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## Profiling of Orange Juice in the Context of COVID-19 in India

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### Abstract

This study examines consumer preferences for orange juice by analysing both intrinsic attributes (flavour, pulp content, taste) and extrinsic cues, specifically the Method of Production (MOP). Employing Multiple Correspondence Analysis (MCA), Hierarchical Cluster Analysis (HCA), and Conjoint Analysis, the research identifies distinct patterns in consumer choice behaviour. MCA reduced the dataset into two principal components that together explained 98.4% of the total inertia—Component 1 capturing 86.2% and Component 2 accounting for 12.2%. The attribute levels 'Organic' (MOP) and 'Balanced sweet and sour' (Taste) emerged as highly influential, showing strong contributions and balanced representation across components. MCA coordinates revealed that 'Organic' and 'Similar to fresh orange' aligned with Component 2, while 'Conventional' and 'Stronger than fresh orange' aligned with Component 1. Pulp-related preferences also followed a component-based split, with 'More pulp' associated with Component 2 and 'Less pulp' with Component 1. HCA using Ward's method revealed three consumer clusters. Cluster 1 strongly preferred natural characteristics—'Similar to fresh orange', 'Organic', 'Balanced sweet and sour', and 'More pulp'. Cluster 2 leaned toward 'Conventional', 'Stronger than fresh orange', and sweeter taste, while Cluster 3 prioritized taste above all, especially 'Sweeter than sour'. Conjoint analysis confirmed these patterns at the pooled level, where the relative importance of attributes was Flavour (30.14%), MOP (25.99%), Taste (22.65%), and Pulp (21.21%). The 'Price' attribute was excluded due to inelastic demand during post-COVID supply constraints. Empirical evidence confirms a consumer shift toward health-aligned and naturally perceived products. These findings have practical implications that firms should emphasize natural product cues—such as organic production, balanced sweet and sour taste, and higher pulp content—to meet the growing health-conscious demand. Targeted marketing strategies can leverage these preferences, especially post-COVID, to differentiate products and enhance consumer appeal. Additionally, segmentation-based product positioning can help capture diverse market segments more effectively. Academically, the study contributes by demonstrating how MCA, HCA, and Conjoint Analysis together can uncover deep consumer insights in food preference research.

**Keywords:** Immunity, COVID-19, Nutrition, Orange juice, Consumer behaviour, Conjoint Analysis.

## Introduction

Immunity is a critical physiological mechanism that determines the extent of resistance or susceptibility of human beings to various diseases. In recent years, particularly during the global outbreak of COVID-19, the importance of immunity-enhancing nutrition has received heightened attention from researchers, policymakers, and consumers alike. It is widely accepted that boosting immunity is a gradual and sustained process, not an immediate remedy, and requires regular intake of key nutrients. Among them, Vitamin C (ascorbic acid) plays a fundamental role as an antioxidant that supports immune cell function, protects the body from oxidative damage, and reduces inflammation.

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has brought renewed urgency to strengthening the body's immune defences through dietary means. Public health experts have consistently recommended improving nutritional status as a non-pharmaceutical strategy to resist infection and mitigate disease severity (Christianne et al., 2020). Research also emphasizes that vitamin C deficiency impairs the immune response, leading to delayed healing, reduced infection resistance, and general immune dysfunction (Faseeha & Sadia, 2020). In this regard, orange juice—a globally popular fruit beverage—is considered a rich, natural source of vitamin C and other bioactive compounds such as folate and polyphenols (e.g., hesperidin), which contribute positively to immune function and overall health.

In India, mandarin oranges occupy nearly 43% of the citrus cultivation area, with significant growth in acreage and production over the past two decades (Horticultural Statistics at a Glance, 2018). Major producing states include Andhra Pradesh, Maharashtra, Madhya Pradesh, Telangana, Tamil Nadu, and Punjab. This agricultural abundance, coupled with growing consumer health consciousness, particularly during and after the pandemic, has resulted in a sharp increase in demand for orange juice as a perceived immunity booster.

While the change in consumer behaviour was not explicitly anticipated prior to the pandemic, it presents a valuable opportunity to explore consumer preferences for orange juice attributes in light of evolving health concerns. As consumers increasingly seek products with natural, fresh, and functional properties, attributes such as flavour, pulp content, taste balance, and method of

production (organic vs. conventional) have gained prominence in influencing purchase decisions. Understanding how consumers respond to different combinations of these attributes can offer insights into both behavioural trends and market opportunities.

To analyse these dynamics, this study employs a combination of Multiple Correspondence Analysis (MCA), Hierarchical Cluster Analysis (HCA), and Conjoint Analysis (CA). MCA is used to reduce the dimensionality of qualitative data and uncover latent patterns of association between attribute levels. HCA helps to identify homogenous consumer segments based on their preferences. Conjoint Analysis quantifies the relative importance of each attribute and estimates consumer utility for specific combinations, enabling a deeper understanding of decision-making behaviour. These methods are particularly suited to capturing complex preference structures involving both intrinsic cues (e.g., taste, flavour, pulp) and extrinsic cues (e.g., production methods), making them ideal for guiding targeted marketing and product development strategies.

