

# Navigating Dietary Complexities: Understanding Gluten Intolerance Awareness among Stakeholders

Sakshi Sharma<sup>1</sup> and \*Kriti Sen<sup>2</sup>

<sup>1</sup>Lecturer, Institute of Hotel Management Catering and Nutrition, Pusa, New Delhi,

<sup>2</sup>Inspire- Manager in Training, Sofitel Mumbai BKC

sakshish2008@yahoo.com, \*kritisenihmp@gmail.com

## Abstract

**Background:** Eating out is not only a common trend these days but also necessity for many who live away from their families especially students pursuing higher education. With growing trend of food hypersensitivity catering industry needs to get driven for such special requirement. **Objective:** This study aimed to check the awareness of stakeholders for gluten intolerance with respect to the market and sensory evaluation of the developed alternative. **Methodology:** A cross-sectional study was conducted on consumers and food business operators of Central Delhi. Consumers were 18 years and above and claiming to be gluten intolerant. Food business operators were local shopkeepers running food stalls and bakery. A self-structured questionnaire was designed for stakeholders respectively. Developed gluten alternative was sensory evaluated by consumers on 9-point hedonic rating scale for its overall acceptability. Data was analyzed for the stakeholders by using descriptive statistics. **Results:** The results indicate that majority (53.65%) consumers were familiar with the symptoms of gluten intolerance like headache and digestive issues. Furthermore, majority (68.3%) identified rice and corn to be an alternative for gluten. Level of satisfaction from market for availability of alternatives is medium (61%). Sensory score for developed alternative was  $7.19 \pm 1.53$ . Regarding food business operators' majority (53.12%) receive customer request for availability of gluten free products, 46.87% are affirmative to provide alternatives subjected to demand of consumers. 53.12% also showcased interest in receiving training or resources for gluten intolerance and lactose free cooking skills and outsourcing of such food items. **Conclusion:** In general stakeholders showcased awareness about their food intolerance and improved availability of alternatives in market. At the same time willingness of food business operators to offer such products on menu. The study recommends to provide training to food business operators for provision of diversified menu for prospective consumers.

**Keywords:** Gluten free, gluten intolerance, food hypersensitivity, stakeholders, food business operators, alternatives, consumer

## Introduction

An adverse reaction of the immune system after consumption of food or any specific ingredient is known as food allergy (Kaya et al., 2013). Any food can lead to food allergy symptoms which vary from itching, eczema, digestive issues like bloating, nausea, vomiting, diarrhea, abdominal cramps (Morita et al., 2013; Venter et al., 2012). Majority it is found to be milk, nuts, egg, wheat, fish, soyabean etc. (Yue et al., 2018) The reactions to such allergens are seen

within minutes or hours which can be deleterious for person's health (Gupta et al., 2016). Consumer suffering from any hypersensitivity need to be very conscious for food choices thus they need accurate information about food ingredients, method of production and made on what type of machines where other allergic foods are also processed (Soós & Lugasi, 2024). Thus eating out for such consumers becomes a challenge, and in their decision making food business

operator play a very significant role (Endres et al., 2020). With current globalization eating out is a trend and in such cases of food allergy it can be a threat to health if consumers do not get adequately informed (Barnett et al., 2018). Food business operator awareness, willingness to incorporate dietary alternatives can benefit a larger segment of such consumers.

Krishna et al. (2020) study examined food allergens' impact on Indian society, revealing widespread unawareness despite allergic disorders affecting 25% of the population, including 10% of children with food allergies. Makharia et al. (2010) revealed a higher prevalence of celiac disease in the North Indian community with an estimated prevalence of 1 in 96 individuals. These results underscore the importance of increased awareness and diagnostic efforts for celiac disease in India, indicating a need for improved screening and management strategies to address this significant health concern.

Despite regulations, many menus lack proper allergen information. Strategies like educating peers and advocating for better allergen labelling on restaurant menus can significantly contribute to consumer safety (Aljameel et al., 2023). Consumer get satisfied with written information and this aids in making informed choices (Barnett et al., 2018). Versluis et al. (2014) reported that major accidental allergen ingestion occurs when eating out in restaurants, work place and school canteens.

