

# Consumer Profiling Based on Preferences and Concerns Towards Fresh-cut Vegetables: A Cross-sectional Exploratory Study of Sri Lankan Urban Community

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## ABSTRACT

*Fresh-cut vegetables (FCVs) offer convenience and nutritional benefits, meeting the demands of today's fast-paced lifestyle. While the Sri Lankan FCV market is still emerging, many developed countries have already embraced FCVs. This study aimed to identify consumer profiles in urban communities in Sri Lanka based on their preferences in FCVs and purchasing concerns. A cross-sectional survey was conducted using both face-to-face interviews and online questionnaires, resulting in 1722 responses. Descriptive and inferential statistics were employed, including correspondence analysis, Kruskal–Wallis test, factor analysis, and cluster analysis. The findings revealed that convenience, freshness, and affordability are key factors motivating the choice of FCVs over whole vegetables. Consumers showed a strong preference for fruit-type FCVs, followed by root vegetables, while bulbs, tubers, and chillies were among the least preferred. Among labeling information, expiry date*

*and preservation method were prioritized, while nutritional information was less emphasized. Correspondence analysis indicated that natural disinfectants (e.g., salt, vinegar, and baking soda) are more commonly associated with plastic and rigifoam trays. Factor analysis reduced the 12 purchasing concerns into 03 key components as quality, safety, and presentation, explaining approximately 62% of the total variance. Based on standardized factor scores, consumer segmentation was performed through hierarchical clustering followed by K-means clustering. The analysis revealed three distinct consumer segments: 1) less concerned about all three factors (the smallest cluster); 2) moderately concerned about all three factors and quality-driven consumers; and 3) highly concerned about all three factors and safety-driven consumers. These insights offer practical guidance for advancing the commercial viability of FCVs in Sri Lanka. Future research will expand to include non-urban populations to improve generalizability.*

**Keywords:** Fresh-cut vegetables, Consumer profiles, Correspondence analysis, Factor analysis, Cluster analysis

### 1 Introduction

Vegetables are essential for a healthy diet, providing nutrients including vitamins and minerals that contribute to overall well-being. The World Health Organization (WHO) and the Food and Agriculture Organization (FAO) recommend consuming at least 400 g (five servings) of fruit and vegetables per day, consisting of at least five varieties to reduce the risk of noncommunicable diseases while ensuring an adequate daily intake of dietary fiber (WHO , 2023). In today's fast-paced world, the demand for convenient and nutritious food options has increased the popularity of fresh-cut vegetables (FCVs). This pre-processed option offers a practical solution for busy individuals who wish to have a healthy food intake, however, do not have time for preparing raw vegetables which should undergo washing, peeling and cutting before cooking.

Many developed countries have already embraced FCVs as an option to promote health consciousness and as convenience-oriented food options to support their busy lifestyles (Ragaert et al. (2004). This transformation is driven by advanced processing technologies, cold chain infrastructure, and strong consumer trust in food safety standards (Parry , 2012). In contrast, demand for FCV in Sri Lanka is still in its early stages of development due to the limited consumer awareness, concerns about freshness and hygiene, underdeveloped infrastructure, and relatively higher costs (Dissanayake et al. , 2024). Nevertheless, with urbanization and evolving consumption patterns, the Sri Lankan FCV market holds strong potential for growth, if the perceived concerns are addressed, catering to diverse consumer preferences and concerns.

Many countries have placed significant focus on researching fresh vegetable consumption patterns (Ragaert et al. (2004). Among them, Italian and

Bangladeshi markets have been explored to a great extent to identify consumer preferences for FCVs. According to the survey conducted by Salam et al. (2020), the attitude of Bangladeshi consumers in selected supermarkets towards fresh-cut vegetables was moderately favorable. They have considered the ready-to-cook and time-saving nature, attractiveness, quality, and hygiene, as well as waste reduction at the household level, to be the most appealing attributes. Additionally, the use of the Logit model reveals that factors such as education, family size, occupation, having a maid servant, income, and consumer perception significantly influence the purchase of FCVs. Consequently, consumers with higher education, larger families, and higher income levels are more likely to purchase these products.

The Italian market surveyed by Bertazzoli et al. (2005) found that the Italian FCV industry has to pay much emphasis to high-quality standards, ensuring food safety, and providing comprehensive product information. Another study conducted on Italian consumers of ready-to-eat fresh-cut salads showed the highest preference for freshness and appearance, followed by expiration date and brand (Massaglia et al. , 2019). In contrast, attributes such as price, organic certification, and food safety did not significantly influence their choices. In addition, five consumer groups were identified, with their preferences linked to both purchasing styles and sociodemographic factors.

Testa et al. (2021) conducted an exploratory study to determine the demand of Italian consumers for fresh-cut fruits. It was revealed that consumers' preference for ready-to-eat products go beyond just saving time. Socio-demographic factors and psychometric variables, such as personal values and lifestyles, also play a crucial role in shaping consumer demand for convenience products. By using the food-related lifestyles tool, four consumer groups were found to exist.

Despite the global trend towards FCVs, there is a notable gap in the literature identifying the preferences of Sri Lankan consumers for FCVs. This study aimed to identify consumer profiles based on the preferences and concerns for FCVs while providing valuable insights for producers in the market. Accordingly, the research questions of this study are:

- What are the key factors that drive Sri Lankan consumers to choose FCVs over whole vegetables?
- What are the purchasing preferences and concerns for FCVs in relation to demographic attributes?
- What consumer segments exist based on purchasing concerns?