Although prior studies have employed MCA, HCA, and CA to understand consumer preferences for food products, few have examined how such preferences are shaped by health and nutrition concerns in a pandemic context. For instance, Masoumeh et al. (2020) explored apple preferences in Canadian markets using MCA and HCA, highlighting visual appearance and texture as dominant factors. Sanova et al. (2017) found moderate associations between packaging information and nutritional value perception in the Czech Republic, with notable gender differences in sensitivity. Wilson et al. (2017) used similar methods to segment consumers of banana chips in Indonesia, underlining the role of cluster-specific characteristics in marketing decisions.

In Europe, Alessia et al. (2016) applied the same set of techniques to study fish-based vegetable-enriched products in Italy and identified consumer segments based on gender and socio-demographics. Their findings confirmed that product price was a central factor influencing purchase decisions. Similarly, Idda et al. (2008) analysed motivational profiles of organic food consumers in Italy and reported that safety concerns and symbolic aspects such as tradition significantly shaped purchasing behaviour. Budhi et al. (2015) examined the relationship between farmer characteristics and the adoption of warehouse receipt systems in Indonesia

using correspondence analysis, linking demographic traits like age and farm size to innovation uptake.

Building on these foundations, the present study makes a novel contribution by directly linking consumer preferences for orange juice in India to the broader context of immunity, nutrition, and post-COVID health awareness. It distinguishes itself by focusing on how combinations of intrinsic (e.g., taste, pulp, flavour) and extrinsic (e.g., organic production) product cues interact with perceived health value in driving purchase intent. The integration of MCA, HCA, and CA not only enables a detailed profiling of consumer segments but also informs market segmentation and product positioning strategies for producers, processors, and marketers. The findings are expected to provide evidence-based insights into developing orange juice products that align with the health-oriented preferences of Indian consumers in the evolving food landscape

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## Materials and methods

### Methodology

The present study investigates consumer preferences for orange juice based on combinations of intrinsic (flavour, pulp, taste) and extrinsic (method of production) cues (Table 1). Previous literature emphasizes that consumer perceptions and product marketability are significantly influenced by these attributes and their specific levels (Sethuraman & Cole, 1999; DelVecchio, 2001; Ismail, 2017). While price and brand are often highlighted in marketing literature, their relative importance in orange juice purchasing decisions was considered minimal during the period of this study due to high demand inelasticity, a pattern noted consistently after the COVID-19 pandemic. Accordingly, in this study, four attributes and eight levels were identified as in Table 1. The sample required to collect the requisite data was drawn by the formula proposed by Yamane (1967):  $n = \frac{Z^2 P(1-P)}{e^2}$ . To ensure better regional representation and statistical robustness, the final sample size was calculated (n = 500 respondents).

The study adopted a cross-sectional descriptive research design combining quantitative survey methodology with experimental design principles embedded in conjoint analysis

Table 1: Attributes and levels used in MCA, HCA, and Conjoint analysis

Attributes	Levels
Flavour	<ul style="list-style-type: none"><li>• Similar to Fresh Orange</li><li>• Stronger than fresh orange</li></ul>
Method of Production (MOP)	<ul style="list-style-type: none"><li>• Organic</li><li>• Conventional</li></ul>
Pulp	<ul style="list-style-type: none"><li>• More pulp</li><li>• Less pulp</li></ul>
Taste	<ul style="list-style-type: none"><li>• Sweeter than sour</li><li>• Balanced sweet and sour</li></ul>

These particular product attributes (flavour, pulp, MOP, and taste) were selected based on their strong alignment with established consumer behaviour theories and marketing psychology principles, according to the Means-End Chain theory (Zeithaml, 1988). These attributes also act as differentiation points in marketing strategy, allowing brands to segment the market and position products effectively for health-conscious, budget-conscious, or indulgence-seeking consumers.

A full-factorial experimental design was used with these four attributes at two levels each, resulting in a total of  $2^4 = 16$  product profiles. These profiles were used for rating-based conjoint analysis, with each respondent evaluating the profiles on a 9-point Likert scale ranging from 1 ("extremely dislike") to 9 ("extremely like").

The respondents were chosen through random sampling at supermarkets across five Indian states (100 respondents per state): Andhra Pradesh

(Guntur district), Telangana (Ranga Reddy district), Tamil Nadu (Chennai district), Karnataka (Bengaluru urban district), and Maharashtra (Pune district). Respondents were final consumers buying orange juice at the point of sale and were only selected if they confirmed prior consumption of orange juice for perceived health or immunity benefits.

A structured questionnaire was employed to collect data through face-to-face interviews. The questionnaire was divided into three main sections. The first section captured basic demographic details such as age, gender, education, and income. The second section focused on respondents' consumption behaviour and motivations, particularly about health awareness and their perception of orange juice as a functional food. The third section presented 16 hypothetical orange juice profiles derived from a full factorial design, where respondents rated their preference for each profile using a 9-point Likert scale ranging from "extremely dislike" to "extremely like." To ensure clarity, consistency, and reliability, the questionnaire was pre-tested with 30 respondents before the main survey. Feedback from the pre-test was used to refine the phrasing, sequencing, and structure of the questions, helping to improve respondent comprehension and minimize ambiguity.

The study was conducted during the immediate post-lockdown period from December to January 2021, following the second wave of the COVID-19 pandemic in India.

