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A Study on the Consumer Preference of Kamalapur Red Banana and G9 Banana in Karnataka

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Abstract— *The present study was conducted in Kalaburagi district in North Eastern Karnataka. Kamalapur taluk was purposefully chosen for the study. The Kamalapur red banana is exclusively grown in the Kamalapur taluk of the Kalaburagi district. Both Primary and secondary data was collected to fulfil the objectives of the study. The primary data was collected through survey method using well-structured pre-tested schedule to collect information from Kamalapur red and other banana varieties growing farmers, marketing intermediaries and consumers. The data on cost and returns, marketing cost and constraints of banana farmers collected through personnel interview. The significance of this study lies in its comprehensive analysis of consumer preferences for red and G9 bananas, providing valuable insights for farmers, policymakers and stakeholders in the horticultural sector. The focus on consumer preferences highlights the potential for market development, especially with the Kamalapur Red banana's Geographical Indication (GI) tag, which can unlock premium market opportunities. Conjoint analysis technique used to analyse the questions such as, what banana attributes are important to the consumer. What level of banana attributes are the most or least desirable in the consumer's mind. These attributes and levels resulted in 16 profile solutions. The study revealed that while both rural and urban consumers valued attributes such as price and keeping quality highly, there were notable differences in preferences for attributes like fruit skin colour and taste. Understanding these preferences is crucial for producers and marketers to tailor their products and marketing strategies effectively to meet the specific needs of rural and urban consumers. By aligning product offerings with consumer preferences, stakeholders can enhance the acceptance and marketability of red bananas. The analysis of the utility values for various attribute combinations of bananas revealed significant insights into consumer preferences. Among the attribute combinations analyzed, the combination with low price, red fruit skin colour, large fruit size, small cluster size, moderately ripened state, low sweetness, and high keeping quality was ranked highest with a total utility value of 5.325. This combination was preferred the most, highlighting that consumers valued a balance of red skin colour, large fruit size, and high keeping quality, along with a low price and moderately ripened state. To align with consumer preferences for red and G9 bananas, policy initiatives should focus on improving product quality, accessibility, and consumer awareness. For red bananas, leveraging their Geographical Indication (GI) tag through branding and promotional campaigns can highlight their unique attributes, such as nutritional benefits and cultural significance, to attract a premium market.*

Keywords— ***G9banana, Kamalapur red banana, Consumer preference, North Eastern Karnataka***

I. INTRODUCTION

Bananas (*Musa acuminate)*, belonging to the genus *Musa*, are one of the most popular fruits consumed worldwide. They are essential not only for their nutritional value but also for the economic importance they hold, especially in tropical countries like India. Bananas are cultivated across various agro-climatic zones in India, making it the largest producer of this fruit globally. Among the several varieties cultivated, the G9banana and the Kamalapur Red Banana **(***Musa acuminata* 'Red Dacca'**)** are two prominent varieties that have distinct characteristics, market potential, and nutritional profiles. The G9banana, widely grown across India, is favoured for its high yield, disease resistance, and export suitability. It has become the backbone of banana exports due to its long shelf life, appealing taste, and ability to withstand transportation challenges. On the other hand, the Kamalapur Red Banana, native to the Kalaburagi region of Karnataka, is known for its striking red peel, unique flavour, and significant cultural importance. While it is primarily consumed in domestic markets, it has the potential to penetrate international niche markets due to its distinct characteristics and growing consumer interest in unique, exotic fruits. Karnataka, which ranks fourth in banana production, cultivates bananas on 113,730 hectares, contributing 8.33 per cent of India's total banana production. The state's key banana-producing districts include Kalaburagi, Bagalkote, Belagavi, Chitradurga, and Shivamogga, each contributing significantly to the state's overall banana output. Kalaburagi, in particular, is known for producing two important banana varieties: the widely cultivated **G9**and the regionally significant Kamalapur Red Banana

The G9 banana is the most dominant variety in the Kalaburagi district and is widely grown across India due to its adaptability, high yield, and disease resistance. In Kalaburagi, the G9 variety covers an area of 1,941 hectares, producing 65,814 MT annually, which constitutes 79.74 per cent of the total banana production in the district. The G9 is particularly popular due to its commercial viability and demand in both domestic and export markets. Its high yield, coupled with its long shelf life, makes it a preferred variety for export to various international markets, including the Middle East, Europe, and neighbouring countries like Nepal and Bangladesh (Anonymous (c) 2022-23). The Kamalapur Red Banana, on the other hand, is a unique variety indigenous to the Kalaburagi region, particularly grown in Kamalapurtaluk. Though the cultivation area for this variety is relatively small, covering only 25 hectares with an annual production of 636 MT, it holds high cultural and economic value in the region. This variety is known for its distinct red colour, high iron content and unique flavour, which makes it highly prized in local markets. Due to its limited production and high demand, the Kamalapur Red Banana commands a premium price. Efforts are currently being made to increase its visibility in both domestic and international markets, though its contribution to exports remains limited at present (Anonymous (e) 2022-23).

Kalaburagi's G9 bananas are well-suited for export due to their superior quality and durability during long-distance transport. Farmers in Kalaburagi are increasingly engaging in contract farming and working with export agencies to ensure that their produce meets international quality standards. Despite this, marketing challenges remain, especially concerning price fluctuations and the cost of transportation and storage. Infrastructure improvements such as better cold storage facilities and streamlined transport networks could further enhance the export potential of the region's bananas. The Kamalapur Red Banana, while currently not a major export product, has the potential to tap into premium international markets if its unique attributes—such as its rich flavour and nutritional content—are effectively marketed. Local government initiatives are working to develop branding and promote geographical indication (GI) certification for Kamalapur Red Bananas, which could increase their value in both domestic and export markets.

The G9 banana is preferred for export due to its ability to withstand long-distance transportation and its resistance to diseases, which reduces post-harvest losses. Improved cold chain infrastructure and better transportation facilities have further enhanced the export potential of this variety. States like Maharashtra, Gujarat, and Tamil Nadu are the leading contributors to banana exports, accounting for a large portion of the country's export volume. In contrast, the Kamalapur Red Banana has not yet made significant inroads into international markets. However, it holds potential as a niche product in premium export markets, particularly among consumers who are seeking exotic and nutritionally rich fruit varieties. Efforts to secure Geographical Indication (GI) status for the Kamalapur Red Banana could further boost its marketability, both domestically and internationally. While the G9 banana dominates the domestic and export markets, the Kamalapur red banana holds potential in niche markets due to its unique characteristics and nutritional value. The growing demand for bananas, both domestically and internationally, presents significant opportunities for India's banana industry to expand and diversify. Kamalapur Red Banana (*Musa acuminata* 'Red Dacca') is a special variety of Red banana which is exclusively grown in the valley of Kamalapur village and its surrounding areas in Kalaburagi district of The horticultural product is protected under the Geographical Indications of Goods (Registration & Protection) Act (GI Act) 1999 of the

Government of India. It was registered by the Controller General of Patents Designs and Trademarks under the title "Kamalapur Red Banana" and recorded at GI Application number 133 under Class 31 as a horticulture item. In view of its GI identity, genetic engineering tests are not allowed to be done on this variety of banana, and it is exclusively the property of Kamalapur farming community.