## **2 Methodology**

### **2.1 Data collection and study area**

A cross-sectional survey was conducted from May to October 2023, targeting both existing and prospective FCV consumers in urban areas of Sri Lanka

following ethical approval. The survey instrument was prepared in Sinhala, Tamil and English. Both online and face-to-face interviews were used as data collection methods. While an online questionnaire was distributed via social media platforms, the field data collection was carried out by trained field research assistants under the supervision of a sociologist by visiting selected supermarkets during all seven days; the time of visits on week days after office hours and peak times during weekends. In total, 1722 responses were used for the final analysis.

### **2.2 Preparation of the questionnaire**

The questionnaire was developed to gather information on demographics, purchasing motivations, and consumer preferences concerning various features of FCVs. This included preferred vegetable types, packaging materials, and disinfecting agents. It also examined preferences related to labeling information, intended household use, and frequency of purchase. Furthermore, the survey captured consumer concerns regarding product quality, pricing, and other relevant factors. Prior to the full-scale survey, both the questionnaire and the collected data underwent validation to ensure accuracy and reliability.

### **2.3 Analytical approach**

A number of statistical analyses were performed using IBM Statistical Package for Social Scientists (Version 23) software. Initially, standard descriptive statistics were used to summarize and compare key variables, including consumer demographics, purchasing motivations, and consumer preferences related to FCV products. Correspondence analysis (CA) was used to explore the associations between the disinfecting agents and the packaging materials preferred by the consumers. CA is an exploratory multivariate technique suitable for visualizing the relationships between two categorical variables using a two-dimensional biplot (Kassambara, 2017). In CA, a contingency table is created to represent the frequencies or counts of the categories of the variables. The contingency table is then transformed into a matrix of proportions or percentages to normalize the data. Then, it determines the principal components of the normalized matrix and plots the variables and categories in two dimensions according to their proximity to one another. The relationships and patterns between the variables and categories are shown in a plot, where a closer distance indicates a stronger relationship.

Subsequently, purchasing concerns were analyzed, first by calculating the mean value of each concern to assess its relative importance, and then the Kruskal–Wallis test, a nonparametric alternative to one-way ANOVA, was used to determine whether statistically significant differences existed in consumer purchasing concerns across various demographic groups. The Kruskal–Wallis test is suitable for ordinal or non-normally distributed continuous data and is an extension of the two-sample Mann–Whitney U test (Kruskal and Wallis, 1952). It compares three or more independent groups and assesses

whether their mean ranks differ significantly. This approach is particularly useful in consumer studies where the data often involves ranked preferences or non-parametric characteristics (McKight and Najab , 2010).

To segment consumers, an exploratory factor analysis (EFA) was initially conducted to reduce the twelve purchasing concerns into a smaller set of latent factors. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were applied to evaluate the suitability of the data for factor analysis. According to Williams et al. (2010), a KMO value of at least 0.5 is considered acceptable for proceeding with factor analysis. In this study, principal component analysis (PCA) was used as the factor extraction method, along with varimax rotation to improve the interpretability of the factor structure. Based on the extracted factor scores, consumer segments of potential buyers of fresh-cut vegetables (FCVs) were identified using a two-step clustering approach: hierarchical clustering to determine the number of clusters, followed by K-means clustering for final segment formation.

### 3 Results and Discussion

#### 3.1 Descriptive statistics of demographic attributes of the sample

Table 1 presents the descriptive statistics of the sample with a size of 1722. The majority of buyers/intended buyers are from Kandy district, followed by Colombo district. 75% of the total respondents are females and approximately 50% of the respondents are aged between 32 to 44. More than 75% of the respondents hold educational qualifications at GCE Advanced Level or above. 64% of the respondents have a family with 3 to 4 members. The income level of the majority of respondents (nearly 90%) is below LKR 200 000.

**Table 1: Socio-demographic Characteristics of Sample**

| Features        | Categories | Frequency | Percentage |
|-----------------|------------|-----------|------------|
| District        | Colombo    | 553       | 32%        |
|                 | Gampaha    | 255       | 15%        |
|                 | Kaluthara  | 170       | 10%        |
|                 | Galle      | 114       | 7%         |
|                 | Kandy      | 612       | 36%        |
|                 | Other      | 18        | 1%         |
| Gender          | Male       | 424       | 25%        |
|                 | Female     | 1298      | 75%        |
| Family size     | 1 to 2     | 164       | 10%        |
|                 | 3 to 4     | 1109      | 64%        |
|                 | 4 to 6     | 431       | 25%        |
|                 | 6 to 8     | 18        | 1%         |
| Age (years-old) | 18–31      | 443       | 26%        |
|                 | 32–44      | 864       | 50%        |
|                 | 45–57      | 314       | 18%        |
|                 | 58–70      | 101       | 6%         |