Hossny et al. (2019) advocated that there is a need for directing sufficient resources towards public health education and training of healthcare providers to effectively manage food allergies. Wen and Kwon (2017) highlighted that staff of restaurants lack in food allergies knowledge and think that knowing and preventing is largely responsibility of customers. As per Soós and Lugasi (2024) findings a large proportion of consumers find that the information regarding food allergen is provided to them inadequately by the restaurant staff. Consumers prefer asking restaurant staff for presence of allergens in food, thus considering them an additional source of information (Barnett et al., 2018).

To reduce environmental triggers, improve access to quality care, and establish formal allergy training programs to enhance understanding and diagnosis of allergic diseases, Krishna et al. (2020) calls for public health measures.

Hossny et al. (2019) emphasized the importance of support from governments, scientific partnerships, and funding from global organizations to enable physicians in the developing world to address challenges effectively. Furthermore, it advocated for directing sufficient resources towards public health education and training of healthcare providers to effectively manage food allergies. Makharia et al. (2010) study underscore the importance of increased awareness and diagnostic efforts for celiac disease in India, indicating a need for improved screening and management strategies to address this significant health concern. For ensuring support to consumers food preparation staff need effective communication system for their adequate training so as to make consumer feel more confident when eating out (Begen et al., 2016).

The research aims at finding the level of awareness of gluten intolerance among the people of the nation. Celiac disease also known as gluten intolerance accounts for less than 1% of the allergens are nothing but microscopic substances and organisms that can have fatal consequences. In the wake of COVID-19 it has become even more important to ensure that safety is ensured while indulging in eating habits. The research aims to help increase the level of awareness among people and help them lead a more conscious and healthier life. Researching the awareness of gluten alternatives among food business operators in Delhi holds significant implications for both market understanding and consumer health concerns. This investigation provides critical insights into emerging market trends and the increasing demand for dietary alternatives driven by the growing prevalence of gluten and lactose intolerance. Understanding the level of awareness among food business operators offers valuable information about the accessibility of such products to consumers and potential challenges within the supply chain. Moreover, conducting a survey among respondents, particularly those with gluten intolerance, allows for a deeper understanding of their preferences, behaviors, and challenges in finding suitable alternatives. This data not only informs product development strategies but also helps in tailoring marketing approaches to target the specific needs of the consumer segment. By providing viable alternative to traditional gluten containing products, this research contributes to promoting health-conscious dietary choices and improving the quality of life for individuals with dietary restrictions. Ultimately, this research not only serves to address consumer needs but also presents business opportunities for local food store

owners to expand their product offerings and attract a wider customer base in the competitive food industry landscape.

### Objectives

1. To assess the level of awareness of stakeholders with regard to gluten intolerance and its alternatives available in market.
2. To conduct sensory evaluation of the developed gluten free alternative product.

### Methodology

**Research Design:** Cross sectional design was adopted for the work where awareness of consumers and food business operators was studied for gluten intolerance in terms of availability of alternatives and willingness for provision of alternatives to consumers.

**Locale:** The area selected for the work was Central Delhi as it gives access to diverse range of people.

**Sampling Design:** Non probability method of sampling method was adopted. For checking the awareness of subjects for gluten intolerance and alternatives availability (n=41) subjects enrolled were gluten intolerant and aged 18 years and above. For awareness regarding food intolerance and willingness to provide alternatives (n=33) food business operators (local shop owners and bakeries) were surveyed. For sensory evaluation of the developed product (n=31) volunteered participants were selected. All the subjects were made part of the study after an informed consent.

**Tools and Technique:** For finding the awareness a self-structured questionnaire was developed separately for gluten intolerant subjects and food business operator which was pilot tested on the selected group of people. All the questions were closed ended. Trials for development of gluten free product were conducted in the commercial bakery and then the standardized. Sensory evaluation was done by using a 9point Hedonic Rating Scale was used where the scale ranged from like extremely to dislike extremely.

