Original Research Article

Consumer Preferences for Turmeric Quality Attributes: A Conjoint Analysis in Chamarajanagar District

Abstract

Consumer purchasing behaviour, heavily influenced by quality preferences, drives the need to understand the desired quality attributes of turmeric. With the increasing emphasis on health and wellness, there's a growing demand for organic and sustainably sourced turmeric among health-conscious consumers. To meet these preferences, quality control measures throughout production and processing stages are crucial. The study employed conjoint analysis to elucidate consumer preferences for turmeric quality attributes in Chamarajanagar district utilizing both primary and secondary data sources. Well-structured questionnaires were employed to gather consumer preference data on attributes such as quantity, colour, texture, origin and longevity. Turmeric's area and production exhibited a positive growth rate despite moderate instability. The additive model was used for analysis proved to be a good fit, with both Pearson's rank correlation coefficient (0.97) and Kendall's correlation coefficient (0.89) significant at the one percent probability level. Preferred attributes for turmeric powder among respondents included light-yellow colour, fine texture, a 50g quantity pack, organic origin, and long-lasting nature. Insights gained from this analysis inform product development, marketing strategies, and pricing decisions, enabling producers to tailor turmeric offerings to meet consumer demands effectively and enhance market competitiveness.Promoting domestic turmeric cultivation not only boosts foreign exchange inflow but also improves the economic standing of farmers. Thus, prioritizing enhancements in turmeric cultivation presents a promising avenue for encouraging the agricultural sector and fostering economic growth.

Key words: CAGR, Consumer preference, Quality attribute, Conjoint analysis, Instability index

Introduction

Turmeric, a perennial herbaceous plant belonging to the ginger family (Curcuma longa), has attracted significant attention from both the scientific and culinary realms(Hewlings, *et al.* 2017). Being used in Ayurvedic medicine, turmeric has been utilized for centuries to address a spectrum of ailments including diabetes, coughs, anorexia and sinusitis(Jayaprakasha,*et al.* 2005; Nelson,*et al.* 2017).Its versatile nature extends beyond medicinal applications, as it serves as a cornerstone ingredient in various cuisines, lending distinct colour, flavour and even preservation properties to dishes. Several research articles delve into the multifaceted aspects of turmeric, offering insights into its chemical composition, bioactivity, quality control protocols and pharmaceutical applications (Kotra,*et al.*, 2019). Some studies highlight the significance of turmeric as a "golden spice of life," elucidating its diverse biological actions and medicinal potential (Rathaur, *et al.*, 2012). Furthermore, research endeavours explore innovative approaches such as sensor-based computer vision for quality control in turmeric processing. These scholarly works provide a comprehensive understanding of turmeric's significance, its quality attributes and evolving consumer preferences, thereby informing agricultural practices, industrial processes and market strategies within the turmeric sector.

India, renowned as the world's largest turmeric producer, features a widespread cultivation landscape spanning states such as Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra (Thiripurasundari and Selvarani, 2014). Despite regional variations in productivity influenced by soil conditions, climate and agricultural practices ongoing efforts to enhance yields persist through the adoption of modern cultivation techniques and technological innovations. Turmeric, a significant spice crop in India, has experienced considerable expansion in both cultivation area and production output in recent decades. This commercial crop holds a substantial presence in both domestic and international markets (Choudhary and Rahi, 2018).The significant growth in turmeric cultivation in India corresponds to the rising demand for high-quality turmeric products worldwide. As efforts to boost yields persist, ensuring adherence to consumer preferences for vibrant colour, robust flavour and purity becomes essential.

In terms of quality attributes and consumer preferences, several factors shape the market dynamics. Consumers often prioritize turmeric products with high curcumin content, the active compound responsible for its medicinal properties. Additionally, there's a preference for turmeric exhibiting vibrant colour, robust flavourand purity, free from adulterants or contaminants. With the rising awareness of health and wellness, organic and sustainably sourced turmeric has gained traction among health-conscious consumers. They

are actively seeking products that align with their tastes, preferences and values, leading to a rising demand for food products characterized by unique quality, locality and support for local producers. These preferences highlight the importance of quality control measures throughout the production and processing stages to meet consumer expectations.With this background, the study elucidates consumer preferences for quality attributes of turmeric.