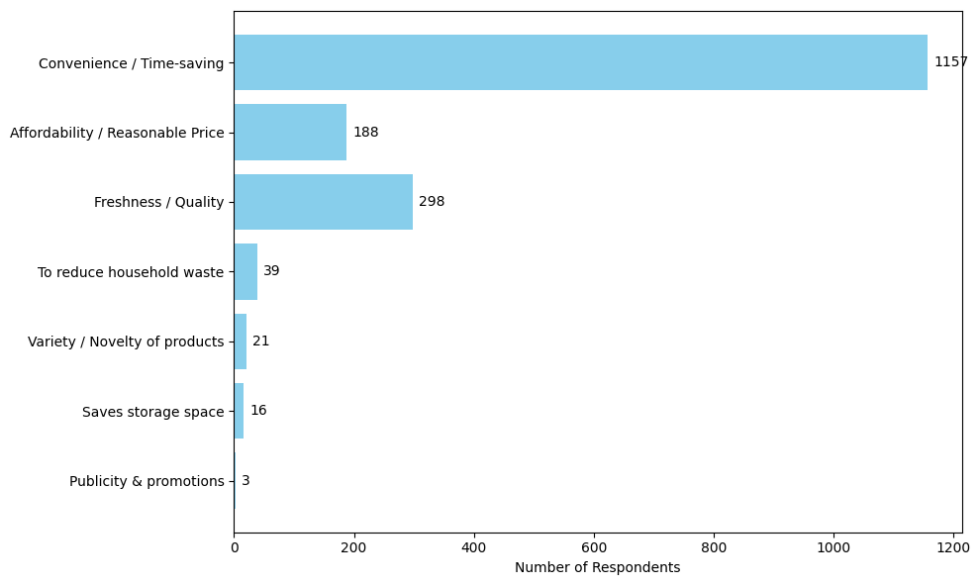


Fig. 1: Key drivers to choose FCVs over whole vegetables

|                 |                      |     |     |
|-----------------|----------------------|-----|-----|
| Education Level | School Education     | 252 | 15% |
|                 | A/L Passed           | 545 | 32% |
|                 | Diploma              | 388 | 23% |
|                 | University Education | 537 | 31% |
| Income Level    | <100 000             | 852 | 49% |
|                 | 100 000–199 999      | 692 | 40% |
|                 | 200 000–500 000      | 134 | 8%  |
|                 | >500 000             | 44  | 3%  |

3.2 Purchasing motivations of FCVs over whole vegetables

As presented in Figure 1, convenience emerged as a key driver for choosing FCVs, likely appealing to consumers with busy lifestyles. This aligns with the time-saving benefit of fresh-cut options, eliminating the need for washing, cutting, and preparing vegetables. Interestingly, the study also indicates that freshness is a concerning factor in choosing FCVs. This could be due to perceptions of consistent quality control or extended shelf life offered by some pre-cut options. Additionally, the survey suggests that affordability plays a role in the decision-making process. FCVs might be perceived as a cost-effective option, especially if whole vegetables incur waste due to spoilage or unused portions.

### 3.3 Analysis of Consumer Preferences

#### 3.3.1 Types of Vegetables Preferred by FCV Consumers

This section presents an analysis of consumer buying behavior related to different types of fresh-cut vegetables. The data were visualized using a heatmap, where vegetable types are presented on the y-axis and buying frequency categories: Always, Often, Sometimes, Rarely, and Never are shown on the x-axis. The intensity of green shading represents the number of responses in each cell, allowing clear visual interpretation of consumer preferences and purchasing trends. The vegetable types were classified into several categories to facilitate meaningful comparisons: leafy vegetables (salad leaves, cabbage, leeks, Mukunuwenna, Gotukola), root vegetables (carrot, beetroot, radish), bulbs (onion, garlic), flowers (broccoli, cauliflower), fruits (baby jackfruit, jackfruit, breadfruit), other vegetables (pumpkin, brinjal, cucumber, ash plantain, bitter gourd, ladies' fingers), chilies (green chili, capsicum, bell pepper), legumes (green beans, long beans, winged beans), stems, and tubers. This categorization enabled a comprehensive understanding of consumer preferences across a broad range of fresh-cut vegetable types.

Consumers exhibited a strong preference for fruit-type FCVs, including jackfruit, baby jackfruit, and breadfruit, followed by root vegetables. In contrast, bulbs, tubers, and chillies were among the least preferred options. As illustrated in Figure 2, a significant number of consumers reported either often (537) or always (483) purchasing fruit-type FCVs, reflecting a strong and consistent demand for these products. This trend is likely driven by the convenience offered by pre-cut options, particularly given the challenges associated with preparing these vegetables in their raw form. Their large size, tough outer rinds, and sticky latex can make them difficult and time-consuming to handle, especially for individuals with busy lifestyles. By offering fresh-cut jackfruit, baby jackfruit, and breadfruit, producers meet the needs of consumers seeking both convenience and traditional flavors, thereby enhancing consumption and expanding market demand. Root-type vegetables also received high frequencies in the often (637) and sometimes (445) categories, showing that root vegetables are a favored choice in fresh-cut form. Bulb-type vegetables are markedly unpopular in fresh-cut form, with the highest count in the never (689) category. Tubers and chilli-type vegetables also showed limited consumer preference, with relatively high frequencies in the rarely and never categories. Leaves and stem vegetable types showed a balanced distribution across often, sometimes, and rarely, indicating moderate and occasional buying behavior. Flower-type vegetables are the most frequent purchase in the sometimes category, indicating occasional but uncertain consumer interest.



Fig. 2: Consumer preference for types of vegetables

3.3.2 Expected labeling Information

Consumer labeling preferences for FCVs were analyzed to identify the most desired information influencing purchase decisions. As illustrated in Figure 3, the expiry date emerged as the most important labeling element, with an overwhelming majority of respondents (approximately 97%) indicating its necessity. Information on the preservative agent or technique used was also highly regarded, with about two-thirds of consumers expressing interest. In contrast, fewer respondents (approximately 43% ) considered details about the disinfecting agent and its concentration to be essential. Nutritional values and health benefits were among the least prioritised labeling attribute, with only one-third of consumers showing interest. Interestingly, opinions on the inclusion of quality assurance logos were evenly distributed. These findings suggest that consumers place the highest importance on freshness and preservation-related labeling, while safety treatments and nutritional information hold comparatively less influence in purchase decisions.

