

## **SENSORY APPEAL ATTRIBUTES AND CONSUMER ACCEPTANCE OF PASTA FROM BLENDED FINGER MILLET FLOUR IN RESTAURANTS IN NAIROBI, KENYA**

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### **Abstract**

The main purpose of this paper was to investigate the influence of sensory appeal attributes on the acceptability of pasta made from blended finger millet flour, guided by the principles of Consumer Perception Theory. To assess consumer acceptance, data were collected from 356 respondents selected purposively from a target population of 15,840 customers across eight restaurants in Nairobi. Questionnaires were utilized to gather information, and the data were subsequently analyzed using multiple linear regression techniques. The analysis demonstrated that the sensory attributes of finger millet flour pasta (FMFP), including taste, aroma, texture, and visual appeal, accounted for 40.6% of the variation in pasta acceptability. The results indicated that these specific sensory characteristics significantly influenced consumer acceptance. Therefore, the study concludes that these findings underscore the critical role sensory appeal plays in shaping consumer preferences for FMFP. Moreover, the study has significant policy implications, highlighting the need for strategies that promote the incorporation of sensory enhancements in food product development to boost consumer acceptance and foster market growth.

**Keywords:** *Sensory Appeal Attributes, Acceptability, Pasta, Finger Millet Flour*

## 1. Introduction

Pasta is a widely consumed staple across many cultures and regions, appreciated for its versatility, convenience, and nutritional profile. Notably, its consumption has helped reduce food insecurity in regions where cereals and grains, such as maize, rice, and wheat, are primary dietary sources (Ali et al., 2024a; Raheem et al., 2021; Bayav & Gül, 2024). In response to a rising demand for healthier, locally-sourced food options, there is increasing interest in developing pasta from alternative grains like millet, which offer unique nutritional benefits. Finger millet, in particular, holds significant potential for such innovation due to its rich nutrient profile and suitability for cultivation in regions with low rainfall, such as sub-Saharan Africa (Balasubramanian & Viswanathan, 2010). However, the success of finger millet pasta hinges not only on its nutritional qualities but also on sensory attributes, which are crucial in consumer acceptance of new food products.

Consumer acceptance of food products is closely tied to sensory appeal—qualities like appearance, taste, aroma, and texture that consumers instinctively evaluate (Le-Anh & Nguyen-To, 2020). These sensory attributes form the foundation of consumer perception and are critical in determining a product's market success. Research suggests that sensory factors significantly influence consumer decisions, particularly for new or alternative products, where familiarity might be low (Kusumowardani et al., 2022). While sensory studies on widely consumed grains like wheat and maize are extensive, millet, including finger millet, has not received the same level of attention (Sangamithra et al., 2016). This gap in sensory data is particularly evident in the African context, where finger millet is indigenous, yet its application in processed products like pasta remains under-researched.

Existing studies on finger millet have primarily focused on its nutritional and functional properties, with limited emphasis on its sensory attributes and consumer acceptability. For instance, research on finger millet-based extruded products has explored physical and nutritional characteristics but has not fully investigated the sensory aspects that could drive consumer acceptance (Sawant et al., 2013). In the broader field of food science, studies highlight that consumer acceptance is influenced not only by sensory attributes but also by intrinsic and psychological factors, as well as contextual influences, such as familiarity and availability (Huey et al., 2024; Raimondo et al., 2024; Mazurek et al., 2024). This underscores the importance of comprehensive sensory evaluations in understanding how consumers might perceive and accept finger millet pasta.

In Kenya, the limited presence of millet-based pasta has contributed to a lack of consumer studies focusing on the sensory =behavioral attributes specific to this product. Without these insights, it is challenging to anticipate how Kenyan consumers might respond to finger millet-blended pasta or to understand the sensory factors that could enhance its acceptance. This study, therefore, aims to fill this gap by evaluating the influence of sensory appeal attributes on consumer acceptability of finger millet pasta. By exploring sensory attributes like taste, texture, appearance, and aroma, this study seeks to provide valuable insights into consumer preferences, ultimately supporting the development of finger millet-based pasta products that are both nutritionally beneficial and appealing to the local palate.