Consumer questionnaire was conducted both one on one and via online mode. Data from food business operator was obtained by visiting their outlets. Sensory evaluation done on volunteers, were asked to clean their palate before evaluation,

sit comfortably and evaluate the developed product which was gluten free pizza base.

**Data Analysis and Statistical Analysis:** The data of consumers and food business operator has been treated separately for awareness and evaluation of product. Descriptive analysis has been applied to study the findings of work.

### Results and Discussion

Consumer awareness for gluten intolerance and demand for gluten free alternatives was assessed from subjects who were suffering from gluten intolerance where majority (65.9%) of the subjects who participated in the study were 18-25 years old but and only 4.9% were more than 65 years old. Majority (53.7%) of the participants were female. As seen from table 1 majority (53.65%) of the subjects were familiar with the symptoms of gluten intolerance. Main symptoms observed by subjects were headache (53.7%), digestive issue (51.2%) like bloating, fatigue (41.5%) and only 2.4% were facing other symptoms apart from the list.

In a study by Aljameel et al. (2023) subjects were found to be highly aware about food allergens where female of age group 23 to 27 and 33 to 37 years was more aware in comparison to 18 to 22 year old. 74% were aware about the correct food allergy reactions. In current study too subjects were familiar with most of the symptoms as they were suffering from the intolerance.

**Table 1: Demographic Details of the Subjects**

Demographic parameters		Frequency(%)
Age (years)	18-25	27 (65.9)
	25-35	5 (12.2)
	35-45	2(4.9)
	45-55	2(4.9)
	55-65	3 (7.3)
	>65	2 (4.9)
Gender	Male	19 (46.3)
	Female	22 (53.7)
Familiarity with symptoms of gluten intolerance	Very familiar	22 (53.65)
	Somewhat familiar	19 (46.35)
	Not familiar at all	-

Demographic parameters	Frequency(%)
Symptoms faced by subjects	Percentage
Digestive issues	51.2
Fatigue	41.5
Headache	53.7
Joint pain	26.8
Skin problems	31.7
Mood swings	22
All of the above	22
None of the above	7.3
Others	2.4

Table 2 depicts awareness of consumers for availability of gluten alternatives in the market. It was observed that majority (68.3%) identified rice and corn as gluten alternative followed by quinoa and amaranth (58.5%). These findings highlight a need for further education and promotion of alternative grain and flour options to enhance dietary diversity and meet consumer preferences. Regarding challenges encountered by gluten intolerant subjects' majority (51.2%) reported social situations 41.5% considered limited food options and cross contamination as a challenge also 39% considered these to be costly. Majority (65.9%) of the subjects reported that it is somewhat easy to find gluten alternatives in the market. There is need to improve availability and accessibility of such grains. Level of satisfaction of majority (61%) subjects for available gluten alternative food products was found to be mediocre. Expanding the range of gluten free products in market and raising awareness of food business operators can help address these challenges, ensuring inclusivity and better satisfaction for consumers with dietary restrictions. This will also increase the dining experience of the consumers.

Consumers know what they are supposed to consume as alternative is similar to the findings of (Soós & Lugasi, 2024). Research by Conner et al. (2018) highlighted that people with openness trait have higher difficulty in managing their food allergies like problems while eating allergy free food, social aspects and psychological issues. Similar to this in the present work gluten intolerant consumers reported that social circumstances are one of the challenge faced by them. Bhukya and Paul (2023) mentioned that because of social influence such people find it difficult to be a part of event. Consumers find purchasing easier over eating at the restaurant (Soós & Lugasi, 2024). Aljameel et al. (2023) reported that consumer believe that they should be allowed by restaurants and café to make choices from the menu much more easy for better acceptability by people suffering from food hypersensitivity.

