# Study on Consumer Behaviour and Economic Advancements of Gluten-free Products

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***Authors' contributions***

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## ABSTRACT

Gluten-free food was among the top five most-searched words on Google in 2013. During past five years, "gluten" has steadily advanced in consumer online-search interest. Globally gluten free products were estimated to have a market potential of 4639.13 Million USD in 2015 and 7594.43 Million USD in 2020. Gluten-free foods were not only just a fad but a rising marketing section which had grown from a niche market to a main-stream market segment. It had immense potential specially in developing nations when its demand had been rising due to increase in awareness, product availability and number of cases being diagnosed. Regular use of gluten-free products was reported to have multiple health benefits like increased energy levels, reduced gas and bloating. Some major improvements were observed in patients of gluten sensitivity and autistic children. The gluten-free diet had become popular among celebrities and had gain media attention due to the claims of weight loss and boost in energy levels. Gwyneth Paltrow, Ryan Gosling and Jenny McCarthy were the celebrities who had adopted a gluten-free diet for health benefits. A detailed review study in this paper would facilitate understanding of trends, pattern, consumer preferences, market penetration and expansion strategies. This review paper would provide a detailed knowledge of leading sections of gluten-free foods and different factors affecting the buying behaviour of gluten-free foods.

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## 1. INTRODUCTION

Wheat flour is consisted of Glutenin and Gliadin proteins, when combined with water produced gluten. Gluten had property of being elastic, thus allowing the dough to stretch and trap air bubbles. This enabled wheat bread to rise higher than bread made from other flours such as barley, rye, corn, oats and millet. Thus more bread could be prepared from the same quantity of grain, and in commercial terms this meant potentially more revenue from the same outlay. Hence, wheat was the most preferred grain of commercial bakers [1]. Celiac disease had been caused by reaction of Gliadin - a gluten protein found in wheat, barley, rye, and sometimes oats. The chronic digestive disorder lead to the malabsorption of minerals and nutrients. Gluten allergy, a part of celiac disease, been considered an autoimmune disorder that could occur in genetically predisposed people, where the ingestion of gluten lead to damages in the small intestine. It was estimated that 1 in 100 people worldwide were severely affected and 6 people had sensitivity or intolerance [2]. Common symptoms were diarrhoea, bloating, gas, stomach cramping, constipation, joint pain, itchy skin, lesions etc. leading to long term effects like anemia, infertility/multiple miscarriage, lactose intolerance, depression and osteoporosis [3]. Two and a half million Americans were undiagnosed and at risk for long-term health complications. Celiac patients were also increasing in Europe, Middle East and India. The largest manufacturers of gluten-free products were North America, Europe and Asia-Pacific. Since 2010 to 2014, people with undiagnosed celiac disease cost an average of $3,964 more than healthy individuals [4]. Most effective treatment for the patients of gluten allergy was a gluten-free diet. The celiac disease diagnosis rate might increase by 50-60% by 2019. Gluten-free sales reached more than $2.6 billion by the end of 2010 and was expected to exceed more than $5 billion by 2015. The "gluten-free" lifestyle was considered a fad but for celiac patients avoiding the protein present in wheat, barley and rye was the only way to alleviate their symptoms [5]. Pulses had become a popular stand-in for wheat in gluten-free pastas, baked foods and snacks, while appealing to health-savvy shoppers who seeked products high in protein and fiber [6]. Regular use of gluten-free products was reported to have multiple health benefits like increased energy levels, reduced gas and bloating. Major improvements were observed in patients of gluten sensitivity and autistic children [7]. The gluten-free diet had become popular among celebrities and had gain media attention due to claims of weight loss and boost in energy levels. Gwyneth Paltrow, Ryan Gosling and Jenny McCarthy were celebrities who adopted gluten-free diet for health benefits [8]. The greater availability and higher quality of gluten-free foods had resulted in a greater willingness on the part of consumers to pay premium prices for gluten-free products. Nearly 26% of consumers in USA reported that gluten-free foods worth their higher prices [9]. Detailed review study would facilitate understanding of the trends, pattern, consumer preferences, market penetration and expansion strategies. This review paper would provide a detailed knowledge of leading sections of gluten-free foods and different factors affecting the buying behaviour of gluten-free foods.