Kamalapur Red Banana is a unique species of red banana that is only grown in the valley of Kamalapur village and its surrounding areas in Karnataka's Kalaburagi district. It is characterized as a "rich man's fruit" since it is marketed at a higher price than other banana kinds due to larger fertilizer inputs in farming. The Kamalapur Red Banana is a variety of banana with a higher calcium, iron, potassium, and fiber content than other banana varieties1. It is high in potassium, Vitamin B6, and Vitamin C, and it also has a significant amount of fiber. A 100-gram portion of Red Banana has around 21 grams of carbohydrates, 90 calories, 1.3 grams of protein, 0.3 grams of fat, and 3 grams of fiber2. It also has 9% potassium and 9 per cent magnesium. Therefore in order to extend the area and production of this varieties there is need to study its cost, returns, marketing efficiency. The production of Kamalapur red banana is confined to only few villages such as Kamalapur, Rajnal, Okali, Navnihal etc which area situated nearby Kamalapur. Hence it is essential to know the reasons for limited cultivation of Kamalapur red banana which will help to design policy to widen the cultivation of Kamalapur red banana to other areas also.

II. MATERIALS AND METHODS

Conjoint analysis

Conjoint analysis is a flexible method of conducting marketing research that can yield useful data for forecasting, price and market segmentation decisions, advertising and distribution, repositioning, and competitive analysis, among other applications. It is a technique for evaluating the value judgments of consumers. Therefore, it was utilized to gauge customer preference for the qualities of bananas in the current study.

One of the important requirements for the conjoint analysis is the identification of critical attributes to describe the preferences for banana and the specific and feasible levels of these attributes. On the basis of the objective attributes and then attribute levels with orthogonal variables 18 cards were developed. The respondent was first asked to rank the set of profiles, or cards according to his or her preference. On each of these profiles, all factors of interest were represented and a different combination of factor levels appeared. The task of respondents was to rank each profile from the most to the least preferred. From these rankings or scores, conjoint analysis derived utility scores for each factor level. These utility scores, analogous to regression coefficients were called partworth and were used to find the relative importance of each factor.

Conjoint analysis technique used to analyse the questions such as, what banana attributes are important to the consumer. What level of banana attributes are the most or least desirable in the consumer's mind. These attributes and levels resulted in 16 profile solutions. Each profile was described on a separate card called plan cards. The respondents were interviewed and each respondent was shown a randomly mixed set of 18 plan cards and was asked to rank them accordingly to their own perception. The ranks provided by them through these 18 cards were noted down. For each attribute/ response, art-worth as well as relative importance of each attribute was estimated using conjoint analysis.

The additive conjoint model was used in this study. The model has been formulated as:

$$\mathbf{Y = \sum_{i=1}^{n} \sum_{j=1}^{m} v_{ij} x_{ij}} \text{ ... ...} \mathbf{.....(1)}$$

Where,

Y = Consumer's overall evaluation of the banana

Vij = Part worth associated with 'j' (1,2,3,….m) of attributes, 'i'(1,2,3,…..,n)

Xij = Dummy variable representing the preference of the jth level of ith attribute.

The conjoint analysis in this study was conducted using SPSS. The process began by defining the problem, where key product attributes relevant to consumer preferences were identified, such as price, fruit skin color, fruit size, cluster size, ripeness, taste, and keeping quality. Each attribute was assigned different levels, representing realistic options that consumers might face. After selecting the attributes and their respective levels, various attribute combinations were systematically created, with each combination representing a possible product option.

Using SPSS, a survey was designed and presented to respondents, who were asked to rank or rate the combinations based on their preferences. The responses were then analyzed in SPSS through a conjoint analysis procedure. This method estimated utility (part-worth) values for each attribute level, which reflected the contribution of each attribute to the overall preference for a given combination. The total utility for each combination was calculated by summing the utility values of all the attributes. The combinations were ranked according to their total utilities, revealing the most preferred attribute sets. This approach helped to identify the attributes that had the greatest influence on consumer preferences, offering insights that could guide decisions in product

development, marketing, and strategy. For each attribute, the utility values represent the contribution of that attribute's level to consumer preference. Summing these values provides the total utility for the given product combination. An example formula would look like:

Total Utility = (Utility of Price)+(Utility of Skin Color)+(Utility of Fruit Size)+⋯+(Utility of Keeping Quality)

For this study, profile describing alternatives was constructed by combining levels of seven attributes based on products and four attributes based on consumers. Profile of product specific and consumer specific attribute levels are presented in the Table 1 and Table 2.

Table 1 Product specific attributes of red and G9 banana

Sl. No	Attributes	Attribute levels
1	Price	Less
		High
2	Fruit skin colour	Red
		Yellow
3	Fruit size	Small
		Large
4	Cluster size	Small
		Medium
5	Ripeness	Moderately ripened
		Ripened
6	Taste	Low sweetness
		High sweet
7	Keeping quality	Low
		High

Table 2. Consumer specific attributes of red and G9 banana

Sl. No	Attributes	Attribute levels
1	Family size	Joint
		Nuclear
2	Children below age of 6	More
		Less
3	Number of old age individuals	More
		Less
4	Income	High
		Low

III. RESULTS AND DISCUSSION

Socio- economic profile of respondent consumers

Understanding the demographic characteristics of rural and urban households is crucial for analyzing consumer preferences, especially for horticultural products like the red banana. This study aimed to explore the demographic attributes of rural and urban consumers, focusing on gender, age, education level, type of work, family income, and number of family members. By examining these variables, the study provides valuable insights into the differences and similarities between rural and urban populations, which can influence consumer behaviour and preferences (Table 3).