## 2. Theoretical Framework

The Consumer Perception Theory offers an insightful framework for analyzing consumer behavior in relation to new food products, such as finger millet pasta. Ratchford and Andreasen (1974) and Deliza and Ares (2018) suggest that consumer acceptance is largely determined by sensory appeal attributes, including appearance, taste, texture, and aroma, which play a pivotal role in shaping consumer expectations and initial perceptions. This theory posits that consumers form impressions based on past experiences, cultural factors, and intrinsic sensory responses. Therefore, when new products like blended finger millet pasta are introduced, consumer hesitance may emerge from unfamiliarity with these sensory properties (Wee et al., 2014; Feldmann & Hamm, 2015). Perception is rooted in how individuals process sensory information through receptors combined with memory, providing a foundation for understanding acceptance (Tuorila & Recchia, 2014). Consequently, in contexts of novel food products, sensory-based evaluations are essential, especially in cultures with specific staple food preferences.

Consumer Perception Theory also highlights the importance of both subjective (affective) and objective assessments in understanding consumer acceptance. Affective or hedonic measures capture untrained consumers' preferences based on immediate sensory experiences, such as the texture and aroma of finger millet pasta, making these evaluations highly relevant in Nairobi's restaurant market (Costa et al., 2020). Objective assessments, in contrast, use trained panels to perform structured sensory profiling, ensuring consistent and repeatable measurements for attributes like flavor intensity and mouthfeel (Cattaneo et al., 2023; Jobarteh et al., 2020). For the development of finger millet pasta, using both approaches can provide a comprehensive sensory profile, aligning product development closely with consumer expectations and facilitating greater acceptance in local markets where finger millet is a culturally valued grain.

## 3. Review of Literature and Hypotheses Development

The appeal attributes of food products, including their sensory characteristics, significantly influence consumer acceptance, especially for new formulations such as pasta from blended finger millet flour. Food texture can be evaluated both subjectively, through sensory analysis, and objectively using specialized instruments (Chen & Opara, 2013). Researchers use diverse methodologies to assess attributes like cohesiveness, leveraging both sensory and instrumental approaches to gauge food appeal accurately (Pascua et al., 2013; Nishinari & Fang, 2018). The organoleptic or sensory properties of food—including appearance, taste, aroma, and texture—are multifaceted and processed through various sensory pathways, shaping consumer attitudes and preferences (Oluwajuyitan et al., 2021; Syardiansya et al., 2024). In this context, food texture attributes, whether smooth, rough, or elastic, can determine consumer acceptability, as these sensory elements play a central role in creating an enjoyable eating experience (Yang et al., 2020).

For many consumers, sensory appeal is crucial, as they often favor foods with appealing textures, flavors, and appearances, as well as well-packaged products that convey a sense of quality and nutritional balance (Macall et al., 2021; Salvatore et al., 2022). However, inconsistencies often arise between a consumer's initial perception, acceptance, and purchase intention. Studies on finger millet, particularly those assessing its composite forms like pasta, remain limited in their focus on sensory attributes and have primarily concentrated on physical and functional properties rather than acceptability (Sawant et al., 2013). Expanding sensory

studies to incorporate different millet varieties and comprehensive acceptability measures could enhance product development, catering to broader consumer preferences.

Consumer behavior toward food products is multifaceted and shaped by intrinsic and extrinsic factors. Intrinsic attributes involve sensory properties such as taste and aroma, while extrinsic factors cover consumer resources, personality, lifestyle, and other external influences like cultural and economic context (Bangsa & Schlegelmilch, 2020). Current food industry practices emphasize the value of sensory analysis and consumer testing throughout product development to optimize sensory appeal (Bolha et al., 2020; Cardona et al., 2023). This approach is instrumental for pasta products, yet studies on consumer acceptance of millet-based pasta, particularly in Kenyan markets, remain sparse. Most evaluations rely on producer-based panels, potentially biasing outcomes. A shift toward consumer-based sensory evaluations is crucial for accurately gauging consumer preferences and could involve methodologies such as multivariate analysis to refine sensory attribute intensities (Wakil et al.). Therefore, this literature proposes the hypothesis that sensory appeal attributes have a significant positive effect on consumer acceptance of finger millet-blended pasta. Given the foundational impact of intrinsic attributes, the study hypothesizes:

*H1: Sensory appeal attributes have significant positive effect on consumer acceptability of finger millet blended pasta*

#### **4. Methodology**

##### ***Sampling***

The target population for this consumer acceptance study comprised customers from eight Nairobi restaurants offering millet-based products, which consented to participate. Each restaurant had an average seating capacity of 22 customers per day. Over the three-month (90-day) study period, the estimated total customer population was calculated as 15,840, based on the formula: 8 restaurants  $\times$  22 customers/day  $\times$  90 days. The sample size, drawn from this target population, was determined using Slovin's formula (Tejada and Punzalan, 2012), resulting in a sample of 390 customers, sufficient to meet the Central Limit Theorem ( $n \geq 60$ ). Simple random sampling was used to select participants, while proportionate sampling ensured each restaurant contributed proportionally to the sample.

