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Original Research Article

Influence of food properties on hospital meal consumption among inpatients in level four public hospitals in Nairobi City County, Kenya

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ABSTRACT

Background: Adequate food intake among hospitalized patients is essential for recovery and nutritional well-being. Despite investments in hospital catering services in Kenya, low inpatient food consumption persists. Sensory and qualitative food properties strongly influence acceptance and eating behavior. This study examined the influence of food attributes taste, texture, aroma, temperature, variety, and presentation on meal consumption among inpatients in two level four public hospitals in Nairobi County.
Methods: A cross-sectional analytical study was conducted among 160 inpatients at Mbagathi and Mama Lucy Kibaki Hospitals using stratified random sampling. Data were collected through structured questionnaires and observation checklists. Quantitative data were analyzed using descriptive statistics, Pearson correlations, and multiple linear regression to assess associations between food properties and consumption levels.
Results: Food properties showed a non-significant yet theoretically meaningful influence on food consumption, explaining 4.2% of the variance (R^2=0.042, p=0.117). Texture approached significance (p=0.094). Observational findings indicated that hospital meals, though nutritionally adequate, lacked sensory appeal due to monotony, suboptimal temperature, and limited variety factors linked to higher plate waste, particularly of vegetables.
Conclusions: Food properties are critical determinants of food consumption in public hospitals. Enhancing food variety, flavor, texture, temperature control and overall meal presentation can significantly improve intake and reduce plate waste. Hospital catering departments should incorporate sensory quality controls and patient-centered feedback mechanisms to guide meal planning.

Keywords: Hospital food, Food properties, Inpatient nutrition, Sensory quality, Food consumption, Nairobi City County Hospital(s), Kenya public healthcare

INTRODUCTION

Hospital-provided meals constitute an essential element of inpatient care, contributing significantly to nutritional support, clinical recovery, and overall patient outcomes. Inadequate food consumption within hospital settings continues to be a documented challenge, particularly in resource-constrained environments. Low hospital food consumption (LHFC) has been associated with increased nutritional risk, delayed healing, and extended hospital stays, all of which contribute to increased healthcare costs and reduced patient satisfaction.[1,2] In addition, uneaten food generates substantial waste, exacerbating economic and environmental burdens on healthcare institutions.[3]

Food consumption behavior is shaped by a variety of factors, including physical health status, psychological conditions, sociocultural influences, and characteristics of the food itself. Within hospital environments, food properties play a decisive role in determining whether meals are accepted or rejected by patients. Food properties refer to the intrinsic and extrinsic attributes of a meal such

as flavour, temperature, texture, variety, portion size, and presentation that collectively influence palatability and appetite stimulation.[4,5] These attributes affect patients' sensory perception prior to and during meal consumption and have direct implications for intake levels.

Low hospital food consumption continues to present a critical challenge within Kenya's public hospitals. Reports show that a large proportion of inpatients do not consume the meals provided, citing dissatisfaction with meal quality and preference for externally sourced food.[6,7] Sensory-related factors such as bland flavour, poor texture, lack of variety, and inappropriate temperature have been consistently associated with reduced intake and increased food waste.[1,8,9] Despite these challenges, limited empirical research has explored the specific role of food properties in shaping patient consumption behaviour in Kenya's public healthcare context. This gap undermines efforts to improve meal satisfaction, reduce nutritional risk, and optimize resource use within hospitals.

Sensory responsiveness to meal quality has been shown to significantly affect energy and nutrient intake. Empirical evidence has established a direct correlation between poor food texture, unappealing temperature, and low patient intake in clinical settings.[9] The inability of hospital meals to meet acceptable sensory standards often results in poor acceptance, diminished appetite, and elevated plate waste. Research conducted in Canadian hospitals indicated that dissatisfaction with flavour, temperature, and presentation of meals was closely linked to under-consumption of protein and calories.1 Palatability and sensory congruence are therefore fundamental to improving food intake among inpatients, particularly those with illness-induced appetite suppression.

Nutritional adequacy alone does not ensure effective consumption. Meal variety, for example, has been highlighted as a factor that maintains dietary interest and reduces menu fatigue, which is common in hospital environments with repetitive offerings.[10] Similarly, texture plays an important role in determining acceptance or rejection, especially for patients with oral or swallowing difficulties.[10] Temperature and appearance of meals further shape taste perception, satiety response, and satisfaction. When meals are served cold, overcooked, or visually unappealing, patients are less likely to consume adequate portions, regardless of nutritional content.[11]

In Kenyan public hospitals, the alignment between food properties and patient preferences is seldom prioritized due to rigid meal systems, limited menu flexibility, and centralized foodservice operations. This context presents unique challenges where standardization may conflict with individualized patient needs. Limited empirical studies have explored the extent to which food properties influence inpatient meal consumption within Kenya's public healthcare sector, particularly in level four hospitals which serve large patient volumes under constrained resources. The study sought to examine the influence of food properties specifically flavour, temperature, texture, variety, and portion size on hospital meal consumption among inpatients in level four public hospitals in Nairobi City County. The findings are intended to provide context-specific insights that can inform hospital foodservice improvements, support policy recommendations, and contribute to the optimization of nutritional care in public health institutions.