### 1.1 Market Overview

Gluten-free food was among the top five most-searched words on Google in 2013. In the past five years, "gluten" had steadily advanced in consumer online-search interest. It had become a hot topic in food publications and business news. Gluten-free products were those specialty products that were intentionally directed to the consumer who needed or wanted to buy a substitute for wheat-, barley- or rye-based products. Places where gluten-free products could be bought were grocery stores, drug, mass merchandising, clubs, dollar shops, military canteens, online stores, health food stores and specialty food stores [10].

Globally gluten free products were estimated to market potential of 4639.13 Million USD in 2015 and 7594.43 Million USD in 2020. The North American region accounted for the largest share of the gluten-free products market, at a value of USD 1,985.72 million in 2014. The European market was projected to grow at the highest CAGR of 11.2% from 2015 to 2020 [11].

The gluten-free products market was a diversified and competitive market with a large number of players. It was dominated by various players, depending on their core competencies. The key players in this market were the Boulder Brands Inc. (U.S.), The Hain Celestial Group, Inc. (U.S.), General Mills, Inc. (U.S.), Kellogg's

Company (U.S.), and The Kraft Heinz Company (U.S.) [12].

It was been forecasted that sales volume in Europe would increase up to 40% in 2015 and UK gluten-free market would rise to £250 million by 2017. Apart from gluten-free flour, biscuits, cookies and snacks, product innovations like gluten-free beers and wines were becoming very popular. One such example was Lasso drinks' "Against the Grain" beer which had become quite popular [13]. In Europe and America, organically produced, non-GMO, gluten-free products were doing well, few examples were Hain Celestial biscuits, VitaFiber cookies and Dr.Schar bread. Ten years ago, gluten-free foods were only sold in local bakeries, natural channels and established stores like Whole foods market, Traders Joe. While most of the early products were tasteless, the flavour and shelf-life of recently launched gluten-free products had been improved significantly. The products were now marketed and sold in mainstream retail stores like Stop & Shop, Safeways, Walmart etc. Restaurants refreshed their menus to attract gluten-free customers; food manufacturers created new products, and retailers redesigned their stores [14].

## 1.2 Types of Gluten-intolerance

- Celiac Disease (autoimmune disorder)- Gluten triggered immune system to attack the lining of small intestine
- Gluten sensitivity (Non-celiac gluten sensitivity/ Gluten Intolerance )-People who did not have celiac disease, but suffer symptoms from gluten
- Gluten rash (Dermatitis herpetiformis)- Incredibly itchy skin rash that occurred when patient consume gluten
- Gluten Ataxia-Attack by immune system on brain and neurological system in response to consumption of gluten-containing foods
- Wheat allergy- Allergic reaction involving more components of wheat than just the gluten protein

The classical presentation of celiac disease, with symptoms referable to the gastrointestinal tract, might account for only a proportion of the cases. The fact that celiac disease was actually a multi-system disorder which was highly variable in its clinical expression, might occur at any age, and might be present with variety of manifestations. The diagnosis had often been delayed in many cases [15].

The estimated population prevalence of diagnosed celiac disease in many Western countries was 1% to 2–5%. The global gluten-free market was projected to reach US$6.2 billion by 2018, with North America contributing about 59% of the share [16]. The U.S. was the largest and fastest-growing gluten-free market globally.

North America was the largest market for gluten-free products which accounted for a market share of 52% in 2014. The celiac disease incidence rate for Americans was one in 133. About three million Americans had celiac disease and a further estimated 40 million suffer from gluten-intolerance or sensitivity. It had been anticipated that the number of celiac patients were expected to double every 15 years [11].

Perceived as a 'Western disease,' gluten sensitivity had never really been taken seriously in India. Due to lack of awareness it had remain highly undiagnosed. Celiac disease had been an impending epidemic. Unlike traditional allergies, which cause immediate reactions, gluten sensitivity was harder to pin down because of being gradual and in various forms: headaches, stomach cramps, bloating, anxiety and depression [16].