##### ***Data Collection Instruments***

This study used two research-administered questionnaires. The first questionnaire gathered organoleptic evaluation responses from a panel rating the consumer behaviour attributes of the finger millet pasta. The second questionnaire focused on consumer acceptance, employing a hedonic evaluation test to assess if the new pasta product met consumer expectations. Consumers rated their acceptance of the pasta on a 5-point hedonic scale (1 = "dislike extremely" to 5 = "like extremely") for the four sensory attributes. Pasta samples were presented sequentially to minimize ranking bias. Following the organoleptic evaluation, a sample of 390 consumers from eight Nairobi restaurants participated in the acceptance test. Reliability was confirmed through a Cronbach's Alpha test, with scores  $\geq 0.70$  indicating acceptable reliability (Alkhadim, 2022).

### *Data Analysis and Model Specification*

The collected data was organized and edited to ensure completeness, comprehensibility, and consistency, classified and coded for analysis. The data was analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0, STATISTICA 13.1 (StatSoft©, Inc. Tulsa, USA). To evaluate consumer acceptance, the normality distribution of data was tested using skewness and kurtosis. In a normally distributed data, one-way ANOVA was done (Karimova *et al.*). Multiple linear regression, Principal Component Analysis (PCA) were used to examine significant relationships among attributes. The Regression model was as follows:

$$Y = \beta_0 + \beta_1x_1 + \varepsilon_1$$

Where

Y is consumer acceptability of finger millet blended pasta;

$\beta_0$  = constant (coefficient of intercept);

$X_1$  = Sensory appeal attributes

$\varepsilon$  = Error Term;  $B_1$ , = regression coefficient of four variables

All assumptions of regression of linearity, normality, homoscedasticity, multicollinearity and autocorrelation were tested. Normality was tested using normal Q-Q Plot of the studentized residuals, linearity using scatter plots, homoscedasticity using Levene's test of variance, multicollinearity used Tolerance and Variance Inflation Factor (VIF) while autocorrelation used Durbin Watson.

### **5. Findings**

This section presents results, interprets them, and discusses their findings relative to other studies done elsewhere. A total of 390 self-administered questionnaires were distributed out of which 356 were returned. This resulted in a return rate of 91.3%. The overall return rate was found to be suitable for analysis and making interpretations and conclusions for this study since return rate of 60-100% is considered adequate to validate survey based studies (Meyer *et al.*, 2022).

#### *Descriptive Statistics*

The sensory appeal attributes of finger millet-blended pasta were evaluated across appearance, taste, smell, and texture to assess consumer acceptability. Organoleptic or sensory tests were conducted with both expert and consumer panels to ensure a balanced evaluation, allowing consumers to express preferences in simpler terms compared to technical descriptions used by experts (Ray, 2021; Piggott *et al.*, 2023). Since consumer perspectives are crucial for acceptability studies, the analysis aimed to determine how attributes such as appearance, taste, and texture influenced the perceived quality of this novel pasta product (Santa Cruz *et al.*, 2002; Rodbotten *et al.*, 2015).

The overall mean score for appearance attributes was  $3.75 \pm 0.79$ , indicating positive consumer feedback. The highest-scoring elements included shape ( $3.85 \pm 0.20$ ) and color ( $3.81 \pm 0.24$ ), suggesting a favorable visual appeal, comparable to studies on pasta made from alternative ingredients (Lawal *et al.*, 2022). Positive skewness (0.17) indicated slight leaning toward higher ratings, and the kurtosis value (0.06) signified a normally distributed response. For taste, the overall mean rating was  $3.07 \pm 0.65$ , reflecting moderate consumer satisfaction. Attributes such as pleasantness ( $3.78 \pm 0.83$ ) and appetizing quality ( $3.65 \pm 0.81$ ) scored well, while