3.3.3 Intended buying frequency

Figure 4 illustrates the intended buying frequency of FCVs products. The x-axis represents the frequency categories, ranging from “Daily” to “Rarely” while the y-axis indicates the number of respondents falling into each category. The most popular responses were “2-3 times a week”, and “once a week”, with a significantly higher number of respondents compared to other

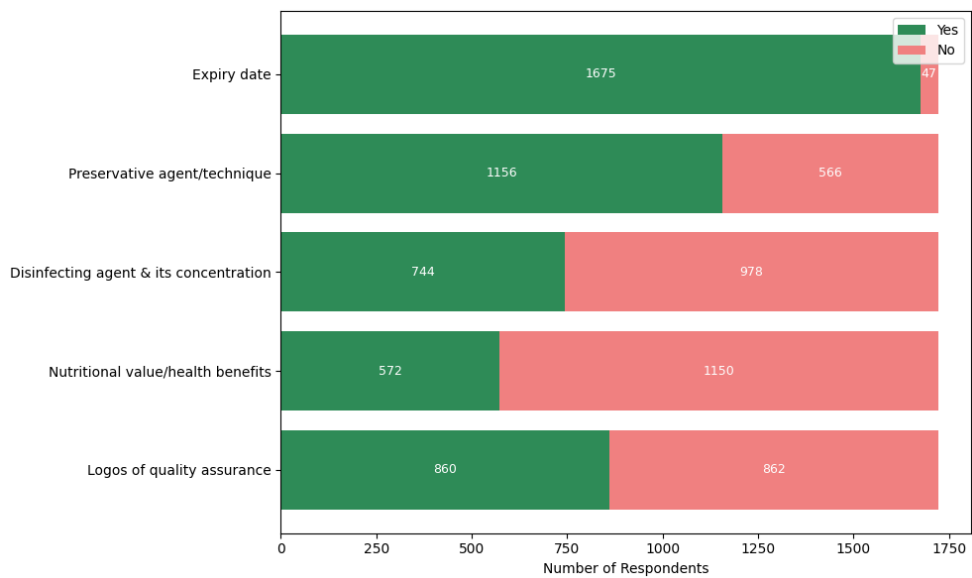


Fig. 3: Consumer preference for expected labeling information

categories. This suggests that purchasing fresh-cut vegetables on a weekly basis is a common practice among consumers. The smallest number of respondents indicated that they intend to purchase fresh-cut vegetables daily. This implies that daily purchasing is the least common among the surveyed population. This information can be valuable for businesses involved in the production, distribution, and retail of fresh-cut vegetables as it provides insights into consumer purchasing habits.

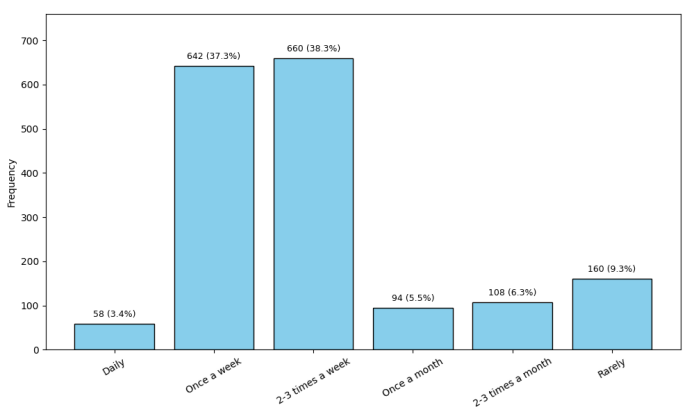


Fig. 4: Buying Frequency of FCVs

3.3.4 Consumer preference for FCVs usage at household level

As presented in Figure 5, household usage of FCVs revealed that the majority of consumers prefer using them as ingredients for cooking rather than single-serve options like side dishes, monotype salads, sandwiches/wraps, and short eats/snacks.

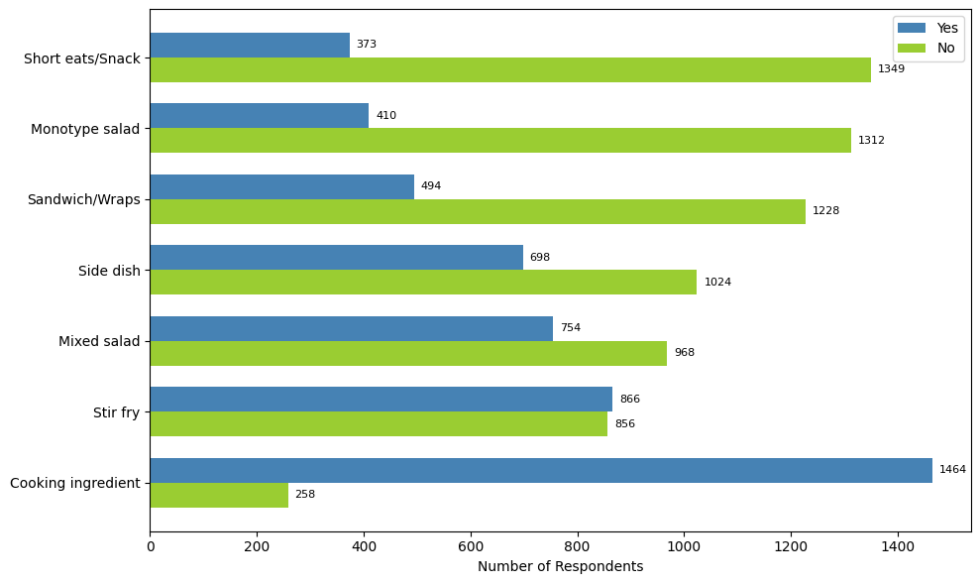


Fig. 5: Consumer preference for intended usage at household level

3.3.5 Consumer preference for packaging materials and disinfecting agents

As Figures 6 and 7 illustrate, consumers expressed a clear preference for FCVs treated with natural disinfecting agents and packaged in eco-friendly materials. Tap water was found to be the most preferred disinfecting agent, possibly reflecting concerns about the health implications of harsh chemicals. Following tap water, salt and lime / lemon juice (citric acid) emerged as preferred disinfecting agents. This trend emphasizes a growing consumer interest in minimally processed and potentially organic options.