Age distribution further highlighted differences, with rural areas having a higher proportion of older respondents. In rural areas, 40 per cent of respondents were aged between 46-60 years, compared to only 16.67 per cent in urban areas. Conversely, urban areas had a higher percentage of younger respondents, with 50 per cent aged between 26-45 years, compared to 36.66 per cent in rural areas. This pattern suggests that urban areas may attract younger individuals due to better employment opportunities, while older individuals might prefer rural settings for a lower lifestyle. The level of education among respondents showed a clear disparity, with urban areas having a higher percentage of individuals with secondary and graduate education. In urban areas, 40 per cent of respondents had secondary education, and 23.34 per cent were graduates, compared to 26.67 per cent and 33.34 per cent, respectively, in rural areas. Both rural and urban areas had a similar proportion of illiterates, at 6.66 per cent. The higher level of education in urban areas can be attributed to better access to educational institutions and a greater emphasis on higher education, which may lead to better employment opportunities. Regarding the type of work, rural and urban respondents exhibited significant differences. In rural areas, 26.67 per cent were women respondents and remaining were male respondents, and among male respondents 10 per cent were farmers, reflecting the traditional occupations associated with rural life. In contrast, urban respondents were more likely to be employed in the private sector (36.66%) or as civil servants (26.66%). The presence of more diverse employment opportunities in urban areas likely explains this difference, offering a wider range of job options compared to the primarily agriculture-based rural economy.

Family income levels also varied, with urban areas showing higher income brackets. In urban areas, 13.34 per cent of households earned more than Rs.500,000 annually, compared to only 6.67 per cent in rural areas. Additionally,

a greater proportion of rural households (50.00%) had an income of less than Rs.100,000, compared to 40 per cent in urban areas. This discrepancy can be attributed to the economic activities in urban areas, which often provide higher paying jobs and business opportunities compared to the agriculture centric rural areas. The number of family members differed between rural and urban households, with urban households tending to be smaller. In urban areas, 33.33 per cent of households had 1-2 persons, compared to only 13.33 per cent in rural areas. Conversely, rural households were more likely to have 3-4 members (40.00%) or even 7-9 members (16.67%), compared to 16.67 per cent and 10 per cent, respectively, in urban areas. This trend towards smaller family sizes in urban areas could be due to higher living costs and the influence of urbanization and modern lifestyles. The analysis of family type in relation to banana purchasing decisions revealed that nuclear families constituted 40 per cent of the sample, while joint families made up 60 per cent. This indicates that joint families were more prevalent among consumers, possibly due to a greater number of individuals contributing to household purchases. Additionally, joint families may have larger household sizes, leading to higher banana consumption compared to nuclear families. In urban areas family type is of nuclear with 73.33 per cent.

When considering the number of children below six years, 43.33 per cent of the households had 1-2 children, while 56.67 per cent had more than two children in rural. Households with a greater number of children may have higher demand for bananas, as families with young children often seek nutrient-rich fruits to support child health. In urban 66.66 per cent of the household had 1-2 children and above 2 members with 26.67 per cent. Regarding the number of oldage individuals in the household, 46.66 per cent in rural and with 66.66 per cent in urban of the families had 1-2 oldage members, whereas 53.34 per cent in rural and with 36.67 per cent had more than two oldage members. Households with more oldage individuals might have been inclined to purchase bananas more frequently, given the fruit's known health benefits, particularly for older adults. The higher proportion of households with a larger oldage population suggests that health considerations could have played a role in their banana purchasing patterns. The demographic analysis highlights the distinct differences between rural and urban respondents. Urban areas tend to have a more balanced gender representation, younger and better-educated individuals, more diverse employment opportunities, higher family incomes, and smaller family sizes. These differences reflect the socio-economic and cultural dynamics of rural and urban areas and can have significant implications for consumer preferences and behaviours, especially concerning agricultural products like the red banana. Understanding these factors can aid in tailoring marketing strategies to different consumer segments, ultimately enhancing the reach and acceptance of such products in both rural and urban markets.

Consumer preferences for red and G9 banana based on product specific attributes

The conjoint analysis of consumer preferences for red and G9 banana attributes revealed significant differences in utility values and relative importance of various attributes between rural and urban consumers. The results are depicted in Table4 and Fig.1. Price emerged as one of the critical factor for both rural and urban consumers. In rural areas, the utility for high price was 1.387, with a relative importance of 19.76 per cent. Similarly, in urban areas, the utility for low price was 1.375, with a slightly higher relative importance of 22.45 per cent. This indicates that both rural and urban consumers were price-sensitive, but urban consumers placed slightly more importance on price. The emphasis on price in urban areas could be due to the higher cost of living and the availability of various alternative fruits, making price a more decisive factor in purchasing decisions. Fruit skin colour showed contrasting preferences between rural and urban consumers. Rural respondents preferred red bananas, with a utility value of 0.456 and a relative importance of

7.55 per cent, while urban consumers preferred yellow bananas, with a utility value of 0.500 and a relative importance of 8.16 per cent.

Table 3. Socio- economic profile of banana consumers

Sl. No.	Particulars	Rural Consumers (n=30)		Urban Consumers (n=30)	
		No.	%	No.	%
I	Age				
1.	< 25 years	5	16.66	6	20.00
2.	26-45 years	11	36.66	15	50.00
3.	46-60 years	12	40.00	5	16.67
4.	> 60 years	2	6.68	4	13.33
II	Level of Education				

1.	Illiterate	2	6.66	2	6.66
2.	Primary	5	16.66	4	13.33
3.	Secondary	8	26.67	12	40.00
4.	Graduate	7	23.34	10	33.34
5.	Post graduate	5	16.67	5	16.67
III	Occupation				
1.	Government service	6	20.00	8	26.66
2.	Private sector employment	8	26.66	11	36.66
3.	Entrepreneur	5	16.67	4	13.34
4.	Housewife	8	26.67	5	16.67
5.	Farmer	3	10.00	2	6.67
IV	Family income (₹)				
1.	< 100000	15	50.00	12	40.00
2.	>100000-250000	9	30.00	10	33.33
3.	>250000-500000	4	13.33	4	13.33
4.	>500000	2	6.67	4	13.34
V	Number of family members				
1.	1-2 person	4	13.33	10	33.33
2.	3-4 person	12	40.00	12	40.00
3.	5-6 person	9	30.00	5	16.67
4.	7-9 person	5	16.67	3	10.00
VI	Family type				
1.	Nuclear	12	40.00	22	73.33
2.	Joint	18	60.00	8	26.67
VII	Number of children below 6 years				
1.	1-2 members	13	43.33	20	66.66
2.	Above 2 members	17	56.67	10	33.34
VIII	Number of oldage individuals				
1.	1-2 members	14	46.66	19	63.33
2.	Above 2 member	16	53.34	11	36.67