Sale of gluten-free market in the United States was $4.2 billion in 2014. It was predicted that the category would grow to $6.6 billion by 2017. North India was referred as a "celiac belt", where a greater than average number of people exhibited symptoms of celiac disease. This was partially because more wheat was consumed in this region, also because the population possessed haplotypes necessary for celiac disease to develop. Prior research found that about 1% of the Indian population had celiac disease, almost entirely in Northern India. This prevalence was very similar to the prevalence in the U.S. and some other areas of the world. New studies sampled 23,331 adults from India and found that Northern India had the highest prevalence of celiac disease (1.23%), North Eastern India had an intermediate prevalence (0.87%) and Southern India had the least prevalence (0.10%) [17].

The gluten-free foods market in Asia-Pacific was estimated to grow from $340.8 million in 2013 to $502.5 million by 2018, at a CAGR of 8.1% from 2013 to 2018. The changing lifestyles and the working culture were adding to the demand for gluten-free products in the Asia-Pacific market. Countries such as China, Japan, India, and Australia were the biggest consumers of gluten-

free food products. The Asia-Pacific region, with the largest population in the world as compared to other regions, had been witnessing impressive growth in the demand for gluten-free foods in recent times. Among the different types of gluten-free foods, the gluten-free bakery & confectionery segment had acquire the largest share of the gluten-free foods market and was also anticipated to post the fastest growth [11].

Inspite of high growth, gluten-free foods were facing problems to establish themselves in Asia market due to high price, lack of awareness about the products, increased number of un-diagnosed cases and inefficient value chain for gluten-free products [12].

One of the major issues faced by gluten-free foods were sky touching prices as compared to regular products. They were almost 200 times expensive than regular foods.

Factors leading to high prices of gluten-free products as suggested by Gluten-Free Standards Organization were [18]:

1. Vigorous certification process for a product to carry a gluten free label.
2. High cost associated with certification process.
3. For a product to be labeled gluten-free, the level of gluten must be less than 10 ppm, determined by third-party testing.
4. Manufacturing in a dedicated gluten-free facility
5. Utilizing specialized equipment
6. Creating written documentation on product specification and analysis
7. Creating written document on processing conditions and certifications
8. Testing every batch produced for gluten and allergens
9. Obtaining third-party written certification to verify products as gluten-free
10. At every stage of manufacturing and bringing a product to market, cross-contamination with gluten was possible, and protecting against that cross-contamination required extra work. To ensure that products remained gluten-free at all times, manufacturers needed procedures in place to address this risk.

Going forward, the price of gluten-free foods would remain high until more people would be diagnosed with celiac disease or would prefer to purchase gluten-free foods for other reasons. In other words, the price would be high until critical

mass in the retail and manufacturing segments would be reached. A cost comparison study on gluten-free products revealed they were 242 per cent more expensive than comparable, regular products [18].

As per development of new products the price difference had shrunk. Gluten-free flours, baked goods and prepared foods were 162 per cent more than regular products [19].

It was found that some celiac patients resisted gluten-free foods due to low nutritive value as compared to foods containing gluten. The problem was very acute in Asian region where wheat was considered as one of the major source of fibre and protein. Studies should come up solutions to provide high nutrition gluten-free foods at affordable prices [20].

Currently available gluten-free foods in Asia-Pacific region were reported to have low nutritional level as they were being locally prepared. This provided an opportunity for global brands to enter in this market due to increased number of celiac patients, awareness about availability of international brands and improved incomes. America had wide range of products available from low nutritive to high nutritive value. But mostly people preferred cheap gluten-free products with low nutritive value. Studies of value chain in both nations will provide an opportunity to leading brands to come up with affordable options with high nutritive value to achieve economies of scale and to satisfy the masses with their quality products [21].

India was considered as an important global producer of important gluten-free grains such as sorghum, rice, corn, soybeans, millets, and pulses [22]. However, wheat had been a staple diet in the northern parts of India and this had led to higher risks for celiac disease among the consumers. With the increasing rate of diagnosis and awareness about celiac disease, the demand for gluten-free products was projected to grow at the highest CAGR of 10.7% from 2015 to 2020 in the Asia-Pacific region. The demand had also been increasing in other parts of India as consumers were seeking more processed varieties of gluten-free products.