With regard to packaging materials, eco-friendly options were the clear favorites, likely driven by environmental awareness. However, some level of practicality was also evident, with plastic trays coming as a second choice and plastic containers as a third option. This suggests that consumers value both sustainability and functionality in packaging solutions. By prioritizing natural disinfectants and investing in environmentally friendly packaging materials, producers can cater to these evolving consumer preferences, potentially gaining a competitive edge in the market.

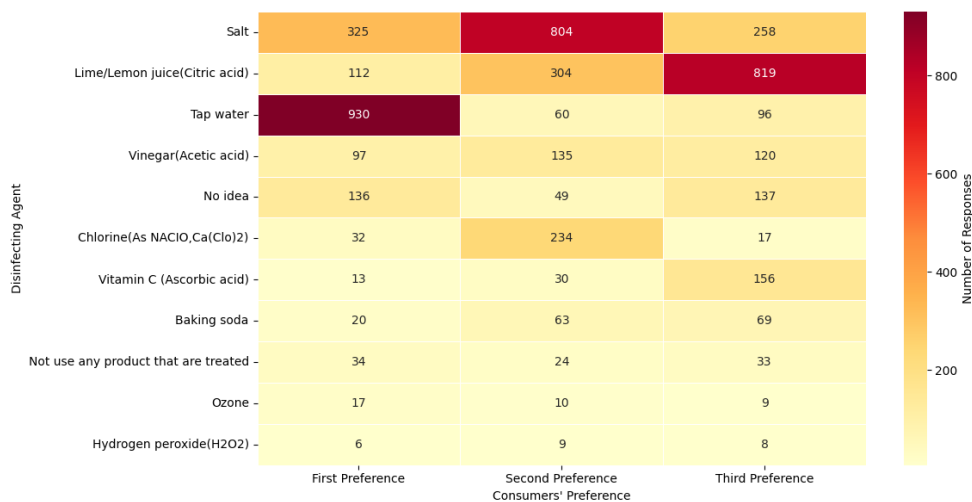


Fig. 6: Consumer preference for disinfecting agent

3.3.6 Consumer preference for both packaging material and disinfecting agent: Correspondence Analysis

The chi-square statistic is used in correspondence analysis to test the total variance explained, along with the associated probability. When there is a high degree of connection between categorical variables, the chi-square statistic is high (Greenacre , 2017). As reported in Table 2, the proposed model is significant at the 0.000 level, having a chi-square value of 871.452.

The Inertia column depicts the total variance explained by each dimension in the model. As stated by Doey and Kurta (2011), “There is no rule of thumb or criteria for keeping or rejecting dimensions for analysis based on proportion of inertia; it depends on the research question, and the researcher decides what is clinically significant versus statistically significant for any given case.” In this case, we have decided to keep two dimensions. Then, as in Table 2, the inertia of the first dimension is 12.3% and the inertia of the second dimension is 2.4%. Finally, the total variance explained by our model is 14.7%.

The biplot presented in Figure 8 revealed distinct groupings, suggesting that natural disinfectants such as vinegar, salt, and baking soda are more commonly associated with plastic and rigifoam trays. In contrast, substances like chlorine and hydrogen peroxide appeared to be outliers, suggesting limited or separate usage. Interestingly, the eco-friendly packaging category clustered responses close to “not used” and “no idea”, implying lower awareness or use of disinfectants among environmentally conscious consumers. These findings provide actionable insights for promoting appropriate disinfectant-packaging combinations and tailoring public awareness campaigns based on consumer preferences and knowledge gaps.



Fig. 7: Consumer preference for packaging material

3.4 Analysis of purchasing concerns

Purchasing concerns related to FCVs were measured using twelve statements on a five-point Likert scale. The twelve statements were used to determine the importance of consumers’ purchasing concerns for FCVs, where a score of 1 is “not very important”, 2 is “not important”, 3 is “neutral”, 4 is “important” and 5 is “very important”. The twelve attributes considered were i) freshness, ii) healthiness, iii) cutting style/method/size/shape, iv) typology (mixed/monotype), v) price, vi) packaging material, vii) packing size, viii) expiry date, ix) labeled suggestions for use, x) logos of quality assurance, xi)

Table 2: Summary table of the correspondence analysis

| Dimension | Singular Value | Inertia | Chi Square | Sig.              | Account for | Cum.  | Standard Devia- tion | Cor   |
|-----------|----------------|---------|------------|-------------------|-------------|-------|----------------------|-------|
| 1         | .351           | .123    |            |                   | .730        | .730  | .014                 | -.021 |
| 2         | .154           | .024    |            |                   | .140        | .870  | .013                 |       |
| 3         | .141           | .020    |            |                   | .117        | .988  |                      |       |
| 4         | .046           | .002    |            |                   | .012        | 1.000 |                      |       |
| Total     |                | .169    | 871.45     | .000 <sup>a</sup> | 1.000       | 1.000 |                      |       |