The rural preference for red bananas might be due to traditional and cultural associations with the fruit, while urban consumers, having a more diverse exposure to fruit varieties, might prefer the more common yellow bananas. Here, the consumers are visitors who prefer red banana. Fruit size had lower relative importance in both rural (5.08%) and urban (2.04%) areas, indicating that size was not a major deciding factor for consumers. Rural consumers slightly preferred small bananas (utility of 0.50), whereas urban consumers showed a minor preference for small bananas as well (utility of 0.125). This suggests that while size may play a role, it is not as significant as other attributes such as price or taste. Cluster size had a moderate impact on consumer preferences, with a preference for medium-sized clusters in both rural and urban areas. Rural respondents had a utility value of 0.287 for medium clusters with a relative importance of 5.80 per cent, while urban respondents had a utility of 0.375 and a relative importance of 6.12 per cent. The preference for medium-sized clusters suggests a balance between convenience and quantity, appealing to both market and household consumption needs. Ripeness was another important factor, with moderately ripe bananas being preferred by both rural (utility of 0.744 with relative importance of 10.78%) and urban (utility of 0.750 with relative importance of 12.25%) consumers. The preference for moderately ripe bananas indicates a desire for optimal taste and texture, balancing sweetness and firmness, which is appealing for immediate consumption.

Taste was a significant determinant, especially for urban consumers, who showed a strong preference for low sweetness with a utility value of 1.250 and a relative importance of 20.40 per cent. In rural areas, the preference for low sweetness had a utility of 0.769 with a relative importance of 11.28 per cent. The stronger preference for mild taste in urban areas may reflect a trend towards health-conscious consumption, where less sweetness is associated with healthier options. Keeping quality was the most critical attribute for both groups, particularly for rural consumers. The utility value for high keeping quality was 2.756, with a relative importance of 39.75 per cent in rural areas, compared to a utility of 1.750 and relative importance of 28.58 per cent in urban areas. The high priority given to keeping quality, especially in rural areas, may be due to the need for longer storage times, reducing spoilage and waste. In contrast, urban consumers might have better access to frequent shopping opportunities, making keeping quality slightly less crucial. The Pearson's rank correlation and Kendall's rank correlation coefficients were both positive and significant for rural (0.822 and 0.712, respectively) and urban (0.806 and 0.702, respectively) consumers, indicating a strong agreement between predicted and actual preferences. The study revealed that while both rural and urban consumers valued attributes such as price and keeping quality highly, there were notable differences in preferences for attributes like fruit skin colour and taste. Understanding these preferences is crucial for producers and marketers to adapt their products and marketing strategies effectively to meet the specific needs of rural and urban consumers. By aligning product offerings with consumer preferences, stakeholders can enhance the acceptance and marketability of red bananas.

The results of the study are in line with the study conducted by Rumapea*et al.* (2022) in consumer attitudes and preferences for bananas in traditional markets in Semarang City. The study found that the most purchased varieties were Kepok, Raja, Ambon, and Cavendish bananas, while the least purchased was the Pisang Raja. Consumers prioritized attributes such as taste (17.17%), fruit skin colour (14.97%), size (10.46%), and number of fruits per comb (9.96%). They preferred bananas with a slightly sweet taste, medium size (10-14 cm), greenish-yellow skin, and a large number of fruits per comb (>16 pieces). Taste, skin colour, number of fruits per comb, and size were ranked in order of importance for purchase decisions.

Table 4. Consumer preferences for red and G9 banana based on product specific attributes

Sl. No	Product specific attributes	Attribute levels	Rural Consumers (n=30)		Urban Consumers (n=30)	
			Utility value	Relative importance (%)	Utility value	Relative importance (%)
1	Price	Low	-1.387	19.76	1.375	22.45
		High	1.387		-1.375	
2	Fruit skin colour	Red	0.456	7.55	-0.500	8.16
		Yellow	-0.456		0.500	
3	Fruit size	Small	0.50	5.08	0.125	2.04
		Large	-0.50		-0.125	
4	Cluster size	Small	-0.287	5.80	-0.375	6.12
		Medium	0.287		0.375	
5	Ripeness	Moderately ripened	0.744	10.78	0.750	12.25
		Ripened	-0.744		-0.750	
6	Taste	Low sweetness	0.769	11.28	1.250	20.40
		High sweet	-0.769		-1.250	
7	Keeping quality	Low	-2.756	39.75	-1.750	28.58
		High	2.756		1.750	
Total				**100**		**100**
			Values		**Values**	

Pearson's rank correlation	0.822***	0.806***
Kendall's rank correlation	0.712**	0.702**
Constant	0.845	0.823
***Significant at 5 per cent **Significant at 10 percent		