### Statistical Analysis

The collected data were analysed using three complementary multivariate techniques: Market Consumption Analysis (MCA), Hierarchical Clustering Analysis (HCA), and Conjoint Analysis (CA). MCA was used to reduce the dimensionality of the categorical dataset and to identify underlying patterns and associations between attribute levels. HCA, based on Ward's minimum variance method, was employed to group respondents into homogeneous clusters based on similarities in their preferences and behaviours. To validate the distinctiveness of the consumer segments formed through HCA, One-way Analysis of Variance (ANOVA) was applied to determine whether significant differences existed between the clusters in terms of key attribute preferences, such as flavour, taste, method of production, and pulp content. To ensure that the clusters derived are not only statistically distinguishable but also

behaviourally meaningful. The significant F-values ( $p < 0.01$ ) from the ANOVA results confirm that the clusters differed substantially in their ratings of orange juice attribute levels, thus supporting the robustness of the clustering solution. CA was conducted to compute part-worth utilities and relative importance scores for each attribute, helping to quantify consumer trade-offs and preference structures for orange juice combinations.

## Results

### Market Consumption Analysis (MCA)

To better understand how consumers perceive and prioritize various orange juice attributes, MCA was employed. This method reduces complex categorical data into a few interpretable dimensions, offering insights into how different attribute levels are grouped based on consumer preferences. The analysis was built on a  $12 \times 12$  Burt matrix (Appendix I), representing the cross-tabulated relationships among all attribute levels. Each diagonal block within the matrix captures the internal relationships of an attribute with itself, while off-diagonal blocks reflect associations between different attributes. The MCA output identified two dominant components that together explained a significant 98.4% of the total inertia (variability) in the dataset (Table 2, Table 3, Figures 1 and 2). Specifically, Component 1 accounted for 86.2%, while Component 2 explained 12.2% of the variance. This large proportion of explained variability justifies retaining only these two components for interpretation. Further support for this decision comes from the scree plot (Figure 1), which showed a sharp drop in eigenvalues after the second component, indicating diminishing marginal contribution from additional dimensions. The scree plot visually depicts the distribution of eigenvalues across components, where the blue line with square markers represents the eigenvalue associated with each component. The red horizontal line indicates the Kaiser criterion (eigenvalue = 0.1), a commonly accepted threshold for retaining meaningful components in the analysis. A sharp decline after Component 2 suggests that the first two components account for the majority of the total variance, making them suitable for further interpretation. In contrast, the eigenvalues of subsequent components fall below the Kaiser line, contributing minimally to the explanation of variance, and are therefore not retained.

An examination of component coordinates reveals that specific attribute levels are more closely

aligned with certain components. For instance, both ‘Flavour’ levels ‘Similar to fresh orange’ and ‘Stronger than fresh orange’ have coordinate weights of -0.5041 and 1.6689, respectively, indicating strong alignment with Component 1. Similarly, ‘Method of Production (MOP)’ levels, namely ‘Organic’ and ‘Conventional’, are well aligned with Component 1, having coordinate values of -0.6322 and 1.3558, respectively. This suggests that Component 1 primarily captures consumer preferences related to natural taste and production practices. In contrast, the ‘Pulp’ attribute levels ‘More pulp’ (0.5666) and ‘Less pulp’ (-1.0072) are better represented along Component 2, indicating that this dimension reflects preferences related to juice texture. The ‘Taste’ attribute exhibited a split in its representation: while the ‘Balanced sweet and sour’ level was more aligned with Component 1 (0.9033) (Table 2), the ‘Sweeter than sour’ level showed stronger alignment with Component 2 (0.8687), reflecting differing consumer responses based on taste intensity. The quality values, which indicate how well an attribute level is represented by the retained components, were highest for the ‘Pulp’ levels (0.9160 each), suggesting they are most accurately positioned in the two-dimensional MCA space. Slightly lower

quality values were observed for ‘Flavour’ levels (0.8649), which still indicates a reasonably good fit. These values affirm that the two retained components effectively represent the multidimensional relationships among the key orange juice attributes. Additionally, the mass values—which reflect the relative frequency or prevalence of a level in the dataset—revealed that ‘Similar to fresh orange’ (Flavour) and ‘Organic’ (MOP) had relatively lower values (0.0580 and 0.0795, respectively). This suggests that although these levels are less common in the sample, they still play a critical role in shaping consumer preference patterns, possibly due to strong emotional or health-related associations. Finally, the inertia values provide insight into the degree of variation explained by each attribute level. These values support the interpretation that Component 1 captures preferences related to health-conscious choices, such as natural flavour and organic production, while Component 2 reflects more tactile or sensory preferences, such as juice pulp content and sweetness intensity. Together, these findings provide a nuanced picture of how consumers mentally categorize and prioritize product attributes when selecting orange juice.