<sup>a</sup> 40 degrees of freedom

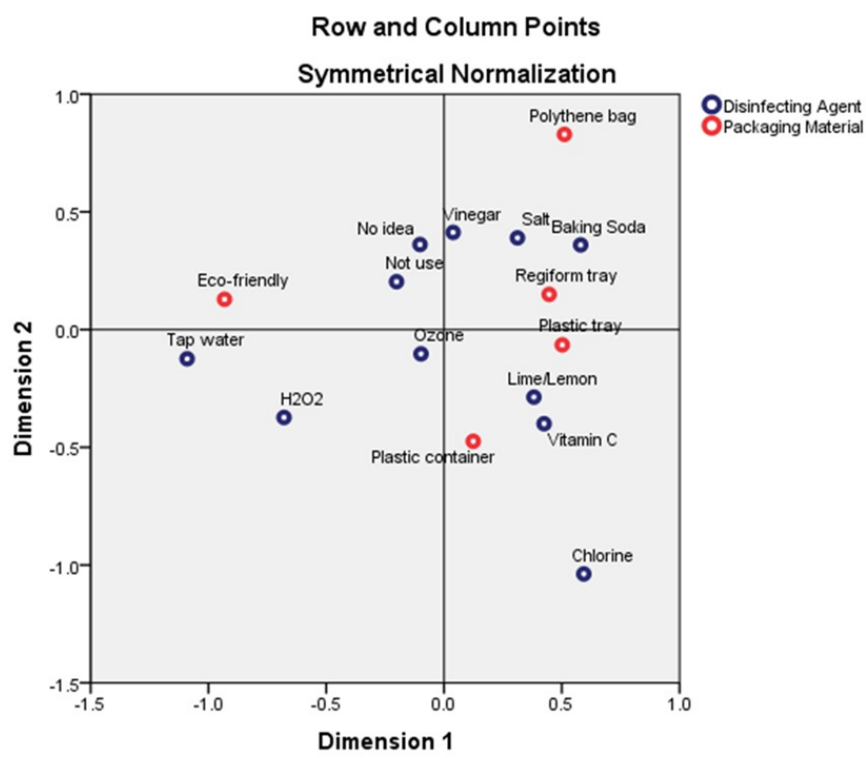


Fig. 8: Correspondence Analysis - Biplot

preservation technique, and xii) organically produced or not. Figure 9 illustrates the distribution of purchasing concerns of the respondents.

The mean value of each attribute was used to determine the importance of each buying attribute. Table 3 presents the mean value score of each buying attribute. Freshness, expiry date, and healthiness were identified as the most important attributes that affect the purchasing of FCVs. Price, preservation technique, packing size, packaging material, organically produced or not, cutting style, typology, and logos of quality assurance were identified as important attributes. A labeled suggestion for use was identified as a neutrally important attribute.

3.4.1 Relationship between demographic attributes and purchasing concerns

Table 4 presents the results of the Kruskal-Wallis test on the impact of the consumer’s education level on the listed 12 buying attributes in terms of mean scores and p-values. Mean scores of responses of the education levels indicate which education level exhibits the highest levels of concern towards these buying attributes. P-value is used to identify whether a correlation ex-



Fig. 9: Distribution of respondents’ purchasing concerns

ists between the buying attributes and consumers’ education level. It has been determined that a noteworthy correlation exists between consumers’ education level and the importance of each buying attribute. This means consumers’ purchasing concerns vary based on their education level.

Table 5 presents the results of the Kruskal-Wallis test on the impact of the consumers’ income level on the listed 12 buying attributes in terms of mean scores and p-values. The mean scores of responses by income level indicate which income level exhibits the highest levels of concern regarding these buying attributes. P-value is used to identify whether a correlation exists between the importance of the buying attributes and consumers’ income level. Based on the p-value, one notable observation is that there is no statistically significant variation in price concern across income levels. Despite the convenience offered by fresh-cut options, consumers across the economic spectrum remain price-conscious. Even for individuals with higher incomes, value for money remains an important consideration. They might be willing to pay a premium for convenience, but the price needs to justify the benefits offered by fresh-cut options. This could involve offering a variety of pack sizes, promoting value-added features like pre-washed and seasoned options, or exploring more cost-effective processing methods. By addressing price concerns, producers can broaden the appeal of FCVs and reach a wider consumer base.

**Table 3: Mean score value of each purchasing attribute**

| Purchasing attribute                      | Mean score value |   | Level          |
|-------------------------------------------|------------------|---|----------------|
|                                           |                  |   |                |
| Freshness appearance/color                | 4.61             | 5 | Very important |
| Expiry date                               | 4.61             | 5 | Very important |
| Healthiness/wholesomeness/nutrition       | 4.57             | 5 | Very important |
| Price                                     | 4.44             | 4 | Important      |
| Preservation technique                    | 4.13             | 4 | Important      |
| Packing Size/Quantity (of a product unit) | 4.00             | 4 | Important      |
| Packaging material                        | 3.93             | 4 | Important      |
| Organically produce or not                | 3.92             | 4 | Important      |
| Cutting Style/Methods/Size/Shape          | 3.87             | 4 | Important      |
| Typology                                  | 3.78             | 4 | Important      |
| Logos of quality assurance                | 3.72             | 4 | Important      |
| Labeled suggestions for use               | 3.34             | 3 | Neutral        |

### 3.5 Consumer Segmentation

Initially, exploratory factor analysis was employed to reduce 12 purchasing concerns into a smaller number of factors by extracting commonalities between variables. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.885, indicating the sample size was adequate for the factor analysis. Bartlett's test of sphericity was also significant (chi-square = 7951.966,  $df = 66$ ,  $p < 0.001$ ), implying that the correlation matrix was not an identity matrix. Bartlett's test further showed that the factor model was appropriate (Costello and Osborne, 2005). Using the Kaiser Criterion, three component factors were extracted. These component factors accounted for approximately 62% of the total variance. Table 6 shows the factor loadings of purchasing concerns, the extracted component factors, and their respective names. Considering the similarities of purchasing concerns within a factor, they were named as quality, safety, and presentation.