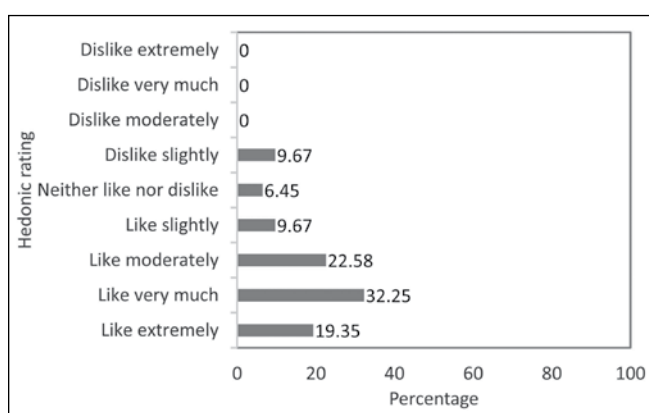
**Table 2: Awareness of Consumers for Availability of Gluten Alternatives in the Market**

Awareness of gluten alternatives	Percentage
Quinoa	58.5
Rice	68.3
Buckwheat	39
Amaranth	31.7
Millet	58.5
Corn	68.3
Oats	46.3
Almond flour	43.9
Coconut flour	29.3
Chickpea flour	29.3
Others	4.9
All of the above	9.5
None of the above	-
Challenges encountered	Percentage
Limited food options	41.5
Cross contamination	41.5
Social situations	51.2
Costly	39
All of the above	39
None of the above	-
Others	-
Ease of finding alternatives in nearby areas	Frequency (percentage)
Very easy	7 (17.1)
Somewhat easy	27 (65.9)
Not at all easy	7 (17.1)
Level of satisfaction with available alternative products	Percentage
Very satisfied	9 (22)
Somewhat satisfied	25 (61)
Not at all satisfied	7 (17.1)

Pizza is nowadays found to be one of the most acceptable food product amongst people of all age groups thus pizza base was considered for development of gluten alternative product. After the development of product by trial and error method, standardized pizza base was further considered for sensory evaluation from consumers where a 9-point hedonic scale was employed. Figure 1 depicts the results where majority (32.25%) found it to be overall acceptable and only 9.67% disliked it slightly which can be attributable to that it was only base whose acceptability was assessed. If the product is presented in final presentation form maybe

it turns out to be acceptable to larger number of people. Mean sensory score was found to be  $7.19 \pm 1.53$ . Masih et al. (2019) big data analysis emphasizes the importance of aligning product offerings with consumer sentiments, as these preferences significantly influence market dynamics and product innovation in the gluten-free foods sector. Pizza craze is ever growing amongst food lovers, its healthier alternatives are seen to be acceptable amongst consumer giving it as good overall acceptability on sensory evaluation (Kumar & Sharma, 2020).

**Figure 1: Sensory Evaluation of the Developed Gluten Free Pizza Base by the Consumers for Overall Acceptability**



**Table 3: Mean  $\pm$  SD for Sensory Score of the Developed Product**

Product	Mean $\pm$ SD
Gluten free pizza base	7.19 $\pm$ 1.53

The food business operators that participated in the study majority (65.62%) were running general food stalls who were catering to full square meals like breakfast, lunch and dinner to people, especially students followed by cafes (21.87%) and 12.5% were bakery operators. The area is popular for preparation of prestigious competitive examinations, thus consumer especially students in good number visit to these eateries for their daily food requirements. Bakeries are famous amongst people for the wide variety of offerings to relish apart from regular meals. The food business operators were questioned to assess their awareness about food intolerance, and willingness to provide alternatives to the consumer on daily and affordable basis who are suffering from such food intolerance specifically gluten and lactose intolerance. As for their daily dietary requirements they are dependent on such food business operators it becomes essential to bring awareness amongst them.

Regarding receiving inquiries from consumer for availability of gluten and lactose free options majority (53.12%) reported affirmatively that they do receive such requests however introducing alternatives remains uncommon in the mid-scale segment. Majority (43.75%) were somewhat familiar with gluten and dairy allergies followed by (31.25%) which was not at all familiar with the concept. There is a huge divide in the theoretical conception and the high-ended supermarkets and the eateries of the common man.