## 1.3 Growth of Gluten-free Products as Per Channel and Product Segment

Conventional stores played an important role in distribution of gluten-free products and this

category accounted for the largest share of ~64% in 2014. Conventional stores were also projected to grow as the fastest growing distribution channel at a CAGR of 9.54% from 2015 to 2020 [11].

Due to the initiatives taken by national government authorities to safeguard the health of the younger generation, schools and colleges were observed to be an effective centre to initiate the supply of gluten-free foods. The sales of gluten-free products through educational institutions was projected to grow at the highest CAGR of 10.6% from 2015 to 2020 [12].

The North American gluten-free products market was valued at USD 2,188.27 million in 2014. It was projected to reach USD 3,989.35 million by 2020, at a CAGR of 10.5% from 2015 to 2020. The U.S. market was the largest in the region in 2014, and was estimated to be valued at USD 1,972.34 million in 2015. It was projected to grow at a CAGR of 10.0% from 2015 to 2020, to reach USD 3,180.71 million by 2020 [11].

**Table 1. Gluten-free products market size, by distribution channel, 2013–2020 (KT)**

| Distribution channel | 2013 | 2014 | 2015-e | 2020-p | CAGR (2015–2020) |
|---|---|---|---|---|---|
| Conventional stores | 212.93 | 232.56 | 254.11 | 400.77 | 9.54% |
| Hotels & restaurants | 26.28 | 28.53 | 30.98 | 47.40 | 8.87% |
| Educational institutions | 39.75 | 43.33 | 47.26 | 73.82 | 9.33% |
| Hospitals & drug stores | 24.01 | 26.00 | 28.16 | 42.50 | 8.58% |
| Specialty services | 28.63 | 30.69 | 32.92 | 47.09 | 7.42% |
| Total | 331.60 | 361.11 | 393.43 | 611.58 | 9.22% |

*e – Estimated; p - Projected*
*Source: Expert Interviews, Related Research Publications, Government Publications, and Markets and Markets Analysis*

**Table 2. Gluten-free products market size, by distribution channel, 2013–2020 (USD million)**

| Distribution channel | 2013 | 2014 | 2015-e | 2020-p | CAGR (2015–2020) |
|---|---|---|---|---|---|
| Conventional stores | 2287.85 | 2524.92 | 2787.57 | 4596.90 | 10.5% |
| Hotels & restaurants | 368.25 | 403.99 | 443.35 | 709.32 | 9.9% |
| Educational institutions | 384.99 | 425.03 | 469.40 | 775.39 | 10.6% |
| Hospitals & drug stores | 311.61 | 340.86 | 372.99 | 587.81 | 9.5% |
| Specialty services | 466.01 | 513.40 | 565.82 | 925.00 | 10.3% |
| Total | 3,818.70 | 4,208.21 | 4,639.13 | 7,594.42 | 10.4% |

*e – Estimated; p - Projected*
*Source: Expert Interviews, Related Research Publications, Government Publications, and Markets and Markets Analysis*

**Table 3. North America: Gluten-free products market size, by country, 2013-2020 (USD million)**

| Country | 2013 | 2014 | 2015-e | 2020-p | CAGR (2015-2020) |
|---|---|---|---|---|---|
| **U.S.** | **1,635.81** | **1,794.38** | **1,972.34** | **3,180.71** | **10.0%** |
| Canada | 290.45 | 328.24 | 371.49 | 687.76 | 13.1% |
| Mexico | 59.47 | 65.65 | 72.61 | 120.88 | 10.7% |
| Total | 1,985.72 | 2,188.27 | 2,416.44 | 3,989.35 | 10.5% |

*e – Estimated; p – Projected, Source: Markets and Markets, 2015*

**Table 4. Asia-pacific: Gluten-free products market size, by country, 2013–2020 (USD million)**

| Country | 2013 | 2014 | 2015-e | 2020-p | CAGR (2015-2020) |
|---|---|---|---|---|---|
| China | 54.22 | 60.60 | 66.89 | 109.67 | 10.4% |
| **India** | **58.50** | **65.65** | **72.75** | **121.39** | **10.8%** |
| Japan | 41.46 | 45.45 | 49.22 | 73.51 | 8.4% |
| New Zealand | 72.65 | 80.80 | 88.75 | 142.21 | 9.9% |
| Australia | 104.17 | 116.15 | 127.91 | 207.46 | 10.2% |
| Others* | 127.25 | 136.35 | 144.21 | 188.74 | 5.5% |
| Total | 458.24 | 504.98 | 549.74 | 842.98 | 8.9% |

*e – Estimated; p – Projected, *Others include Pakistan, Nepal, and South Korea. Source: Markets and Markets, 2015*

In Asia-Pacific, India had shown highest CAGR and has maximum potential due to being a wheat growing region and increased number of diagnosed cases [11].