Ward's method was used to identify the distinct number of consumer segments. Consumers were clustered based on standardized factor scores. Standardized factor scores were computed using the Anderson-Rubin criterion to ensure the orthogonality of component factors. From the dendrogram, three different consumer segments were identified. The three different consumer segments derived from Ward's method were used in the K-means method to obtain final clusters of consumers. The largest cluster (i.e., cluster 3) has 735 consumers, whereas the smallest one (i.e., cluster 1) has 322 consumers. The other remaining cluster (i.e., cluster 2) has 665 consumers. According to the results of the MANOVA test presented in Table 6, the consumer segments were different as all base variables were significant. Moreover, non-parametric tests showed that consumer clusters are significantly different with respect to some of their demographic and behavioral characteristics.

Cluster 1: Less concerned consumers comprise 19% of the sample and reflect a low level of concern across all FCV product attributes. As shown in

**Table 4: Relationship between education level and importance of purchasing concerns**

| Buying attributes           | Education Level (sample size = 1722) |                          |                    |                                    | Kruskal<br>Wallis<br>Chi-Square | P-value   |
|-----------------------------|--------------------------------------|--------------------------|--------------------|------------------------------------|---------------------------------|-----------|
|                             | School<br>Education<br>(n=252)       | A/L<br>Passed<br>(n=545) | Diploma<br>(n=388) | University<br>Education<br>(n=537) |                                 |           |
|                             | Mean Response Score                  |                          |                    |                                    |                                 |           |
| Freshness                   | 4.50                                 | 4.56                     | 4.70               | 4.65                               | 27.063                          | 0 ***     |
| Healthiness                 | 4.49                                 | 4.56                     | 4.59               | 4.61                               | 10.125                          | 0.018 **  |
| Cutting style               | 3.63                                 | 3.81                     | 3.85               | 3.77                               | 7.308                           | 0.063 *   |
| Typology                    | 3.59                                 | 3.68                     | 3.81               | 3.74                               | 6.783                           | 0.079 *   |
| Price                       | 4.41                                 | 4.43                     | 4.52               | 4.40                               | 6.377                           | 0.095 *   |
| Packaging material          | 3.73                                 | 3.70                     | 3.99               | 4.03                               | 38.010                          | 0 ***     |
| Packing size                | 3.71                                 | 3.82                     | 4.12               | 3.99                               | 30.205                          | 0 ***     |
| Expiry date                 | 4.54                                 | 4.56                     | 4.69               | 4.63                               | 20.567                          | 0 ***     |
| Labeled suggestions for use | 3.22                                 | 3.19                     | 3.42               | 3.48                               | 22.494                          | 0 ***     |
| Logos of quality assurance  | 4.05                                 | 4.10                     | 4.21               | 4.13                               | 16.635                          | 0.001 *** |
| Preservation technique      | 3.69                                 | 3.70                     | 4.12               | 4.09                               | 68.044                          | 0 ***     |
| Organically produced or not | 3.77                                 | 3.96                     | 4.11               | 4.06                               | 28.075                          | 0 ***     |

\*\*\*, \*\*, and \* indicate 1%, 5%, and 10% level of significance, respectively.

**Table 5: Relationship between income level and importance of purchasing concerns**

| Buying attributes           | Total monthly income level (in LKR) |                              |                              |                   | Kruskal<br>Wallis<br>Chi-Square | P-value   |
|-----------------------------|-------------------------------------|------------------------------|------------------------------|-------------------|---------------------------------|-----------|
|                             | <100000<br>(n=852)                  | 100000–<br>199999<br>(n=692) | 200000–<br>500000<br>(n=134) | >500000<br>(n=44) |                                 |           |
|                             | Mean Response Score                 |                              |                              |                   |                                 |           |
| Freshness                   | 4.59                                | 4.59                         | 4.79                         | 4.73              | 18.117                          | 0 ***     |
| Healthiness                 | 4.58                                | 4.51                         | 4.78                         | 4.66              | 17.867                          | 0 ***     |
| Typology                    | 3.64                                | 3.76                         | 3.87                         | 4.16              | 21.689                          | 0 ***     |
| Price                       | 4.38                                | 4.49                         | 4.50                         | 4.43              | 4.557                           | 0.207     |
| Packaging material          | 3.81                                | 3.81                         | 4.43                         | 4.39              | 52.308                          | 0 ***     |
| Packing size                | 3.83                                | 3.92                         | 4.44                         | 4.20              | 40.786                          | 0 ***     |
| Expiry date                 | 4.59                                | 4.56                         | 4.88                         | 4.75              | 30.107                          | 0 ***     |
| Labeled suggestions for use | 3.39                                | 3.22                         | 3.43                         | 3.77              | 16.193                          | 0.001 *** |
| Logos of quality assurance  | 4.08                                | 4.13                         | 4.36                         | 4.43              | 50.716                          | 0 ***     |
| Preservation technique      | 3.86                                | 3.84                         | 4.50                         | 4.45              | 61.744                          | 0 ***     |
| Organically produced or not | 4.00                                | 3.96                         | 4.14                         | 4.23              | 11.760                          | 0.008 *** |

\*\*\*, \*\*, and \* indicate 1%, 5%, and 10% level of significance, respectively.