sourness received the lowest score ( $1.23 \pm 0.36$ ), highlighting a limited preference for sour flavors. This rating aligns with other non-traditional pasta studies where taste was highly valued (Cho et al., 2024). The skewness (0.218) and kurtosis (0.24) further confirm a slight skew toward higher scores with normal data distribution. Smell attributes recorded a mean of  $3.22 \pm 0.73$ , with fresh and aromatic smells scoring the highest, while stale smell was rated lowest. A skewness of 0.219 and a kurtosis of 0.12 confirmed normal distribution, reflecting moderate consumer acceptance of the pasta's aroma. The texture of the pasta had an overall mean rating of  $3.22 \pm 0.71$ . Smoothness ( $3.98 \pm 0.78$ ) was particularly appreciated, while roughness scored lower, indicating a preference for smoother textures. Elasticity ( $3.70 \pm 0.93$ ) and firmness ( $3.32 \pm 0.93$ ) showed positive feedback as well, suggesting a balanced texture that aligns with consumer expectations (Yang et al., 2020; Macall et al., 2021).

**Table 1: Sensory Appeal Attributes of Finger Millet Blended Pasta**

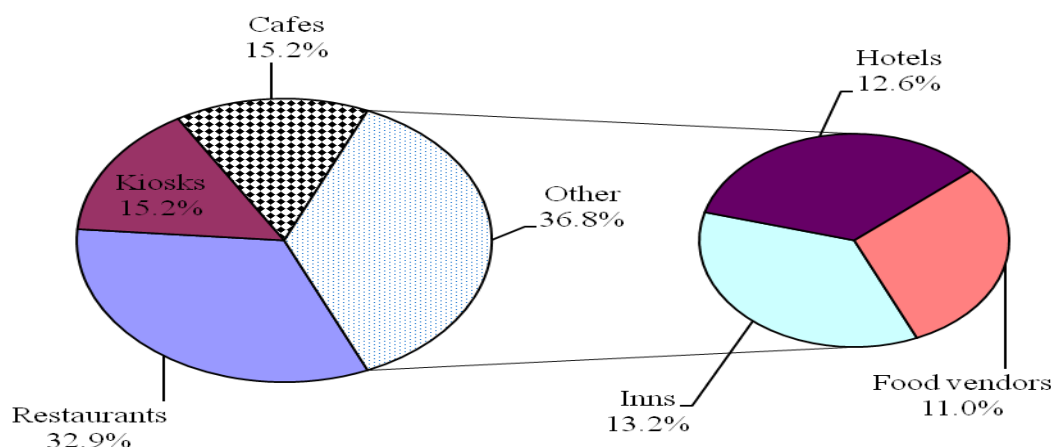
Statement	Mean	STDev.	Skewness	Kurtosis
Eye appeal	3.62	0.30	0.29	0.45
Length	3.74	0.21	0.14	-0.10
Food Shape	3.85	0.20	0.16	0.05
Colour	3.81	0.24	0.09	-0.16
<b>Overall mean rating of the Appearance</b>				
<b>Attributes of FMBP</b>	<b>3.75</b>	<b>0.79</b>	<b>0.17</b>	<b>0.06</b>
Pleasant	3.78	0.83	0.25	0.33
Appetizing	3.65	0.81	0.24	0.20
Delicious	3.62	0.62	-0.05	-0.51
Sourness	1.23	0.36	0.43	0.95
<b>Overall mean rating of the Smell attributes of FMBP</b>	<b>3.07</b>	<b>0.65</b>	<b>0.22</b>	<b>0.24</b>
Aromatic smell	3.81	0.78	0.08	-0.19
Fresh smell	4.18	0.98	0.12	-0.50
Stale smell	1.23	0.36	0.43	0.95
Spicy	3.65	0.81	0.24	0.20
<b>Overall Mean Rating of the Taste</b>				
<b>Attributes of FMBP</b>	<b>3.22</b>	<b>0.73</b>	<b>0.22</b>	<b>0.12</b>
Smooth	3.98	0.78	0.00	-0.59
Rough	1.87	0.22	-0.19	0.21
Elastic	3.70	0.93	0.31	0.52
Firm	3.32	0.93	0.42	0.91
<b>Overall Mean Rating Textural Attributes of FMBP</b>	<b>3.22</b>	<b>0.71</b>	<b>0.14</b>	<b>0.26</b>

Consumers who use millet based products will quite easily accept to eat food pasta made from millet (Hema *et al.*, 2022). Therefore, information concerning utilization of millet products was obtained from the consumers who use millet as their food. The frequency of use of millet-based food pasta are provided in Table 2.