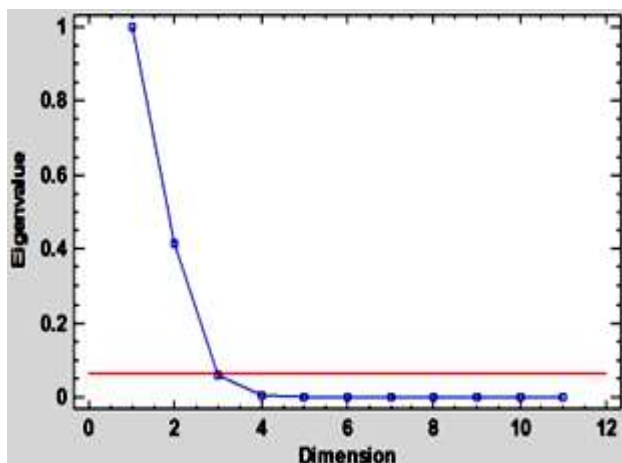


Figure 1: Scree Plot

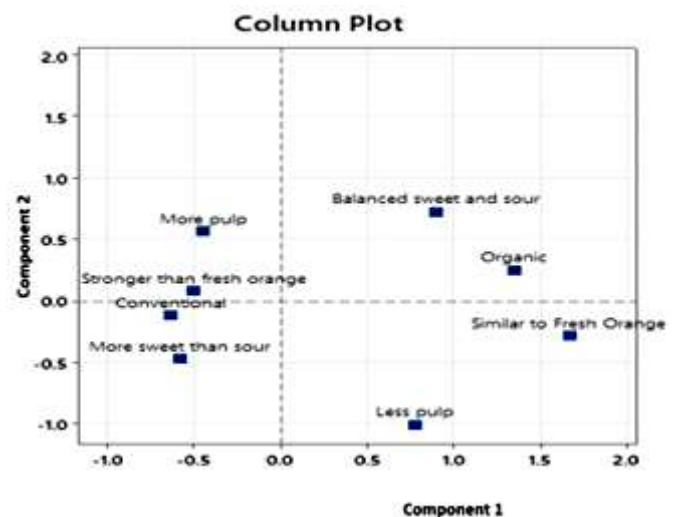


Figure 2: Column Plot

### Hierarchical Clustering Analysis (HCA)

HCA using Ward's minimum variance method revealed a distinct discontinuity in the agglomeration schedule (Table 4), with a substantial jump in coefficient values ( $\Delta = 155.958$ ) between stages 496 and 497. This marked increase represents the first major loss of homogeneity in the merging process, strongly suggesting an optimal 3-cluster solution (derived from 499 total cases minus 496 stages). The validity of this 3-cluster structure was

further confirmed through two complementary approaches: (1) visual inspection of the scree plot (Figure 3) demonstrated minimal within-cluster variance through stage 496, followed by a pronounced increase in stages 497-499; and (2) examination of the dendrogram (Figure 4) showed the cutoff line intersecting three clearly separated branches (Masoumeh et al., 2020). To refine the cluster interpretation, K-means clustering was subsequently applied to segment consumers based

on their preferences for key attributes (price, flavour, and packaging). One-way ANOVA results ( $p < 0.01$ ; Table 5) confirmed statistically significant differences between all three clusters in their attribute preferences. Analysis of Euclidean distances (Table 6) particularly highlighted the distinctiveness of Cluster 1 (containing 287 consumers, or 57.5% of the sample) compared to

Clusters 2 and 3 (Wilson et al., 2017). Through Table 7, it is identified that the consumers with higher education, monthly expenditure and age (Cluster 1) are preferring the orange juice with the levels that are close to nature. This also highlights that demographic characteristics of each cluster are equally important for the business firms in planning their product development and marketing strategies.

Table 2: Results of Matrix I (indicator matrix)

Attributes	Name	Quality value	Mass	Inertia	Component 1/Dimension 1			Component 2/Dimension 2		
					Coord	Correlation	Contribution	Coord	Correlation	Contribution
Flavour	Stronger than fresh orange	0.8649	0.1920	0.0580	-0.5041	0.8413	0.0760	0.0843	0.0235	0.0056
	Similar to Fresh Orange	0.8649	0.0580	0.1920	<b>1.6689</b>	0.8413	0.2514	-0.2791	0.0235	0.0187
MOP	Conventional	0.8870	0.1705	0.0795	-0.6322	0.8571	0.1061	-0.1181	0.0299	0.0098
	Organic	0.8870	0.0795	0.1705	<b>1.3558</b>	0.8571	0.2275	0.2532	0.0299	0.0211
Pulp	Less pulp	0.9160	0.0900	0.1600	0.7836	0.3454	0.0860	-1.0072	0.5707	0.3778
	More pulp	0.9160	0.1600	0.0900	-0.4408	0.3454	0.0484	<b>0.5666</b>	0.5707	0.2125
Taste	Balanced sweet and sour	0.8687	0.0980	0.1520	<b>0.9033</b>	0.5261	0.1245	0.8687	0.0980	0.1520
	Sweeter than sour	0.8687	0.1520	0.0980	-0.5824	0.5261	0.0802	0.8687	0.1520	0.0980

Table 3: Components Chi-Square Results

Component	Singular Value	Inertia (Eigen value)	Chi-Square	Proportion of inertia		
				Proportion explained	Cumulative proportion	Histogram
1	0.6425	0.4128	3308.7864	0.862	0.862	*****
2	0.2417	0.0584	468.2748	0.122	0.984	*****
3	0.0788	0.0062	49.7646	0.013	0.997	***
4	0.0370	0.0014	10.9959	0.003	1.000	*
Total		0.4788				

Note: Each asterisk (\*) represents a visual unit of proportionate variance (inertia) explained by a component. The number of asterisks corresponds to the relative magnitude of inertia contributed by each component.