**Table 6: Rotated component factors and MANOVA of component factors**

| Purchasing concerns                | Component          |         |              |
|------------------------------------|--------------------|---------|--------------|
|                                    | Quality            | Safety  | Presentation |
| Freshness                          | 0.821              | 0.151   | 0.198        |
| Healthiness                        | 0.785              | 0.236   | 0.160        |
| Expiry date                        | 0.728              | 0.306   | 0.074        |
| Price                              | 0.688              | 0.062   | 0.191        |
| Preservation technique             | 0.310              | 0.715   | 0.235        |
| Labeled suggestions for use        | -0.001             | 0.713   | 0.264        |
| Logos of quality assurance         | 0.217              | 0.683   | -0.036       |
| Organically produced or not        | 0.169              | 0.664   | 0.105        |
| Packaging material                 | 0.386              | 0.519   | 0.464        |
| Typology                           | 0.116              | 0.147   | 0.809        |
| Cutting style                      | 0.211              | 0.105   | 0.757        |
| Packing size                       | 0.456              | 0.360   | 0.492        |
| <b>MANOVA of Component factors</b> |                    |         |              |
| Cluster                            | <b>Mean Square</b> |         |              |
|                                    | 537.433            | 418.191 | 144.270      |
|                                    | <b>df = 2</b>      |         |              |
| Error                              | <b>Mean Square</b> |         |              |
|                                    | 0.376              | 0.515   | 0.833        |
|                                    | <b>df = 1719</b>   |         |              |
| F                                  | 1429.806           | 812.633 | 173.129      |
| Significance                       | 0.000              | 0.000   | 0.000        |

Figure 10, the standardized factor scores for all three components are negative. Moreover, this group reports the lowest intended buying frequency among the clusters and predominantly includes individuals with an education level below A/L.

Cluster 2: Moderately concerned consumers (quality-driven) represent 39% of the sample. As illustrated in Figure 10, this group demonstrates moderate concern across all purchasing attributes, with a particular emphasis on product quality. These consumers place high importance on labeling information such as shelf life and quality assurance logos. Similar to the less concerned

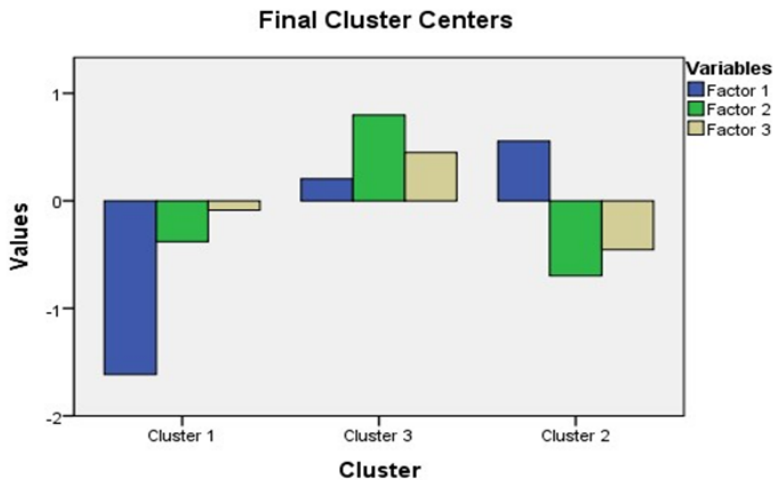


Fig. 10: Final cluster centres based on standardized factor scores

segment, this cluster also includes a relatively lower proportion of highly educated individuals.

Cluster 3: The highly concerned cluster, representing 42% of the sample, is characterized as safety-driven. As illustrated in Figure 10, this group exhibits positive standardized factor scores across all components, indicating a high level of concern for all FCV product attributes. These consumers are particularly focused on safety-related aspects and prioritize labeling information such as preservation techniques, types of disinfecting agents, and their concentrations. This segment includes a larger proportion of individuals with higher educational attainment.

#### 4 Conclusion

This study developed consumer profiles within urban communities in Sri Lanka by examining their preferences and purchasing concerns related to FCVs. Using both descriptive and inferential statistical methods, key insights were gained into consumer behavior and segmentation.

Descriptive analysis revealed that FCVs are perceived as convenient, time-saving, and affordable alternatives to whole vegetables. Among the various FCV types, fruit-type vegetables such as jackfruit and breadfruit were favored the most, whereas bulbs, tubers, and chillies were the least preferred. In terms of labeling, expiry date and preservation methods were considered essential, while nutritional information and disinfecting agent details were of comparatively lesser concern. Buying frequency data indicated that most consumers purchase FCVs on a weekly basis. Consumers preferred FCVs primarily as cooking ingredients rather than ready-to-eat single-serve options and showed

a clear inclination toward products treated with natural disinfecting agents and packaged in eco-friendly materials. Correspondence analysis revealed meaningful associations between disinfecting agents and packaging materials, particularly the preference for natural disinfectants like salt and vinegar when paired with plastic or rigifoam trays.

Expiry date, freshness, and healthiness were identified as the most important product attributes, while demographic factors such as education and income levels significantly influenced purchasing concerns. Notably, price remained a consistently important factor across all income groups. To identify consumer segments, exploratory factor analysis reduced twelve purchasing concerns into three key factors: quality, safety, and presentation. These factors facilitated a cluster analysis, which revealed three distinct consumer segments: less concerned consumers, quality-driven (moderately concerned) consumers, and safety-driven (highly concerned) consumers.

These findings are valuable for stakeholders in the FCV industry as they offer practical direction for product development, consumer targeting, and resource optimization. Future research should extend to rural populations to enhance the generalizability of the results.

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