Methodology

Source and nature of data

Chamarajanagar district was purposively selected for the study, as it ranks first in area under turmeric cultivation in Karnataka.Specifically, the study focused on Chamarajanagar and Gundlupete taluks, where turmeric is cultivated extensively.The study utilized both primary and secondary data. Consumer preference data were gathered through well-structured questionnaires from the respondents. Secondary information regarding turmeric cultivation area and production was obtained from various sources, including the Directorate of Horticulture, Government of Karnataka, Bengaluru, the Directorate of Economics and Statistics, Government of Karnataka, District at a glanceand the District Horticulture Office in Chamarajanagar.

Compound growth rate analysis

The growth in the area, production and productivity of turmeric in the Chamarajanagar district was calculated by using growth function. Growth rates were worked out for a period of ten years from 2001-02 to 2020-21.The Compound growths were computed by using the exponential function of the form,

$$Y_t = ab^t e^u \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

Y_t- Dependent variable

a - Intercept (constant)

b: Regression coefficient

t: Years (1, 2, ….n)

u_t: Disturbance term for the year t

The equation (1) was transformed into log linear function for calculation purpose and was computed using the Ordinary Least Square (OLS) technique. The compound growth rate (g) in percentage was then estimated from the relationship,

$$g = (\{\text{Antilog of ln b}\} - 1) * 100 \text{ ……. (2)}$$

Instability analysis

To find the instability in the area, production and productivity of turmeric, the coefficient of variation is commonly used for estimating instability but in the case of time series data characterized by time trend, the CV sometimes overestimates the instability, hence Cuddy Della Valle's instability index given by Cuddy (1978) was employed.

$$\text{Coefficient of variation (CV)} = \frac{\sigma}{\bar{x}} \times 100$$

Where, σ is the standard deviation given by the following formula:

$$\sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{N}}$$

The formula for Cuddy Della Valle's instability index (CDVI) is

$$\text{CDVI} = \text{CV}(\sqrt{1 - R^2}) \text{……. (3)}$$

Where, CV = Coefficient of Variation

R^2 = Coefficient of determination

N= No. of observations

The ranges of CDVI are given as follows:

Low instability= between 0 and 15

Medium instability = greater than 15 and lower than 30

High instability = greater than 30

Conjoint analysis

Consumer purchasing behaviour is largely influenced by quality preferences. Consumer preference, a marketing term denoting a consumer's inclination towards one option over another, prompts companies to utilize surveys, information, and data to tailor products and services to match consumer preferences. This involves a statistical technique wherein respondents rank preferences for different offers, decomposing them to ascertain individuals' inferred utility function for each attribute and the relative importance of each attribute.

Conjoint analysis is a versatile marketing research technique that can provide valuable information for various purposes, including new variety development, forecasting, targeting

specific consumer segments, conducting comparative analysis among different varieties and facilitating popularization. It aids in selecting features or modifying qualities for new varieties, establishing prices and predicting the resulting levels of demand, sales, or usage.The attributes considered for the study are presented in Table 1.

The aims of conjoint analysis are:

i) To identify attribute combinations which confer the highest utility to the consumers

ii) To establish the relative importance of attributes in terms of their contribution to total utility

The additive conjoint model formulated and used in the present study is as follows;

$$Y = \Sigma_{i=1}^{n} \Sigma_{j=1}^{m} V_{ij} X_{ij} \ldots\ldots\ldots (4)$$

Where, Y = Consumers' overall evaluation of the turmeric.

V_{ij} = Part worth estimates associated with 'j'(1,2,3,….,m) of attributes, 'i'(1,2,3,…, n)

X_{ij} = Dummy variable representing the preference of the j^{th} level of i^{th} attribute.