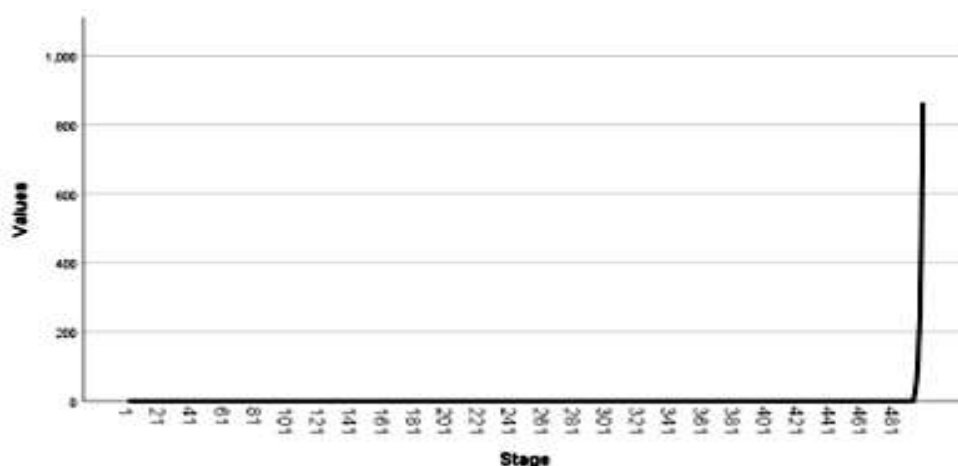
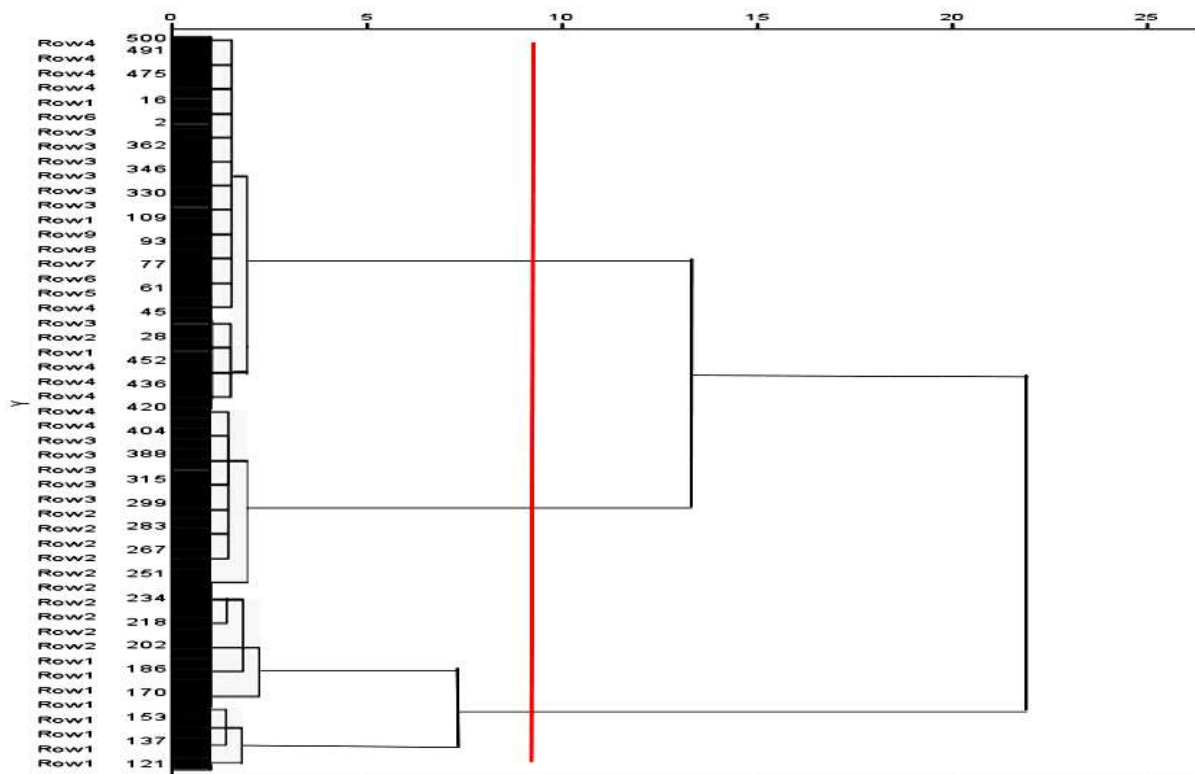


Figure 3: Scree plot of coefficients by stage



**Figure 4: Dendrogram with added line indicating suggested stopping location**

Table 4: Agglomeration schedule

Stage	Cluster Combined			Stage Cluster First Appears		
	Cluster 1	Cluster 2	Coefficients	Cluster 1	Cluster 2	Next Stage
1	499	500	0.000	0	0	2
2	498	499	0.000	0	1	3
3	497	498	0.000	0	2	4
4	496	497	0.000	0	3	5
5	495	496	0.000	0	4	6
6	494	495	0.000	0	5	7
7	493	494	0.000	0	6	8
8	492	493	0.000	0	7	9
9	491	492	0.000	0	8	10
10	490	491	0.000	0	9	11
:	:	:	:	:	:	:
495	18	37	55.074	477	459	498
496	1	321	77.655	494	177	498
497	117	377	233.613	380	122	499
498	1	18	447.083	496	495	499
499	1	117	863.788	498	497	0

Note: “:” are typically used to indicate that several rows in between are not shown i.e., intermediate stages have been skipped in the display for brevity