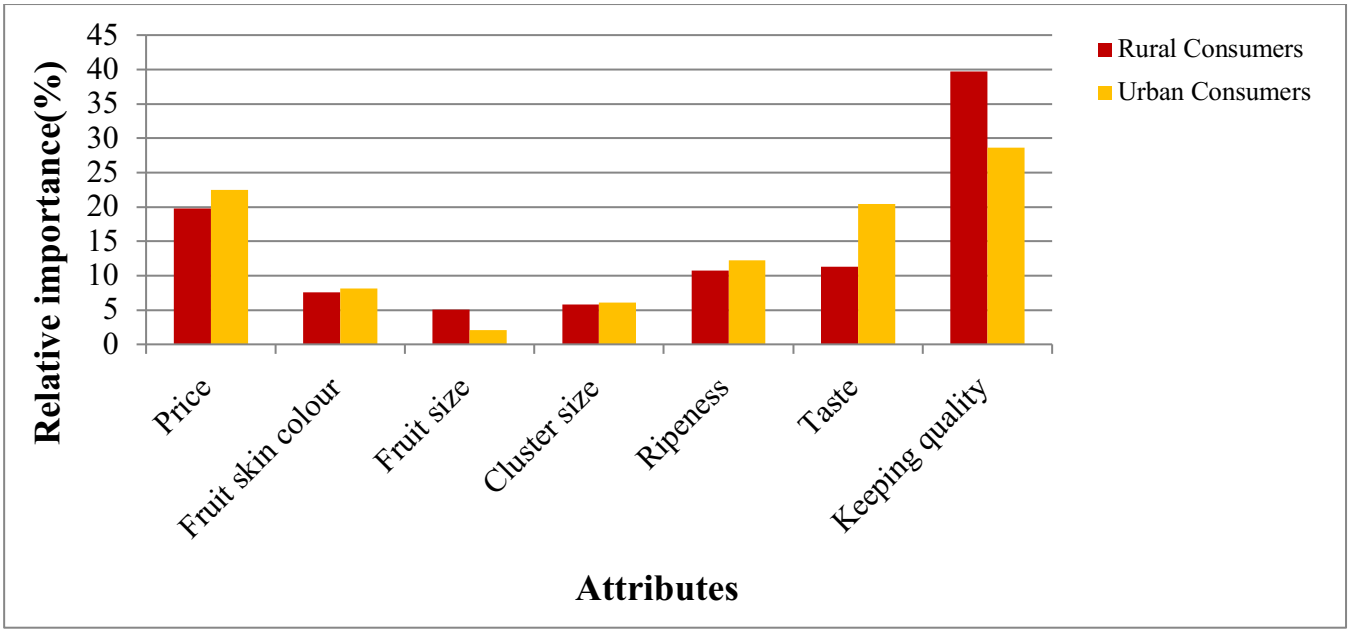


Fig 1. Consumer preference for red and G9 banana based on product specific attributes

Total utility values of combinations chosen based on product specific attributes by the rural consumes for red and G9 banana

The analysis of the utility values for various attribute combinations of bananas revealed significant (Table 5) insights into rural consumer preferences. Among the attribute combinations analyzed, the combination with low price, red fruit skin colour, large fruit size, small cluster size, moderately ripened state, low sweetness, and high keeping quality was ranked highest with a total utility value of 5.325. This combination was preferred the most, highlighting that consumers valued a balance of red skin colour, large fruit size, and high keeping quality, along with a low price and moderately ripened state. In contrast, the combination of low price, yellow fruit skin colour, small fruit size, medium cluster size, ripened state, low sweetness, and high keeping quality, which achieved a total utility of 4.499, was ranked second. This suggested that while yellow-skinned bananas were also favoured, the overall preference still leaned towards the combination of red-skinned bananas with high keeping quality. The combination of low price, yellow fruit skin colour, small fruit size, medium cluster size, moderately ripened state, and high sweetness, with a total utility of 4.449, ranked third. This indicated that consumers were somewhat receptive to yellow-skinned bananas, particularly when they were moderately ripened and sweet. On the other hand, the combination of low price, red fruit skin colour, large fruit size, small cluster size, ripened state, high sweetness, and high keeping quality, with a utility value of 2.299, ranked fourth. This combination was less preferred due to the lower utility attributed to ripened state and high sweetness compared to moderately ripened bananas. The combination of low price, red fruit skin colour, small fruit size, small cluster size, moderately ripened state, low sweetness, and low keeping quality, which had a utility value of 0.813, ranked the lowest. This combination was the least favoured, primarily due to its low keeping quality, despite having desirable attributes like low price and moderately ripened state. The results are in line with study conducted by Rumapea*et al.* (2022) who studied consumer attitudes and preferences for bananas in traditional markets in Semarang City. It was found that the most purchased varieties were Kepok, Raja, Ambon, and Cavendish bananas, while the least purchased was the Pisang Raja. Consumers prioritized attributes such as taste (17.17%), fruit skin colour (14.97%), size (10.46%), and number of fruits per comb (9.96%). Consumers preferred bananas with a slightly sweet taste, medium size (10-14 cm),

greenish-yellow skin, and a large number of fruits per comb (>16 pieces). Taste, skin colour, number of fruits per comb, and size were ranked in order of importance for purchase decisions. Overall, the results indicated that consumers showed a strong preference for red-skinned bananas with high keeping quality and moderately ripened state, balanced with large fruit size and low price. The lower preference for yellow-skinned bananas and certain combinations with high sweetness or low keeping quality provided valuable insights into the attributes that significantly influenced consumer choices.

Total utility values of combinations chosen based on product specific attributes by the urban consumes for red and G9 banana

The utility analysis of different banana attribute combinations provided insightful data on consumer preferences. The highest-ranked attribute combination was the low-priced yellow-skinned bananas, small in size, medium cluster size, ripened, with low sweetness and high keeping quality, which achieved a total utility value of 4.625. This combination was preferred by consumers due to the balance of high keeping quality and a ripened state, despite the low sweetness (Table 6). Following closely, the second-ranked combination included low-priced red skinned bananas, large in size, small cluster size, moderately ripened, with low sweetness and high keeping quality, with a total utility of 4.125. Consumers showed a strong preference for the large fruit size and high keeping quality, although the red skin colour and moderately ripened state also contributed positively to its ranking. The third ranking combination featured low priced yellow skinned bananas, small in size, medium cluster size, moderately ripened, with high sweetness and high keeping quality, which resulted in a total utility of 3.625. This combination was less favoured compared to the top two, primarily because the high sweetness did not compensate sufficiently for the low preference for yellow skin.

Table 5. Total utility values of combinations chosen based on product specific attributes by the rural consumes for red and G9 banana

Sl. No	Attribute combinations							Utility values of respective attributes							Total utility	Rank
	Price	Fruit skin colour	Fruit size	Cluster size	Ripeness	Taste	Keeping quality									
1.	Low	Red	Large	Small	Moderately ripened	Low sweetness	High	1.387	0.456	-0.50	-0.287	0.744	0.769	2.756	5.325	I
2.	Low	Yellow	Small	Medium	Ripened	Low sweetness	High	1.387	-0.456	0.50	0.287	-0.744	0.769	2.756	4.499	II
3.	Low	Yellow	Small	Medium	Moderately ripened	High sweetness	High	1.387	-0.456	0.50	0.287	0.744	-0.769	2.756	4.449	III

4.	Low	Red	Large	Small	Ripened	High sweetness	High	1.387	0.456	-0.50	-0.287	-0.744	-0.769	2.756	2.299	IV
5.	Low	Red	Small	Small	Moderately ripened	Low sweetness	Low	1.387	0.456	0.50	-0.287	0.744	0.769	-2.756	0.813	V

The fourth ranked combination was low-priced yellow skinned bananas, large in size, medium cluster size, moderately ripened, with low sweetness and low keeping quality, achieving a total utility of 2.375. Despite having desirable attributes like a large size and moderate ripeness, the low keeping quality reduced its overall utility. Finally, the combination of low-priced red-skinned bananas, small in size, small cluster size, moderately ripened, with low sweetness and low keeping quality, obtained the lowest total utility value of 0.875. This combination was the least preferred due to its smaller size, low keeping quality, and overall lower utility, despite the red skin and moderately ripened state. The results are in line with study conducted by Damayanti*et al.* (2023) studied consumer attitudes and preferences for bananas at Pangkalpinang City traditional market and revealed that consumers prioritized fruit skin colour (21.57%), aroma (16.27%), fruit size (15.87%), and number of fruits per comb (6.41%) when making purchasing decisions. Consumers preferred bananas with greenish-yellow skin, a sweet taste, a length greater than 14 cm, and more than 16 bananas per comb. Overall, the analysis indicated that consumers preferred bananas with high keeping quality and moderate ripeness, with a balanced consideration for skin colour and fruit size. The results underscored the importance of high keeping quality and ripeness in influencing consumer choices, while the lower preference for certain combinations highlighted the impact of less favourable attributes such as low sweetness and keeping quality.

