisions while purchasing the products

(Sielicka-Rozynska et al., 2021). Furthermore, it has been shown that not adhering to the GF diet could be related to the inability to thoroughly understand the food labels as most consumers were found to purchase GF products upon seeing the additional logos especially if it indicated a "vegan" label (Zysk et al., 2019). This study showed that new uprising trends have an influence more powerful than knowledge itself on GF consumers not diagnosed with celiac disease in choosing their products. As for celiac patients, it is noteworthy to mention the maximum limit of gluten in products should be less than 20 ppm when tested, failing to reach this level implicit harm on the consumers (White et al., 2019). The study assessed that the knowledge of the celiac patients, and it was poor as their adherence to their diets were based on support from associations, logic, social media, and the internet which also affected their perception of some products ((Paganizza et al. 2019)). Noticeably, people tend to overestimate their adherence to the gluten-free diets due to limited knowledge causing them to ingest different amounts of gluten in various products; even if individuals believe they are strictly adherent, their limited knowledge of the products leads to the consumption of gluten that was uncalled for (Sylvester et al., 2016). Given these findings, it is crucial to enhance consumer education on gluten-free products through targeted awareness campaigns and improved labeling practices. By providing accurate information and increasing awareness, consumers can make better-informed decisions, improving adherence to a gluten-free diet and reducing unintended gluten consumption (Myhrstad et al., 2021).

2.5.5. Challenges faced by celiac disease patients and gluten-free customers

The critical challenges identified by Aljada et al. (2021) include ensuring the nutritional adequacy and affordability of gluten-free products. To address these issues, individuals adhering to a gluten-free diet (GFD) should prioritize naturally gluten-free foods such as meat, fish, vegetables, fruits, and nuts. Additionally, it is imperative that gluten-free products on the market are made more affordable and of higher nutritional quality. This could be possible by advocating for government subsidies for gluten-free products or encouraging food manufacturers to invest in research and development to enhance the nutritional profile of gluten-free options. Moreover, it is essential for a consumer to have a proper insight on balanced nutrition and product selection. This could be achieved by opening a platform for the consumer to properly reach needed information to have a proper selection rather than enhance one's knowledge. Therefore, manufacturers must improve the nutritional content of gluten-free options and adhere to stricter regulations to better meet the needs of those with gluten allergies or celiac disease. ople who must abide by a gluten-free diet may consume it from a range of naturally gluten-free foods like meat, fish, vegetables, fruits, and nuts or from dietetic gluten-free foods found in the market. These products extend dietary variety beyond staples like bread and baked goods, encompassing a wider range of options like pastas, cereals, snacks, and prepared meals. Unfortunately, multiple challenges currently hinder access to such products for gluten-free consumers More than one challenge faces gluten-free consumers. Gorgitano and Sodano (2019) stated that based on the implementing Regulation (EU) No. 828/2014, a product can be labeled 'gluten-free' only when the food contains no more than 20 mg/kg of gluten; while the statement 'very low gluten' can be added only when the food has no more than 100 mg/kg of gluten. The first concern is that certain gluten-free labeled food products might not abide by the regulation and exceed the allowed quantity, while others might be subject to cross-contamination.

Cross contamination of gluten-free products might occur during the production process starting from the field till it is packaged and sent to stores (Weiser et al., 2021). Weiser et al. (2021) reported the results of a few studies done in different markets and countries on gluten-free labeled products. A study was done in the United States on gluten contamination found that 59 % of the products contained less than the limit of the gluten level, 41 % contained gluten levels ranging from 8.5 to 29.25 mg (about the weight of a grain of rice)/kg, and 32 % exceeded 20 mg/kg and are not to be classified as gluten-free. Another study done in Canada on naturally gluten-free ingredients indicated that 61 of the 640 samples (9.5 %) were contaminated with gluten above 20 mg/kg. A study done in Brasilia covering 25 bakeries revealed that 22 % of the samples selected were contaminated with gluten above 20 mg/kg. Future research is necessary to further evaluate the quality, affordability, and consumer knowledge of gluten-free products, alongside investigations into stricter regulations for product safety.

3. Conclusion

In this review, multifaceted challenges encountered by individuals opting for a gluten-free diet were addressed. Key challenges include the limited availability and higher costs of gluten-free products, the inferior sensory attributes of gluten-free products affect consumer preference and choice. Addressing these challenges by enhancing the quality and accessibility of gluten-free products is crucial for improving consumer acceptance and adherence to a gluten-free diet. Additionally, subsidizing gluten-free products through health commissions in Lebanon and other countries can enhance affordability and accessibility, ensuring that those with gluten intolerance or celiac disease have better access to necessary dietary options. There is also a noticeable gap in consumer knowledge regarding gluten-free products and labeling. Furthermore, product safety is a critical issue, particularly due to the risks of cross-contamination and mislabeling in gluten-free products. Hence, collaborative efforts among food producers, regulators, and healthcare professionals are crucial to address the common challenges. By improving the availability, quality, affordability, and safety of gluten-free products, and increasing public knowledge, we can significantly enhance the well-being of those dependent on gluten-free diets. The following can be achieved by further researching and evaluating the key elements discussed. These

CRediT authorship contribution statement

Hussein F. Hassan: Writing – review & editing, Writing – original draft, Project administration, Investigation, Data curation, Conceptualization. **Lydia Mourad:** Writing – review & editing, Writing – original draft, Data curation. **Narjes Khatib:** Writing – review & editing, Writing – original draft, Data curation. **Ranim Assi:** Writing – review & editing, Writing – original draft, Data curation. **Shaymaa Akil:** Writing – review & editing, Writing – original draft, Data curation. **Sami El Khatib:** Writing – review & editing, Writing – original draft, Data curation. **Rasha Hteit:** Writing – review & editing, Writing – original draft, Validation, Data curation.

Declaration of competing interest

No conflict of interest.

Data availability

No data was used for the research described in the article.

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