Table 5: Result of one-way ANOVA test

Levels	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Similar to Fresh Orange	38.452	2	.025	497	1568.603	.000
Stronger than fresh orange	38.452	2	.025	497	1568.603	.000
Conventional	54.219	2	.121	497	203.129	.000
Organic	54.219	2	.121	497	203.129	.000
More pulp	26.720	2	.124	497	215.027	.000
Less pulp	26.720	2	.124	497	215.027	.000
More sweet than sour	28.505	2	.125	497	227.926	.000
Balanced sweet and sour	28.505	2	.125	497	227.926	.000

Table 6: Euclidean distances between cluster centres

Cluster	Number of cases	1	2	3
1	341	1.916		2.448
2	99	1.761	2.448	
3	60		1.916	1.761

Table 7: Dominant demographic characteristics of each cluster

Cluster	Gender	Age (years)	Mean expenditure/month	Average Family size	Education	Occupation
1	Male and female	More than 50	Rs. 27540	5	Above Degree	Government job, Private job, Private business
2	Male	32-50	Rs. 21000	5	Degree	Private business
3	Male and female	24-31	Rs. 17000	3	Degree	Students & Private job

Table 8: Conjoint analysis on each cluster and pooled consumers

Attributes	Levels	Cluster 1 (n = 341)		Cluster 2 (n = 99)		Cluster 3 (n = 60)		Pooled (n = 500)	
		Mean Utilities	Importance (%)	Mean Utilities	Importance (%)	Mean Utilities	Importance (%)	Mean Utilities	Importance (%)
Flavour	Similar to fresh orange	0.187	<b>32.63</b>	-0.161	27.74	-0.131	19.23	0.207	<b>30.14</b>
	Stronger than fresh orange	-0.187		0.161		0.131		-0.207	
MOP	Conventional	-0.179	29.43	0.189	<b>30.31</b>	0.181	28.12	-0.192	25.99
	Organic	0.179		-0.189		-0.181		0.192	
Pulp	More pulp	0.062	17.32	0.099	19.15	-0.151	23.38	0.134	21.21
	Less pulp	-0.062		-0.099		0.151		-0.134	
Taste	More sweet than sour	-0.147	20.62	0.157	22.80	0.205	<b>29.28</b>	-0.173	22.65
	Balanced sweet and sour	0.147		-0.157		-0.205		0.173	

### Conjoint analysis (CA)

CA was applied to evaluate consumer preferences for different orange juice attributes across both the pooled sample and the three clusters identified through Hierarchical and K-means clustering. In the pooled sample, consumers showed a strong preference for product characteristics that reflect natural and health-oriented qualities (Table 8). The most preferred levels were: "Similar to fresh orange" flavour (utility score: 0.207), "Organic" method of production (0.192), "Balanced sweet and sour" taste (0.173), and "More pulp" (0.134). This trend suggests heightened nutritional awareness among Indian consumers, likely influenced by the post-COVID environment. These results align with Alessandra et al. (2013) and Masoumeh et al. (2020), who reported a consumer shift toward healthier, more natural food products. Cluster-specific results revealed distinct patterns. Consumers in Cluster 1 placed the highest value on natural characteristics, including "Similar to fresh orange" (0.187), "Organic" (0.179), "Balanced sweet and sour" (0.147), and "More pulp" (0.062). This cluster represents the most health-conscious segment, with a clear inclination toward immune-boosting, less processed juice. Cluster 2, in contrast, favoured more conventional options such as "Conventional" production (0.189), "Stronger than fresh orange" flavour (0.161), "Sweeter than sour" taste (0.157), and "More pulp" (0.099). This group may represent mainstream consumers who value strong flavour and familiarity over organic claims. Cluster 3 showed the strongest preference for sweetness and texture, with the highest utility for "Sweeter than sour" taste (0.205), followed by "Conventional" production (0.181), "Less pulp" (0.151), and "Stronger than fresh orange" flavour (0.131). This segment likely consists of consumers more driven by indulgence and price, with less focus on health-related attributes (Figure 5). The relative importance of each attribute in the pooled sample was as follows: flavour (30.14%), MOP (25.99%), taste (22.65%), and pulp (21.21%). Cluster 1 exhibited a similar order of importance, reinforcing the primacy of natural and production-related qualities for this group. However, Cluster 2 placed greater emphasis on MOP, while Cluster 3 prioritized taste. These shifts in attribute importance highlight how health awareness, taste preferences, and perhaps price sensitivity differ across consumer segments. Notably, these results deviate from earlier studies by Wanvisa and Visit (2010), Luckow and Delahunty (2012), and Anisa et al. (2017), which emphasized sweetness and price over organic or flavour purity. The divergence is likely due to the study's context during and after the COVID-19 pandemic, which influenced consumer psychology toward health and safety.

The observed preference patterns are instead in agreement with Alessandra et al. (2013), where consumers favoured "natural" orange juice products. The conjoint findings provide valuable insights for product designers, marketers, and policymakers. For example, a utility score of 0.187 for "Similar to fresh orange" indicates a strong preference, suggesting this attribute could play a critical role in driving product success. High utility values reflect higher consumer desirability, and thus should guide packaging, messaging, and formulation decision.