Buying behaviour of banana by rural and urban consumers based on consumer specific attributes

The analysis of consumer-specific attributes revealed distinct patterns in purchasing behavior between rural and urban areas. The results are presented in Table 7. In rural areas, households with joint family structures purchased more bananas compared to those with nuclear families, with quantities of 48 kg and 36 kg per annum, respectively. This trend was mirrored in urban areas, where joint families also purchased slightly more bananas than nuclear families, with quantities of 36 kg versus 24 kg per annum. This preference may be attributed to the typically larger size of joint families, which likely leads to higher consumption needs.

Regarding the presence of children below the age of 6, rural households with more children purchased a total of 24 kg, significantly more than those with fewer children, who purchased 12 kg. In contrast, urban households with more children purchased only 6 kg, while those with fewer children purchased 12 kg. The discrepancy in urban areas might be due to the lower overall quantity purchased by urban families, reflecting a generally smaller household size and possibly differing consumption patterns. The number of oldage individuals in a household also impacted purchasing patterns. Rural households with more oldage members bought 12 kg, while those with fewer oldage members purchased 6 kg. Urban households showed a similar trend, with those

Table 6. Total utility values of combinations chosen based on product specific attributes by the urban consumes for red and G9 banana

Sl. No	Attribute combinations							Utility values							Total utility	Rank
	Price	Fruit skin colour	Fruit size	Cluster size	Ripeness	Taste	Keeping quality									
1.	Low	Yellow	Small	Medium	Ripened	Low sweetness	High	1.375	0.500	0.125	0.375	-0.750	1.250	1.750	4.625	I
2.	Low	Red	Large	Small	Moderately ripened	Low sweetness	High	1.375	-0.500	-0.125	-0.375	0.750	1.250	1.750	4.125	II
3.	Low	Yellow	Small	Medium	Moderately ripened	High sweetness	High	1.375	0.500	0.125	0.375	0.750	-1.250	1.750	3.625	III
4.	Low	Yellow	Large	Medium	Moderately ripened	Low sweetness	Low	1.375	0.500	-0.125	0.375	0.750	1.250	-1.750	2.375	IV
5.	Low	Red	Small	Small	Moderately ripened	Low sweetness	Low	1.375	-0.500	0.125	-0.375	0.750	1.250	-1.750	0.875	V

having more old age individuals buying 6 kg and those with fewer buying the same amount. The minimal variation between rural and urban areas in this category could be attributed to similar consumption needs among old age individuals in both settings. Income levels played a notable role in banana purchases. In rural areas, households with higher income purchased 24 kg, while those with lower income bought only 12 kg. Urban households with high income also purchased more, totaling 24 kg, compared to the 12 kg purchased by those with lower income. The higher purchase quantity among wealthier households can be linked to greater disposable income, which likely allows for higher expenditure on food items like bananas. Overall, the findings indicated that family type and income levels were significant factors influencing banana purchase quantities in both rural and urban areas. The larger family size in joint households and higher income levels correlated with increased banana purchases, highlighting the impact of family structure and financial resources on consumer behaviour.

Table 7. Buying behaviour of banana by rural and urban consumers based on consumer specific attributes

Sl. No	Consumer specific attributes and their levels	Rural Consumers (n=30)		Urban Consumers (n=30)	
		Quantity purchased (kg/year)	%	Quantity purchased (kg/year)	%
I	**Family type**				
1.	Joint	48	27.58	36	28.57
2.	Nuclear	36	20.69	24	19.04
II	**Children below age of 6**				
1.	More	24	13.80	6	4.76
2.	Less	12	6.89	12	9.53
III	**Number of old age individuals**				
1.	More	12	6.89	6	4.76
2.	Less	6	3.46	6	4.76
IV	**Income**				
1.	High	24	13.80	24	19.05
2.	Low	12	6.89	12	9.53
	Total	174	100	126	100

Table 8.Consumer preferences for red and G9 banana based on consumer specific attributes

Sl. No	Consumer specific	Attribute levels	Rural Consumers (n=30)		Urban Consumers (n=30)	
			Utility values	Relative importance (%)	Utility values	Relative importance (%)
1	Family type	Joint	0.146	15.13	-0.250	5.71
		Nuclear	-0.146		0.250	
2	Children below age of 6	More	0.896	34.30	-1.355	31.45
		Less	-0.896		1.355	
3	Number of oldage individuals	More	0.210	21.37	-1.305	31.24
		Less	-0.210		1.305	
4	Income	High	0.729	29.20	1.375	31.60
		Low	-0.729		-1.375	
Total				**100**		**100**
Correlations			**Values**		**Values**	
Pearson's rank correlation			0.785***		0.755***	
Kendall's rank correlation			0.622**		0.610**	
Constant			0.709		0.702	

***Significant at 5 per cent **Significant at 10 percent

Consumer preferences for red and G9 banana based on consumer specific attributes

The analysis of consumer preferences for bananas based on various consumer specific attributes revealed significant differences between rural and urban areas. The results are depicted in Table 8. In rural areas, the attribute of family type was notably influential, with joint families showing a positive utility value of 0.146 and a relative importance of 15.12 per cent. This contrasted with nuclear families, which had a negative utility value of -0.146. This preference likely reflected the larger household size in joint families, resulting in higher consumption. In urban areas, however, the impact of family type was less pronounced, with joint families showing a negative utility value of -0.250 and a relative importance of only 5.71 per cent, suggesting that family type had a lesser effect on banana purchasing behavior in urban settings.

The presence of children below the age of 6 emerged as a crucial factor in both rural and urban areas. Rural households with more children had a high positive utility value of 0.896 and a significant relative importance of 34.30 per cent, indicating that more children significantly increased banana purchases. Conversely, urban households with more children had a negative utility value of -1.355 and a relative importance of 31.45 per cent, highlighting that the presence of children in urban areas led to a different pattern, possibly due to smaller household sizes and varying consumption needs.