**Table 1: Frequency of use of millet products**

Attribute	Frequency	Percent	Attributes scores	Weighted score
Never	0	3.7	13	0.04
Rarely	112	17.1	183	0.51
Sometimes	184	57.6	820	2.30
Always	29	18.0	320	0.90
<b>Total</b>	<b>356</b>	<b>100</b>		<b>3.79 ± 0.83</b>

The most frequented hospitality establishments for purchasing millet-based food products among the respondents are shown in Figure 1. Majority of the consumers frequently purchased millet-based food items from restaurants (32.9%), kiosks (15.2%), cafes (15.2%) and other establishments such as inns (13.2%), hotels (12.6%) and from unidentified food vendors (11%).



**Figure 1: Frequented hospitality establishments for purchasing millet-based food products**

The frequency of purchasing pasta among the respondents is provided in Table 2. The overall mean score (**3.84 ± 0.93**) show pasta being purchased at moderate frequency among the respondents. The consumers indicate that they purchase pasta from supermarkets (93.6%) and other retail shops (6.4%).

**Table 2. Frequency of purchasing pasta**

Attribute	Frequency	Percent	Attributes scores	Weighted score
Never	9	2.5	9	0.03
Occasionally	17	4.8	34	0.10
Rarely	61	17.1	183	0.51
Sometimes	205	57.6	820	2.30
Always	64	18.0	320	0.90
<b>Total</b>	<b>356</b>	<b>100</b>		<b>3.84 ± 0.93</b>

The overall acceptability of the finger millet blended pasta was  $7.24 \pm 1.56$  out of 9-point hedonic scale indicating high level of acceptability. There were significant differences in the acceptability of pasta among consumers frequenting different eateries to purchase millet-based foods (Kruskall Wallis ANOVA;  $H = 13.453$ ,  $df = 5$ ,  $P = 0.0324$ ). Customers who frequently purchased their finger millet products from restaurants had the higher rating for acceptance of finger millet pasta compared to other hospitality establishments.

***Relationship Between Consumer Behavior and Acceptability of Pasta***

The correlation analysis presented in Table 3 illustrates the relationship between consumer acceptability and various sensory attributes of finger millet-blended pasta. The analysis reveals a significant positive correlation between consumer acceptability and sensory attributes ( $r = 0.411$ ,  $p < 0.01$ ). This moderate positive correlation suggests that as sensory appeal improves, consumer acceptance of the pasta increases accordingly. This relationship highlights the critical role of sensory attributes in driving consumer preference, where attributes like taste, appearance, and texture positively influence consumers’ willingness to accept and prefer the pasta.

**Table 3: Correlation Analysis**

	<b>Consumer acceptability of finger millet blended pasta</b>	<b>Sensory attributes</b>
Consumer acceptability of finger millet blended pasta	1	
Sensory attributes	0.411**	1

\*\* Correlation is significant at the 0.01 level (2-tailed).

***Multiple Linear Regression (Hypotheses Testing)***

Table 4 presents the results of a multiple linear regression analysis examining the impact of sensory appeal attributes on consumer acceptability of finger millet blended pasta. The model has an R-squared value of 0.406, indicating that approximately 40.6% of the variability in consumer acceptability is explained by the predictors in the model. The overall model is statistically significant, with an F-value of 35.525 ( $p < 0.001$ ). The unstandardized coefficient for sensory appeal attributes ( $\beta = 1.239$ ,  $p < 0.001$ ), suggesting that each one-unit increase in sensory appeal attributes results in an increase of 1.239 units in consumer acceptability. Additionally, the standardized coefficient (Beta) for sensory appeal attributes is 0.631, reflecting a strong positive relationship with consumer acceptability, thereby supporting H1. These findings highlight the significant positive impact of sensory appeal attributes on the acceptability of finger millet blended past.