A short pilot study of 100 celiac disease patients was conducted in India to study the buying behaviour of gluten-free products, its details are provided below.

## 1.4 Objectives of the Study

1. To study variables affecting the consumer buying behavior of gluten-free foods
2. To club variables into factors affecting the buying behavior via factor analysis

## 2. METHODOLOGY

### 2.1 Study Area

Rajasthan, Punjab, Haryana and Delhi NCR and Uttar Pradesh were taken as study area. All these states were wheat consuming areas and had high number of celiac disease patients.

### 2.2 Data Collection

Primary data was collected by in-depth interview of celiac disease patients using pre-structured questionnaire. Snowball sampling technique was considered in the study, where patients for survey were reached using the reference of other patients.

### 2.3 Sample Size

100 celiac disease patients were taken for this study. In all 20 patients were surveyed from each state, making a total of 100 patients from 5 states.

### 2.4 Analytical Technique

Factor analysis was done for consumers' responses, using principal component extraction method with Varimax rotation, to explain the variance. Following variables were studied to under the buying behaviour of celiac disease patents- Taste, smell, product appearance, quality, price, availability, promotion, social status, doctor's recommendation, knowledge, awareness, brand image, food safety certification, claims, packaging options, labelling

information, other users in vicinity. Neutral statements were formed for each variable in questionnaire and responses were measured on 5 point likert scale, where 1 score was provided to response of complete disagreement to the statement and 5 score was provided to response of complete agreement to the statement.

Variables were standardized, the factor analysis model was represented as:

$$X_i = A_{i1}F_1 + A_{i2}F_2 + A_{i3}F_3 + \ldots + A_{im}F_m + V_iU_i \qquad \text{(i)}$$

Where,

$X_i$ = ith standardized variable
$A_{ij}$ = standardized multiple regression coefficient of variable on common factor j
$F$ = common factor
$V_i$ = standardized regression coefficient of variable i on unique factor i
$U_i$ = the unique factor for variable i
$m$ = number of common factors

The unique factors were uncorrelated with each other and with the common factors. The common factors themselves could be expressed as linear combinations of the observed variables.

$$F_i = W_{i1}X_1 + W_{i2}X_2 + W_{i3}X_3 + \ldots + W_{ik}X_k \qquad \text{(ii)}$$

Where,

$F_i$ = estimate of ith factor
$W_i$ = weight or factor score coefficient
$k$ = number of variables

### 2.5 Findings and Analysis

The variables tested for consumer behaviour were taste, smell, appearance, variants, nutrients, quality, price, availability, promotion, social status, doctor's recommendation, retailers recommendation, knowledge, brand image, food safety certification, associated claims along with gluten-free foods, packaging, labelling information, influence of other users.

First test was KMO test to check the appropriateness of factory analysis. If value of KMO came above 0.5, then factor analysis test would be considered appropriate for our research.

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**Table 5. KMO and Bartlett's test**

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .543 |
|---|---|---|
| Bartlett's Test of Sphericity | Approx. Chi-Square | 447.278 |
| | df | 136 |
| | Sig. | .000 |

*KMO measure of sampling adequacy was 0.543 & Bartlett's sphericity test was found highly significant, thus proving the appropriateness of factor analysis test*

Second test was Extraction Method-Principal Component Analysis to understand that which variable made highest impact on consumer buying decision of gluten-free foods. High extraction value denoted high contribution of variable in decision making process.

Claims related gluten-free foods (.929), food safety certification (.915), brand image (.893), labelling information (.897), doctor recommendation (.853), product appearance (.852), product smell (.832), taste (.826) and product price (.819) were variables that contributed most to product buying decision of gluten-free foods.