Table 1: Attributes and its levels of powered turmeric considered for conjoint analysis

Sl. No.	Attributes	Attribute levels
1	Quantity	a. 50 g b. 200 g c. 500 g
2	Colour	a. Light yellow b. Dark yellow
3	Texture	a. Fine b. Rough
4	Origin	a. Organic b. Inorganic
5	Long lasting	a. Yes

		b. No

Results and Discussion

Growth rate of area, production and productivity of turmeric in Karnataka

The growth in the area, production and yield of Karnataka is presented in Table 2. It could be observed that the area and production of turmeric in Karnataka showed a significant positive compound annual growth rate of 5.68 and 5.55, respectively over the study period *i.e.,* from 2001-02 to 2020-21 with high instability whereas theannual growth rate of turmeric yield was -0.12, indicating a medium level of instability.The turmeric productivity exhibited lower variation than area and production indicate relative stability in yield levels, which might be attributed to advancements in agricultural technology, improved crop management practices, or better access to inputs. However, production witnessed higher instability due to market fluctuations, supply chain disruptions, or challenges in post-harvest handling and storage.Similar results are in line with study conducted by Sajjan *et al.* (2018).

Table 2: Growth in area, production and productivity of turmeric in Karnataka (2001-02 to 2020-21)

Particulars	Area(Ha)	Production(Tonnes)	Productivity(Tonnes/ha)
CAGR	5.68***	5.55*	-0.12^{NS}
Mean	18073.10	125434.44	6.88
SD	7375.54	70411.73	1.79
CV	40.81	56.13	26.08
Cuddy-Della Value Index	37.38	51.42	23.89

Note: ***, ** and * significant at one, five and ten per cent level, respectively

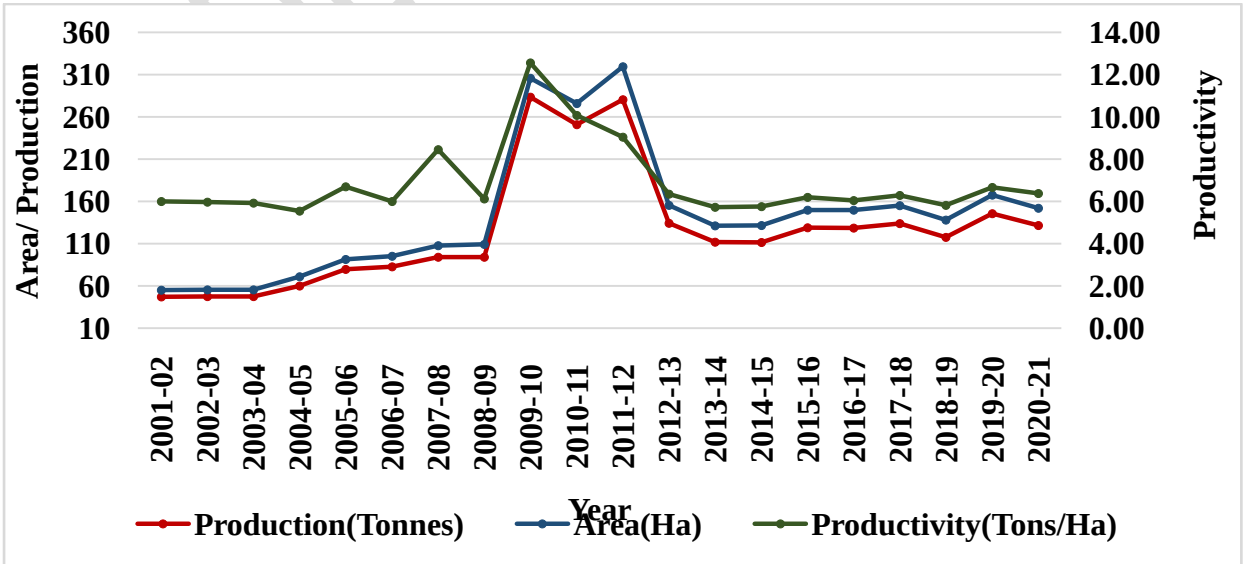

Fig. 1. Trend in area, production and productivity of turmeric in Karnataka

Growth rate of area, production and productivity of turmeric in Chamarajanagar district