The number of old age individuals also impacted purchasing decisions. In rural areas, households with more elderly members had a positive utility value of 0.210 and a relative importance of 21.37 per cent. In contrast, urban areas showed a stronger effect, with more oldage members resulting in a negative utility value of -1.305 and a relative importance of 31.24 per cent. This variation in importance could be attributed to differing needs and consumption patterns between rural and urban elderly individuals. Income levels played a critical role in both settings. Rural households with high income had a utility value of 0.729 and a relative importance of 29.20 per cent, reflecting greater purchasing power. Urban households with high income had a higher utility value of 1.375 and a relative importance of 31.60 per cent, indicating that income had a substantial impact on banana purchases in urban areas as well.

The correlations between the attributes and purchasing behavior were significant, with Pearson's rank correlation values of 0.785 in rural and 0.755 in urban areas, and Kendall's rank correlation values of 0.622 and 0.610, respectively. These high correlations confirmed a strong relationship between the attributes and consumer preferences. Overall, the analysis revealed that family type, presence of children, number of elderly individuals, and income levels were critical factors influencing banana purchases, with varying degrees of impact between rural and urban areas. The different utility values and relative importance percentages highlighted the need to consider these attributes when assessing consumer behavior in different contexts.This supports the findings of a study conducted by Chinnappa et al. (2020) on economic utilisation of areca leaf sheaths for rural livelihood. The study highlighted that consumer preferences were driven by quality parameters such as desired dimensions, portability, eco-friendliness and pricing of leaf products. The industry had significant potential for development, given the abundant supply of raw materials, with 144 crore leaf sheaths produced annually in the state.

Total utility values of combinations chosen based on consumer specific attributes by the rural consumers for red and G9 banana

The analysis of attribute combinations in consumer preference for banana purchases revealed significant differences based on family type, presence of children below the age of 6, the number of elderly individuals and income levels (Table 9). The highest ranked combination, with a total utility value of 1.981, was associated with joint families having more children and more elderly members, along with high income. This result indicated that in such households, the demand for bananas was likely higher due to larger family size and higher purchasing power. The utility values for each attribute 0.146 for family type (joint), 0.896 for more children, 0.21 for more old age individuals, and 0.729 for high income collectively contributed to the highest preference for this combination.

Table 9. Total utility values of combinations chosen based on consumer specific attributes by the rural consumers for red and G9 banana

Sl. No.	Attribute combinations				Utility values				Total utility values	Rank
	Family type	Children below age of 6	Number of oldage individuals	Income						
1.	Joint	More	More	High	0.146	0.896	0.21	0.729	1.981	I
2.	Nuclear	More	More	High	-	0.896	0.21	0.729	1.689	II

					0.146					
3.	Joint	More	Less	High	0.146	0.896	-0.21	0.729	1.561	III
4.	Nuclear	More	Less	High	-0.146	0.896	-0.21	0.729	1.269	IV
5.	Joint	More	More	Low	0.146	0.896	0.21	-0.729	0.523	V

The second ranked combination, with a total utility value of 1.689, involved nuclear families with more children and more old age individuals, and high income. Although the family type had a negative utility value of -0.146, the strong positive influence of more children (0.896), more old age individuals (0.21), and high income (0.729) still resulted in a high overall utility. This indicated that nuclear families, showed a preference for banana purchases when there were more dependents and sufficient income. The third ranked combination, with a total utility value of 1.561, involved joint families with more children, fewer old age members, and high income. The positive utility values for family type (0.146) and children (0.896) remained influential, but the presence of fewer old age individuals (-0.21) slightly reduced the overall preference compared to households with more old age members.

Table 10. Total utility values of combinations chosen based on consumer specific attributes by the urban consumers for red and G9 banana

Sl. No.	**Attribute combinations**				**Utility values**				**Total utility values**	**Rank**
	Family type	Children below age of 6	Number of old age individuals	Income						
1.	Nuclear	Less	Less	High	0.250	1.355	1.305	1.375	4.285	I
2.	Nuclear	Less	More	High	0.250	1.355	-1.305	1.375	1.675	II
3.	Nuclear	More	Less	High	0.250	-1.355	1.305	1.375	1.575	III
4.	Nuclear	Less	Less	Low	0.250	1.355	1.305	-1.375	1.535	IV
5.	Joint	Less	More	High	-0.250	1.355	-1.305	1.375	1.175	V

The fourth ranked combination, with a total utility value of 1.269, involved nuclear families with more children, fewer old age members, and high income. Similar to the third combination, the influence of fewer old age individuals (-0.21) and a negative utility for family type (-0.146) led to a lower preference than for joint families, despite the positive impact of income and children. The fifth ranked combination, with a total utility value of 0.523, represented joint families with more children and old age individuals, but with low income. The positive influence of family type (0.146), more children (0.896) and more old age individuals (0.21) was overshadowed by the negative utility of low income (-0.729), significantly reducing overall preference. This suggested that regardless of family composition, low income served as a major constraint on banana purchases. Overall, the analysis highlighted that family composition, particularly the number of children and old age individuals, along with income levels, played critical roles in shaping consumer preferences for bananas. High income and more dependents generally increased the likelihood of banana purchases, with joint families showing slightly stronger preferences than nuclear families

Total utility values of combinations chosen based on consumer specific attributes by the urban consumers for red and G9 banana

The analysis of consumer attribute combinations in relation to their preferences for banana purchases by urban consumers highlighted the influence of family type, the number of children below the age of six, the number of elderly individuals in the household and income levels (Table 10). The highest-ranked combination, with a total utility value of 4.285, involved nuclear families with fewer children, fewer old age members and high income. The positive utility values for family type (0.250), fewer children (1.355), fewer old age individuals (1.305) and high income (1.375) collectively contributed to this strong preference. This result suggested that households with a smaller family size and higher income had a higher propensity to purchase bananas. The second ranked combination, with a total utility value of 1.675, also involved nuclear families with fewer children and high

income, but with more elderly individuals in the household. While the presence of more old age members had a negative utility value (-1.305), the positive impact of the other factors, particularly income (1.375) and fewer children (1.355), still resulted in a relatively high overall utility. This indicated that nuclear families, even with more oldage members, showed a reasonable preference for banana purchases when income was high and the number of children was low.