**Table 6. Extraction method-principal component analysis**

| Communalities | | |
|---|---|---|
| | Initial | Extraction |
| Taste | 1.000 | .826 |
| Smell | 1.000 | .832 |
| Product_appearence | 1.000 | .852 |
| Quality | 1.000 | .641 |
| Price | 1.000 | .819 |
| Availability | 1.000 | .754 |
| Promotion | 1.000 | .724 |
| Social_status | 1.000 | .416 |
| Doctor_recommendation | 1.000 | .853 |
| Knowledge | 1.000 | .269 |
| Awareness | 1.000 | .810 |
| Brand_image | 1.000 | .893 |
| Food_safety_certfication | 1.000 | .915 |
| Claims | 1.000 | .929 |
| Packaging_options | 1.000 | .676 |
| Labelling_information | 1.000 | .897 |
| Other_users_in_vicinity | 1.000 | .384 |

Extraction Method: Principal Component Analysis.

Next step of analysis involved creation of scree plot, a two dimensional graph between Eigen values and Component number.

Eigen values explained the extent of variation shown by each variable and component number was number provided to variables in descending order of communality extraction.

Scree plot was showing 4 elbows. Elbows meant changing the angle of graph line. Every change in angle created a factor (combination of variables) which impact the buying behaviour. Each factor was different from other and made different impacts. Thus 4 factors were majorly extracted from all the 17 variables which affected the buying behaviour and purchase decision of consumers of gluten-free foods.

Next stages of analysis involved studying the variance explained by each factor. This would help to understand that which factor, also called component explained best the buying behaviour of consumer. Higher percentage of variance explained, indicate greater contribution of the particular factor in buying decision.

Rotated component matrix would tell that each variable will be a part of which factor. In all we were able to identify 4 factors based on scree plots and total variance explained by each factor. Each variable would get loading scores on each 4 factors. The factor on which variable got loaded with highest score, would be considered a part of that particular factor.

Table 7 and 8 had shown that variables including knowledge, brand image, food safety certification, claims, packaging options and labelling information were highest loaded on component 1 or factor 1 which could be named as **product information**. This factor explained the highest variance of 30.4%.

Variables taste, smell, product appearance, quality and social status were highest loaded on component 2 or factor 2 which could be named as **product characteristics**. This factor explained the variance of 18.8%.

Variables price, availability, promotion and other users in vicinity were highest loaded on component 3 or factor 3 which could be named as**.** This factor explained the variance of 15.9%.

Variables doctors' recommendation and awareness were highest loaded on component 4 or factor 4 which could be named as **recommendation**. This factor explained the variance of 8.2%.

Thus consumers mainly consider doctor's recommendation and other product related information while purchasing gluten-free foods. Product characteristics like taste, smell etc. were also leading factors while purchasing gluten-free foods. Price and availability of doctors were used to decide which brand to purchase.
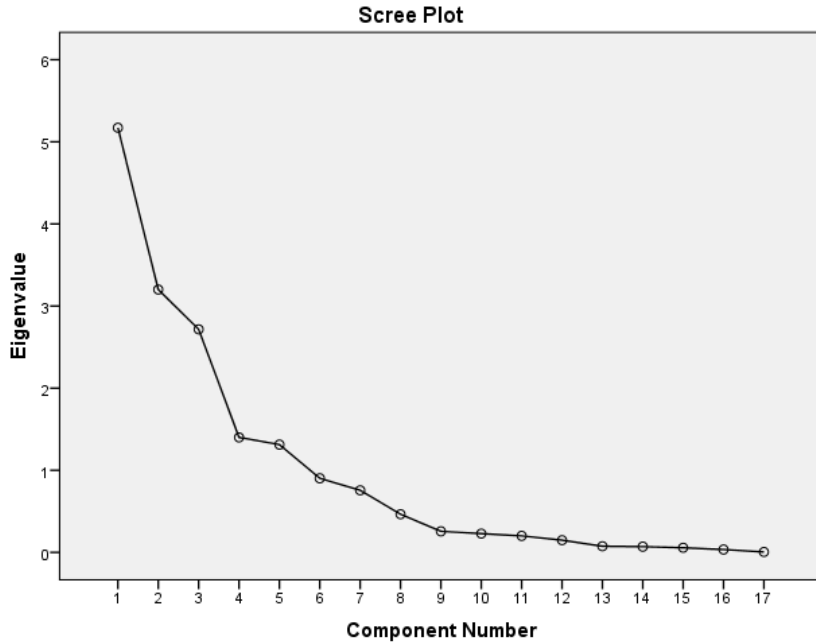