The Table 3 illustrated the annual growth rate of the area, production and productivity of turmeric in Chamarajanagar district. The trend in area, production and productivity of turmeric in Chamarajanagar district of Karnataka is depicted in Fig. 2.The area production and productivity of turmeric was declined in the year 2008-09due to the global recession and highly fluctuating trend. The significant price drop led to a consequent reduction in cultivation area, resulting in decreased production during that same period. However, there was a sudden spike in cultivation area and production in 2009-10. Notably, both the area and production of turmeric wereshowed a positive annual growth rate of 3.40 and 2.71 per cent, respectively, from 2001-02 to 2020-21, exhibiting relatively medium instability levels. Similarly, the annual growth rate of productivitywas -0.75 per cent, indicating a low level of instability. These findings concurred with those of Manu (2013), who found that the area and production of turmeric in the Chamarajanagar taluk were on the rise between 2002-03 and 2012-13. Area and production have medium instability with a Cuddy-Della Value Index value of 19.10 and 21.28 respectively whereas productivity has lower instability with 8.41 index value. Similar results were observed in the study by Anantha and Sidana (2019).

Table 3: Growth in area, production and productivity of turmeric in Chamarajanagar district of Karnataka (2001-02 to 2020-21)

Particulars	Area (Ha)	Production (Tonnes)	Productivity (Tonnes/ha)
CAGR	3.40***	2.71**	-0.75*
Mean	7678.66	33390.00	4.36
SD	1963.16	9515.22	0.49
CV	25.57	28.50	11.27
Cuddy-Della Value Index	19.10	21.28	8.41

Note: ***, ** and * significant at one, five and ten per cent level, respectively

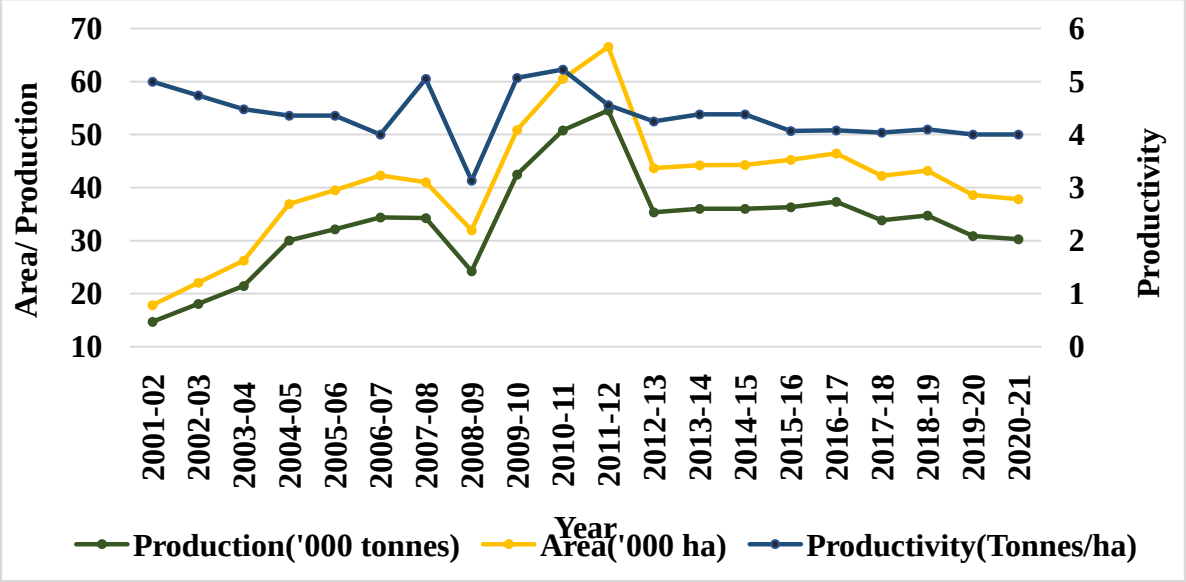

Fig. 2. Trend in area, production and productivity of turmeric in Chamarajanagar district of Karnataka