The third ranked combination, with a total utility value of 1.575, involved nuclear families with more children, fewer old age members, and high income. The negative utility value for more children (-1.355) offset the positive effects of fewer elderly individuals (1.305) and high income (1.375), which resulted in a lower overall preference compared to combinations with fewer children. This suggested that the presence of more children may have been seen as a constraint, despite the favorable income and family structure. The fourth ranked combination, with a total utility value of 1.535, represented nuclear families with fewer children and old age members but low income. Although the family type and number of dependents had positive utility values, the negative effect of low income (-1.375) significantly reduced the overall preference, emphasizing that income played a crucial role in shaping purchasing decisions. The fifth ranked combination, with a total utility value of 1.175, involved joint families with fewer children, more old age members, and high income. The negative utility value for family type (-0.250) and more old age members (-1.305) reduced the overall utility, despite the positive impact of high income (1.375) and fewer children (1.355). This indicated that joint families with more elderly members had lower preferences for banana purchases compared to nuclear families, even when income levels were high. Consumer preferences were most strongly influenced by family structure, the number of dependents, and income levels. Nuclear families with fewer children and elderly individuals, coupled with high income, showed the highest propensity for banana purchases, while low income and the presence of more dependents generally reduced consumer preference.

IV. CONCLUSION

The study revealed that while both rural and urban consumers valued attributes such as price and keeping quality highly, there were notable differences in preferences for attributes like fruit skin colour and taste. The analysis of the utility values for various attribute combinations of bananas revealed significant insights into consumer preferences. Among the attribute combinations analyzed, the combination with low price, red fruit skin colour, large fruit size, small cluster size, moderately ripened state, low sweetness, and high keeping quality was ranked highest with a total utility value of 5.325. This combination was preferred the most, highlighting that consumers valued a balance of red skin colour, large fruit size, and high keeping quality, along with a low price and moderately ripened state. In rural areas, the attribute of family type was notably influential, with joint families showing a positive utility value of 0.146 and a relative importance of 15.12 per cent. This contrasted with nuclear families, which had a negative utility value of -0.146. This preference likely reflected the larger household size in joint families, resulting in higher consumption. In urban areas, however, the impact of family type was less pronounced, with joint families showing a negative utility value of -0.250 and a relative importance of only 5.71 per cent, suggesting that family type had a lesser effect on banana purchasing behaviour in urban settings. The highest-ranked combination, with a total utility value of 1.981, was associated with joint families having more children and more elderly members, along with high income. This result indicated that in such households, the demand for bananas was likely higher due to larger family size and higher purchasing power. The utility values for each attribute 0.146 for family type (joint), 0.896 for more children, 0.21 for more elderly individuals, and 0.729 for high income collectively contributed to the highest preference for this combination. To align with consumer preferences for red and G9 bananas, policy initiatives should focus on improving product quality, accessibility, and consumer awareness. For red bananas, leveraging their Geographical Indication (GI) tag through branding and promotional campaigns can highlight their unique attributes, such as nutritional benefits and cultural significance, to attract a premium market. Consumer education programs that emphasize the health benefits of red bananas can increase demand.

REFERENCES

[1] Amitha K, 2008, A study of household consumption pattern of selected dairy products in Bangalore city. *M.Sc. (Agri.) Thesis*, University of Agricultural Sciences, Bangalore.

[2] Barcanu E, Agapie O L, Gherase I, Tănase B, Dobre G and Vînătoru C, 2022, Consumer preferences for kiwano fruit, a newly introduced crop in Romania. *Scientific Papers*, 1: 409-412.

[3] Basan R J P, 2016 Consumer Preference of Table Banana Quality by Income Groups in the Philippines: Hedonic Price Analysis. *Asian Journal of Agriculture and Development*, 13(2): 21-34.

[4] Budiyati E, Rejeki S and Zamzami L, 2021, Analysis of consumer preferences for 5 varieties of mandarins.*Earth and Environmental Science*, 803(1): 012055.

[5] Damayanti A, Karsiningsih E and Muntoro M, 2023, The Analysis of Attitude and Consumer Preferences to Purchase Decisions of Banana Fruit in Traditional Markets Pangkalpinang City. *JIA (JurnalIlmiahAgribisnis): JurnalAgribisnisdanIlmuSosialEkonomiPertanian*, 8(1): 65-72.

[6] Hernosa S P, Siregar L A M, Hanum C and Supriana T, 2021, Conjoint analysis of consumer preferences for pineapple fruit in LabuhanBatu District, North Sumatra. *Earth and Environmental Science,* 892(1): 012012.

[7] Huang W S, Kuo H Y, Tung S Y and Chen H S, 2020, Assessing consumer preferences for suboptimal food: Application of a choice experiment in citrus fruit retail. *Foods*, 10(1): 15.

[8] Kamble A S, Kshirsagar P J and Torane S R, 2023, Consumer Preference for Cashew and Mango Processed Products in Ratnagiri District of Maharashtra. *International Journal of All Research Education and Scientific Methods*, 11(12): 1652-1657.

[9] Orivri G E, Kassas B, Lai J, House L and NaygaJr R M, 2024, Investigating consumer stated preferences for orange juice: The influence of behavioral traits. *Journal of the Agricultural and Applied Economics Association,* 3(1): 5-24.

[10] Owuor A A, Otieno D J, Okello J J, Oluoch-Kosura W and Dufour D, 2023, Assessment of consumers' preference for orange-fleshed sweet potato puree chapati: a case of rural and urban consumers in Kenya. *Journal of the Science of Food and Agriculture*, 1-7

[11] Ranasingha R G S M, Edirisinghe J C and Ratnayake R H M K, 2019, Willingness to Pay for Fruit Attributes: A Conjoint Analysis. *Journal of Agricultural Sciences (Sri Lanka)*, 102-110:14(2).

[12] Rumapea E, Roessali W and Prasetyo E, 2022, Analysis of consumer attitudes and preferences to banana purchase decisions in the traditional market of Semarang city. *Agrisocionomics*, 6 (1): 94-104.

[13] Rumapea E, Roessali W and Prasetyo E, 2022, Analysis of consumer attitudes and preferences to banana purchase decisions in the traditional market of Semarang city. *Agrisocionomics: JurnalSosialEkonomiPertanian*, 6(1): 94-104.

[14] Shokila C. and Rohini A, 2023, Consumer preference on packed tender coconut water: conjoint analysis approach. *Indian Journal of Economics and Development*, 20(3): 596-601

[15] Simons T, Sivertsen H and Guinard J X, 2018, Mapping the preferences of adult and child consumers for California-grown navel oranges. *HortScience*, 53(5): 661-668.

[16] Sulistyawati I, Dekker M, Verkerk R and Steenbekkers B, 2020, Consumer preference for dried mango attributes: A conjoint study among Dutch, Chinese, and Indonesian consumers. *Journal of food science*, 85(10): 3527-3535.