**Fig. 1. Scree plot between eigen values and component number**

**Table 7. Total variance explained by each factor**

| Component | Initial eigen values | | | Extraction sums of squared loadings | | | Rotation sums of squared loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| 1 | 5.171 | 30.420 | 30.420 | 5.171 | 30.420 | 30.420 | 4.410 | 25.943 | 25.943 |
| 2 | 3.201 | 18.827 | 49.247 | 3.201 | 18.827 | 18.827 | 3.060 | 18.000 | 43.943 |
| 3 | 2.717 | 15.980 | 65.227 | 2.717 | 15.980 | 15.980 | 2.791 | 16.415 | 60.357 |
| 4 | 1.400 | 8.236 | 73.463 | 1.400 | 8.236 | 8.236 | 2.228 | 13.106 | 73.463 |
| 5 | 1.313 | 7.722 | 81.185 | | | | | | |
| 6 | 0.903 | 5.309 | 86.494 | | | | | | |
| 7 | 0.756 | 4.448 | 90.942 | | | | | | |
| 8 | 0.465 | 2.733 | 93.675 | | | | | | |
| 9 | 0.256 | 1.508 | 95.183 | | | | | | |
| 10 | 0.229 | 1.347 | 96.530 | | | | | | |
| 11 | 0.201 | 1.183 | 97.712 | | | | | | |
| 12 | 0.148 | 0.873 | 98.585 | | | | | | |
| 13 | 0.075 | 0.440 | 99.025 | | | | | | |
| 14 | 0.70 | 0.410 | 99.435 | | | | | | |
| 15 | 0.056 | 0.332 | 99.766 | | | | | | |
| 16 | 0.035 | 0.204 | 99.971 | | | | | | |
| 17 | 0.005 | 0.029 | 100.000 | | | | | | |

**Table 8. Rotated component matrix**

| | Rotated component matrix[a] | | | |
| | Factor loading scores | | | |
| | 1 (Product information) | 2 (Product characteristics) | 3 (Distribution mix) | 4 (Recommendation) |
|---|---|---|---|---|
| Taste | .015 | **.860** | -.006 | .294 |
| Smell | .184 | **.825** | -.230 | -.254 |
| Product_appearence | -.048 | **.919** | -.066 | -.023 |
| Quality | .414 | **.570** | -.377 | .055 |
| Price | .185 | .032 | **.863** | .196 |
| Availability | -.173 | -.044 | **.846** | -.076 |
| Promotion | -.086 | -.064 | **.814** | -.224 |
| Social_status | -.038 | **.536** | .178 | -.309 |
| Doctor_recommendation | .189 | .029 | .044 | **.902** |
| Knowledge | **.394** | .138 | .194 | -.239 |
| Awareness | .332 | .315 | .066 | **.772** |
| Brand_image | **.763** | .085 | -.106 | .541 |
| Food_safety_certfication | **.945** | -.029 | -.082 | .120 |
| Claims | **.956** | -.001 | .066 | -.100 |
| Packaging_options | **.742** | -.074 | .201 | .282 |
| Labelling_information | .941 | -.030 | -.092 | .041 |
| Other_users_in_vicinity | .050 | .206 | **.566** | .135 |

## 3. CONCLUSION

Thus it could be concluded that gluten-free foods were not just a fad but a rising marketing section which had grown from a niche market to a mainstream market segment. Conventional stores played an important role in the distribution of gluten-free products and this category accounted for the largest share. It had immense potential specially in developing nations when its demand was rising due to increase in awareness, product availability and number of cases being diagnosed. Doctors' recommendation, price of products, taste, smell and product availability were identified as most important factors in purchase decision of gluten-free products.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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