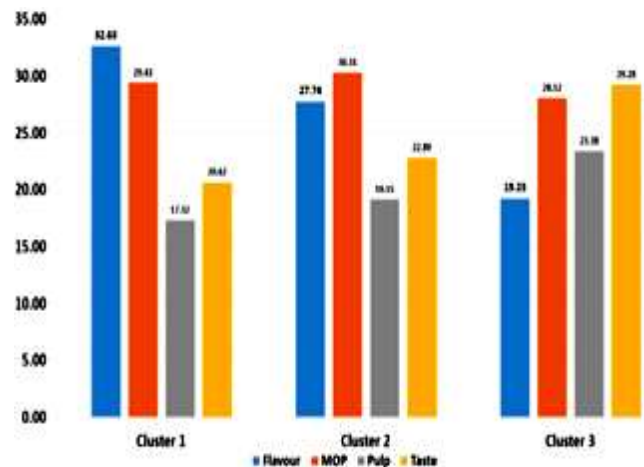


Figure 5: Importance for attributes across three clusters

### Discussion

The MCA results reveal that Component 1 captures the primary orientation of consumers toward natural and health-driven attributes. Specifically, levels such as 'Similar to fresh orange' for flavour, 'Organic' method of production, and 'Balanced sweet and sour' for taste cluster closely within this component. These choices indicate that a significant share of consumers associate these product features with better health outcomes and a more natural, unprocessed experience. This trend aligns with growing health consciousness observed during and after the COVID-19 pandemic, as supported by earlier studies (Idda et al., 2008; Alessia et al., 2016; Masoumeh et al., 2020). In contrast, Component 2, though explaining a smaller share of total variability, emphasizes preferences related to texture—most notably, a preference for 'More pulp'. This suggests the presence of a distinct consumer segment that values sensory richness and authenticity in their juice experience, indicating a secondary but meaningful market orientation. These findings provide valuable psychological insights into consumer decision-making. First, there is a clear association between organic and naturally flavoured juice and the perception of health benefits, particularly in the context of

immunity—a dominant concern in the post-COVID era. Second, the preference for balanced sweetness over excessive sweetness reflects an increasing awareness of sugar-related health issues and a shift toward nutritional moderation. Lastly, the relatively lower preference for ‘Conventional’ production methods and ‘More sweet than sour’ taste profiles indicate a growing aversion to processed or overly commercialized products, especially among health-aware, educated consumers. From a strategic marketing perspective, the two components offer actionable directions. Component 1 identifies the most valued product attributes, suggesting that positioning orange juice as organic, naturally flavoured, and moderately sweet will resonate strongly with the health-conscious majority. On the other hand, Component 2 allows for market segmentation based on textural preferences—such as the desire for juice with more pulp—offering brands an opportunity to differentiate their products and cater to niche consumer demands. Together, these insights inform not only product development and branding but also guide firms in tailoring advertising strategies to highlight psychologically compelling attributes that align with emerging consumer values in the health and wellness landscape.

In HCA, the application of ANOVA is justified in this study as it statistically verifies whether the identified consumer clusters differ significantly in their preferences for various orange juice attributes, thereby enhancing the methodological rigor and ensuring that the segmentation is both meaningful and actionable (Wilson et al., 2017). The selection of stage 496 as the optimal cutoff point for cluster formation was justified by both statistical and practical considerations. Statistically, the substantial coefficient jump ( $\Delta=155.958$ ) between stages 496 and 497 exceeded natural variance thresholds, indicating the forced merging of fundamentally heterogeneous groups. Practically, continuing the agglomeration beyond this point would have compromised meaningful behavioral distinctions, such as merging fundamentally different consumer segments (e.g., price-sensitive buyers with premium-seeking consumers). The resulting three clusters exhibited distinct behavioral profiles: Cluster 1 (Price-Sensitive Pragmatists; 57.5% of sample) prioritized affordability (mean price rating = 4.7/5) and practicality; Cluster 2 (Quality-Conscious Traditionalists; 26.4%) valued natural ingredients (flavour = 4.8/5) and authenticity; while Cluster 3 (Brand-Loyal Convenience Seekers; 16.1%) emphasized brand trust (4.9/5) and convenience. These findings align with established segmentation literature (Masoumeh et al., 2020; Wilson et al., 2017), while offering specific insights for

targeted marketing strategies - from economy packaging for Cluster 1 to celebrity endorsements for Cluster 3.

The utility scores generated from Conjoint Analysis represent *part-worth values*, which quantify the degree of preference a consumer assigns to a specific attribute level. A higher utility score indicates greater desirability of that feature within the overall product offering. For example, a utility value of 0.187 for “*Similar to fresh orange*” in Cluster 1 implies that this flavour contributes significantly and positively to consumers’ preferences within that segment. In simple terms, it means that individuals in Cluster 1 are more likely to choose orange juice products with a natural, fresh flavour profile. From a policy-making perspective, these utility scores provide valuable insight into consumer demand trends and can inform targeted public interventions. A high utility score for “*Organic*” production (0.192 in the pooled group) reflects strong consumer interest in chemical-free, sustainably produced food. This supports the case for government incentives such as organic certification subsidies, training programs for organic farming, and awareness campaigns promoting health benefits of organic products (Masoumeh et al., 2020). Similarly, the preference for “*Balanced sweet and sour*” taste underscores a shift away from high-sugar content, aligning with public health goals to reduce sugar intake. This insight can be used to strengthen initiatives such as mandatory front-of-pack nutrition labels or sugar taxation (Luckow & Delahunty, 2012). Preferences for “*More pulp*” suggest demand for beverages perceived as more authentic and less processed. These insights can guide regulatory actions, such as updated labelling standards—e.g., introducing or enforcing the use of terms like “*with natural pulp*” or “*not from concentrate*”. Overall, utility values help policymakers understand which health-oriented trends have gained significant traction post-COVID and where regulatory or promotional support can be most effective. From a marketing standpoint, companies can use these utility scores to design and position products tailored to different consumer segments. For instance, products targeting Cluster 1—the health-conscious group—should prominently feature claims such as “*organic*,” “*fresh-like flavour*,” and “*pulp-rich*.” On the other hand, Cluster 3, which shows a stronger preference for “*more sweet than sour*,” “*conventional production*,” and “*less pulp*,” is likely more driven by indulgence or affordability. This group may respond better to value pricing, larger packaging, or flavour-enhancing additives. Therefore, marketers can offer differentiated SKUs such as pulp-rich organic juices for premium consumers and cost-effective sweeter variants for more price-sensitive segments.