**Table 4: Multiple Linear Regression Results**

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	3.533	0.350		10.093	0.000
Sensory appeal attributes	1.239	0.206	0.631	6.025	0.000
<b>Model Summary Statistics</b>					
R	0.637				
R Square	0.406				
Adjusted R Square	0.405				
<b>ANOVA statistic for model fitness</b>					
F	35.525				
Sig.	.000				

a Dependent Variable: consumer acceptability of finger millet blended pasta

## 6. Discussion of the results

The findings underscore the critical role of sensory appeal attributes in shaping consumer acceptance of finger millet blended pasta. Previous studies emphasize that sensory characteristics—including texture, taste, aroma, and appearance—are essential factors influencing consumer perceptions and preferences (Oluwajuyitan et al., 2021; Syardiansya et al., 2024). The organoleptic properties of food are processed through various sensory pathways, creating a multifaceted experience that significantly impacts consumer attitudes towards new formulations (Yang et al., 2020). Research has shown that food texture can be evaluated both subjectively through sensory analysis and objectively using specialized instruments (Chen & Opara, 2013). This highlights the importance of comprehensive sensory evaluations to ensure that products like finger millet pasta deliver an enjoyable eating experience.

Moreover, consumer behavior is influenced by a combination of intrinsic attributes, such as taste and texture, and extrinsic factors, including psychological elements and cultural contexts (Bangsa & Schlegelmilch, 2020). The literature indicates that while sensory properties are pivotal, broader contextual factors like social class and previous experiences also significantly affect food choices and acceptance (Dhaliwal et al., 2020). As current industry practices increasingly prioritize sensory analysis and consumer testing throughout product development (Bolha et al., 2021; Cardona et al., 2023), there is a pressing need for research that shifts focus from producer-based evaluations to consumer-centered approaches. This shift will provide critical insights into consumer preferences for millet-based products, facilitating their acceptance and success in the market.

## 7. Conclusions

The findings indicate that conclusion, the findings highlight the significant influence of sensory appeal attributes on consumer acceptance of finger millet blended pasta. This aligns with existing literature, which emphasizes that sensory characteristics such as texture, taste, aroma, and appearance play a crucial role in shaping consumer perceptions and preferences for food products. The positive relationship between sensory attributes and consumer acceptability underscores the necessity for food manufacturers to prioritize these qualities in product development. By doing so, they can enhance the overall eating experience, which is essential

for attracting and retaining consumers, particularly in the context of new formulations like millet-based pasta.

## **8. Study Implications**

### ***Theoretical Implications***

The findings of this study contribute significantly to Consumer Perception Theory by highlighting the intricate relationship between sensory characteristics and consumer acceptance. The emphasis on sensory attributes such as taste, texture, aroma, and appearance supports the idea that consumer perceptions are deeply influenced by these organoleptic evaluations. This research underscores that sensory appeal is not merely an isolated factor but interacts with broader consumer behaviors and preferences, thereby enriching our understanding of how food products are perceived in the marketplace. The results suggest that while sensory characteristics are crucial, they must align with consumer expectations, thus expanding the theoretical framework of sensory marketing by demonstrating the need for a holistic approach that incorporates both sensory attributes and consumer behavior.

### ***Managerial/Practical Implications***

From a managerial perspective, the findings offer actionable insights for food manufacturers looking to enhance the acceptability of finger millet-blended pasta. Prioritizing product optimization based on sensory evaluations can lead to improved market performance. Specific recommendations include focusing on visual appeal through enhancements in color and shape, enhancing taste and aroma through strategic ingredient choices, and improving texture to align with consumer preferences. Additionally, implementing consumer engagement strategies, such as taste tests and feedback surveys, can provide valuable insights into consumer preferences and drive product development. A dual product line targeting both premium and cost-effective markets can also cater to diverse consumer needs, ultimately fostering greater acceptance and market success for new formulations. By strategically addressing sensory characteristics, managers can better align product offerings with consumer expectations, thereby improving overall product performance in a competitive landscape.

### ***Policy Implications***

The findings also hold significant policy implications, particularly for promoting the incorporation of alternative grains like finger millet into the food supply. Policymakers can leverage this research to advocate for funding and support for initiatives that encourage the development and marketing of health-oriented food products. By emphasizing the importance of sensory attributes in consumer acceptance, policy measures could be introduced to incentivize research and development in food innovation, particularly focusing on sensory enhancement techniques. Furthermore, educational campaigns can be designed to raise consumer awareness about the benefits of millet-based products, thus encouraging broader acceptance and consumption. This dual approach—fostering product development while educating consumers—can create a supportive environment for alternative grain products, promoting nutritional diversity and food security in the marketplace.

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