Consumer preference for the quality attributes of turmeric

The important attributes of turmeric powder influencing consumer preferences in the study area were the quantity of the product available for sale, colour, texture, origin, and long-lastingness of the product. The additive model considered for the analysis was found to be a good fit. The Pearson's rank correlation coefficient (0.979) was found to be significant at the one percent probability level. Similarly, the Kendall's correlation coefficient (0.895) was also found to be significant at the one percent probability level (Table 4). These findings indicate the suitability of the additive model to the dataset.

Table4: Correlation between consumer preference attributes

Correlations	Values	Significance
Pearson's rank correlation	0.979***	<0.01
Kendall's tau correlation	0.895***	<0.01

***Significant at one per cent level

The relative part-worthiness of the attributes preferred in the study area were estimated using conjoint analysis. The results on utility score and relative importance across each attribute is presented in the Table5.Among all the attributes, turmeric powder colour was having highest relative importance of 27.03 per cent which was found to be the most important attribute among the consumers with a utility score of 5.81. The long-lasting quality of the powder had a strong influence on consumer's preference after colour among the sample respondents with 21.85 per cent of relative importance and a utility score of 4.68. The texture of the powder formed the third most important factor having a relative importance of

18.97 per cent with a utility of 4.08. Origin was having relative importance of 17.85 per cent with a utility score of 3.84. Quantity available for sale had the least relative importance of 14.30 per cent with the highest utility score of 7.46.The preferred attributes among the sample respondents were turmeric powder with light yellow colour, fine texture, 50g quantity pack, organic origin and long-lasting nature. Hence, new entrepreneurs/cooperatives/FPOs/SHGs who are investing in turmeric processing units should consider these major qualities in local brand development.Indumathi *et al*. (2020) also concluded that good quality, product variety, brand image and attractive package were essential to attract customers.

Table5: Results of conjoint analysis of consumer preference for various attributes of turmeric powder

Sl. No. ***(n=30)***	**Attributes**	**Attribute levels**	**Utility score**	**Relative Importance (%)**
1	Quantity	a. 50g b. 200g c. >200g	-7.46 -1.317 +8.78	14.30
2	Colour	a. Light Yellow b. Dark Yellow	-5.81 +5.81	27.03
3	Texture	a. Fine b. Rough	-4.08 +4.08	18.97
4	Origin	a. Organic b. Inorganic	-3.84 +3.84	17.85
5	Long lasting	a. Yes b. No	-4.69 +4.69	21.85
Total				**100.00**

Conclusion

The study concluded that the preferred attributes among sample respondents for turmeric powder include a light-yellow colour, fine texture, a 50g quantity pack, organic origin, and long-lasting nature. These findings highlight the importance of considering these factors in local brand development initiatives. However, it is noted that the productivity of turmeric remains lower than the state average. To address this issue, the implementation of high-yielding varieties along with proper agronomical and technical guidance is imperative in

the study area. Furthermore, expanding the cultivation area dedicated to turmeric will contribute to augmenting the overall quantity of turmeric production in the country. Although price fluctuations may persist due to market instability, effective government-led export promotion measures can mitigate such challenges. Encouraging turmeric cultivation domestically not only fosters foreign exchange inflow but also uplifts the economic status of farmers. Therefore, prioritizing the enhancement of turmeric cultivation stands as a promising pathway towards encouraging the agricultural sector and fostering economic growth in Karnataka.

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