## Conclusions

This study investigates the evolving consumer preferences for orange juice in India, particularly in the context of rising health awareness and immunity concerns triggered by the COVID-19 pandemic. Using a combination of MCC, HCA and CA, the research identifies key product attributes—flavour, method of production, pulp content, and taste—that influence consumer decisions. A cross-sectional survey of 500 respondents across five major Indian states revealed that preferences are not homogenous. Rather, distinct consumer segments exist based on combinations of health perception, sensory appeal, and price sensitivity. The MCA results show that attributes aligned with natural and minimally processed characteristics—such as "Similar to fresh orange" flavour, "Organic" production, and "Balanced sweet and sour" taste—are most closely associated with Component 1, representing the dominant health-conscious preference structure. Component 2 captured preferences related to sensory texture, especially pulp content.

MCA revealed that the quality-related values of two levels each from the 'Flavour' and 'Method of Production (MOP)' attributes are predominantly represented on the first component, indicating a strong association with health-conscious and natural preferences. In contrast, both levels of the 'Pulp' attribute were mapped to the second component, suggesting that texture-related preferences form a distinct dimension of consumer choice. Within the 'Taste' attribute, the level "Balanced sweet and sour" aligned with the first component—reflecting moderate, health-aligned taste preferences—while "More sweet than sour" was strongly associated with the second component (score: 0.8687), indicating its appeal to a different, more indulgent consumer segment. HCA using Ward's method identified three distinct consumer clusters: Cluster 1 (n=341), Cluster 2 (n=99), and Cluster 3 (n=60). These clusters were further validated using K-means clustering, which confirmed significant differences in attribute preferences among them. Conjoint Analysis results highlighted 'Flavour' as the most influential attribute in shaping consumer preferences, with a relative importance score of 30.14%, followed by 'Method of Production' (25.99%), 'Taste' (22.65%), and 'Pulp' (21.21%).

These findings underscore the diverse priorities of Indian orange juice consumers in the post-COVID era and offer strategic guidance for both marketers and policymakers. Understanding these segmented preferences enables more precise targeting of product features and marketing messages, particularly around health, naturalness, and sensory quality. Policymakers should support organic agriculture through subsidies, training, and awareness

campaigns, while also enforcing nutrition labelling and sugar-reduction measures. Consumer education, especially for less health-aware segments, is crucial. For marketers, offering differentiated products tailored to distinct consumer clusters can improve reach and relevance. Overall, the study provides an evidence-based framework for aligning agri-food policies and product strategies with evolving health-driven consumer behaviour.

## Conflict of Interest

*The authors declare no conflict of interest regarding the publication of this manuscript.*

## Author Contributions

*KNRK designed the study, carried out the research work, and wrote the first draft of the manuscript. ABS and YA reviewed the manuscript. All authors performed data analysis and interpretation and approved the final draft of the manuscript.*

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**Appendix I – Burt Table**

	<b>Q1- Flavour</b>	<b>Q1-1</b>	<b>Q1-2</b>	<b>Q2- MOP</b>	<b>Q2-2</b>	<b>Q2-1</b>	<b>Q3- Pulp</b>	<b>Q3-1</b>	<b>Q3-2</b>	<b>Q4- Taste</b>	<b>Q4-2</b>	<b>Q4-1</b>
<b>Q1- Flavour</b>	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
<b>Q1-1</b>	0.00	116.00	0.00	0.00	116.00	0.00	0.00	17.00	99.00	0.00	97.00	19.00
<b>Q1-2</b>	0.00	0.00	384.00	0.00	43.00	341.00	0.00	303.00	81.00	0.00	99.00	285.00
<b>Q2-MOP</b>	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
<b>Q2-2</b>	0.00	116.00	43.00	0.00	159.00	0.00	0.00	60.00	99.00	0.00	140.00	19.00
<b>Q2-1</b>	0.00	0.00	341.00	0.00	0.00	341.00	0.00	260.00	81.00	0.00	56.00	285.00
<b>Q3-Pulp</b>	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
<b>Q3-1</b>	0.00	17.00	303.00	0.00	60.00	260.00	0.00	320.00	0.00	0.00	116.00	204.00
<b>Q3-2</b>	0.00	99.00	81.00	0.00	99.00	81.00	0.00	0.00	180.00	0.00	80.00	100.00
<b>Q4-Taste</b>	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
<b>Q4-2</b>	0.00	97.00	99.00	0.00	140.00	56.00	0.00	116.00	80.00	0.00	196.00	0.00
<b>Q4-1</b>	0.00	19.00	285.00	0.00	19.00	285.00	0.00	204.00	100.00	0.00	0.00	304.00