These findings suggest a significant level of receptiveness towards such alternatives, albeit with a notable portion of the sample expressing reservations. Further investigation into the underlying reasons behind these attitudes could provide valuable insights for decision-making regarding the introduction of gluten-free and dairy-free options. Willingness to introduce gluten and dairy free alternatives majority (46.87%) were receptive as it depends on the consumer demand. Business is about profit or at least reaching breakeven this suggest consumer has to show their interest so that food business operators efforts are worth. Majority believed that offering alternatives will attract consumers. On further investigating they reported products like bread, pastry, pasta, wrap can be some food items where they can think of giving alternatives as they mentioned these are demanded by consumers. When asked whether they are ready to receive any training or resources regarding gluten free and lactose free cooking skills and outsourcing such products majority (53.12%) responded affirmatively. This shows that there is a desire amongst them to attract more consumers and also to satisfy the people who are actually looking out for such alternatives which is really appreciative.

It has to be noted that as consumer awareness is increasing and their interest in their upkeep and overall health is ever rising food business operators need to become competitive to satisfy such consumer as Aljameel et al. (2023) reported in their work that consumer showcase interest in visiting those restaurants and café which list all allergens on their menu. There is a pressing need for comprehensive approaches and collaborative efforts to address the complex and evolving landscape of food allergies in the modern world (Hossny, et al., 2019), present work also aligns with it wherein food business operators reflect the receptiveness for training and resources. Reliable information is very important for consumer suffering from food hypersensitivity so food business operators have to be equipped be current trends of the consumer for their

positive business (Soós & Lugasi, 2024). Food handling staff showcase poor knowledge to provide allergen safe meals to the consumer (Common et al., 2103)

**Table 4: Perception of Food Business Operators**

Parameters		Frequency (%)
Type of food stalls		
	Bakery/baked goods	4 (12.5)
	General food stall	21 (65.62)
	Café	7 (21.87)
Encountered inquiries from consumer for gluten and dairy free options		
	Yes	17 (53.12)
	No	15 (46.85)
	Familiarity with gluten and dairy allergies	
	Very familiar	8 (25)
	Somewhat familiar	14 (43.75)
	Not at all familiar	10 (31.25)
Willing to introduce gluten and dairy alternatives in menu		
	Yes, definitely	10 (31.25)
	Depends on customer demand	15 (46.87)
	No	7 (21.87)
Offering alternatives will attract tolerant customers		
	Yes	14 (43.75)
	No	6 (18.75)
	Not sure	12 (37.5)
Interested in receiving training for alternatives		
	Yes	17 (53.12)
	No	3 (9.37)
	Maybe, depend on availability	12 (37.5)
	All of the above	9.1
	None of the above	21.2
	Reasons for not offering alternatives in the menu	
	Concern about cost and profit	15.2
	Lack of knowledge	24.2
	Limited storage space	6.1
	Lack of demand	42.4
	All of the above	24.2

Offering alternatives will attract tolerant customers		
	Yes	14 (43.75)
	No	6 (18.75)
	Not sure	12 (37.5)
	Interested in receiving training for alternatives	
	Yes	17 (53.12)
	No	3 (9.37)
	Maybe, depend on availability	12 (37.5)

## Conclusion

The study underscores the importance of addressing the needs of individuals with food intolerance in the local food market. Despite the prevalence of these dietary restrictions, awareness and availability of suitable alternatives remain limited. Through survey, it was evident that while there is a willingness among food business operators to learn and introduce alternatives, there is still a gap between awareness and action. However, the sensory evaluation of newly developed alternative products yielded promising results, indicating potential acceptance among consumers thus food business operators can be educated further as per willingness which will set the momentum for a healthy India. It becomes imperative to assess the needs of the consumer as well as the food business operators in terms of updating so as to meet the consumer demands in the ever growing market. Educating the food handlers will provide higher satisfaction to consumers and also build trust between both the stakeholders. This will further ensure quality of life and enjoyable eating amongst by the consumers.

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