METHODS

Research design

A cross-sectional analytical research design was employed to investigate the influence of food properties on hospital meal consumption among inpatients in level four public hospitals in Nairobi City County, Kenya. This design facilitated the assessment of relationships between specific variables at a single point in time.[12] Primary data were collected using researcher-administered questionnaires and structured observation methods.

Study population

The unit of analysis comprised inpatients on a normal diet, admitted to medical and surgical wards in two level four public hospitals; Mbagathi Hospital and Mama Lucy Kibaki Hospital. As of October 2024, Mbagathi Hospital had a total bed capacity of 550, and Mama Lucy Kibaki Hospital had 420. Applying the inclusion criteria, only patients in the medical and surgical wards were considered, yielding a study population of 266 inpatients (143 from Mbagathi and 123 from Mama Lucy).

Sample size determination

The sample size (n) was determined using Israel's (2009) formula for defined target population, where N=266, e=0.05.

$$n = N/(1 + N(0.05)^2)$$

$$n = 266/(1 + 266(0.05)^2) = 160$$

To ensure proportional representation - Mbagathi Hospital: 143/266×160=86, and Mama Lucy Kibaki Hospital: 123/266×160=74.

Data collection instrument and procedure

Data were collected using a structured, researcher-administered questionnaire and an observation checklist, both designed to assess food properties. The tools were adapted from validated instruments used in hospital foodservice research and contextualized for public hospitals in Nairobi City County.[13] The questionnaire focused on four sub-dimensions of food properties: variety, flavor, texture, and temperature. Each was measured through multiple items rated on a five-point Likert scale (1=very dissatisfied to 5=very satisfied). Items

captured perceptions of menu diversity, taste, aroma, meal consistency, and serving temperature. In addition to self-reported data, a structured observation checklist was employed to assess appearance, aroma, texture, and meal temperature at delivery. This enabled triangulation of data for greater validity.

Data collection took place from 17 October to 31 December 2024 during lunch and dinner in the medical and surgical wards of Mbagathi and Mama Lucy Kibaki Hospitals. Instruments were administered in English or Kiswahili, based on patient preference, and were pretested to ensure clarity and contextual relevance.

Recruitment strategy

Recruitment was conducted in the medical and surgical wards of Mbagathi and Mama Lucy Kibaki Hospitals. Eligible participants were inpatients aged 18 years and above, admitted for at least three days, receiving a normal diet, and not scheduled for discharge within 24 hours. Systematic random sampling was employed. Using hospital ward records, patients were assigned sequential numbers. A sampling interval (k) was calculated as:

$$k = N/n = 266/160 \approx 2$$

Every second eligible inpatient was selected from the list. In cases of non-consent or early discharge, the next eligible patient was chosen. Data collection protocols adhered to hospital infection control measures, including the use of personal protective equipment and sanitization of data collection tools. One trained research assistant with a background in public health and quantitative research conducted the sampling and data collection, under supervision of the principal investigator.

Recruitment was carried out after morning ward rounds to ensure clinical stability and up-to-date patient records. The process was overseen by the researcher and executed by a trained research assistant with public health credentials and no affiliation to the study sites. All selected participants received a verbal and written explanation of the study and signed an informed consent form prior to participation. The research assistants received training on ethical conduct, patient communication, and consent procedures to ensure consistency and protocol adherence.

Data analysis

To address the study objectives, completed questionnaires were coded and entered using Microsoft Excel. Data cleaning was subsequently performed using Python 3.9.16 to detect and address errors or missing values before the statistical analysis. Prior to regression analysis, diagnostic tests were conducted to assess the key assumptions. Normality was evaluated using Q–Q plots for both food properties and food consumption. As shown in Figure 1, the data points closely followed the diagonal line in both plots, indicating that the variables were approximately normally distributed. Linearity was confirmed through visual inspection of scatterplots, which showed a consistent linear relationship between food properties and food consumption. Multicollinearity was not a concern, as variance inflation factor (VIF) values were below 1.2 and tolerance values exceeded 0.8, suggesting adequate independence among the predictors. The Durbin-Watson statistic was 2.201, indicating no evidence of autocorrelation in the residuals. Homoscedasticity was confirmed through residual plots, which displayed a random and even spread of standardized residuals around the predicted values. These findings confirmed that all necessary assumptions for multiple linear regression were satisfied.

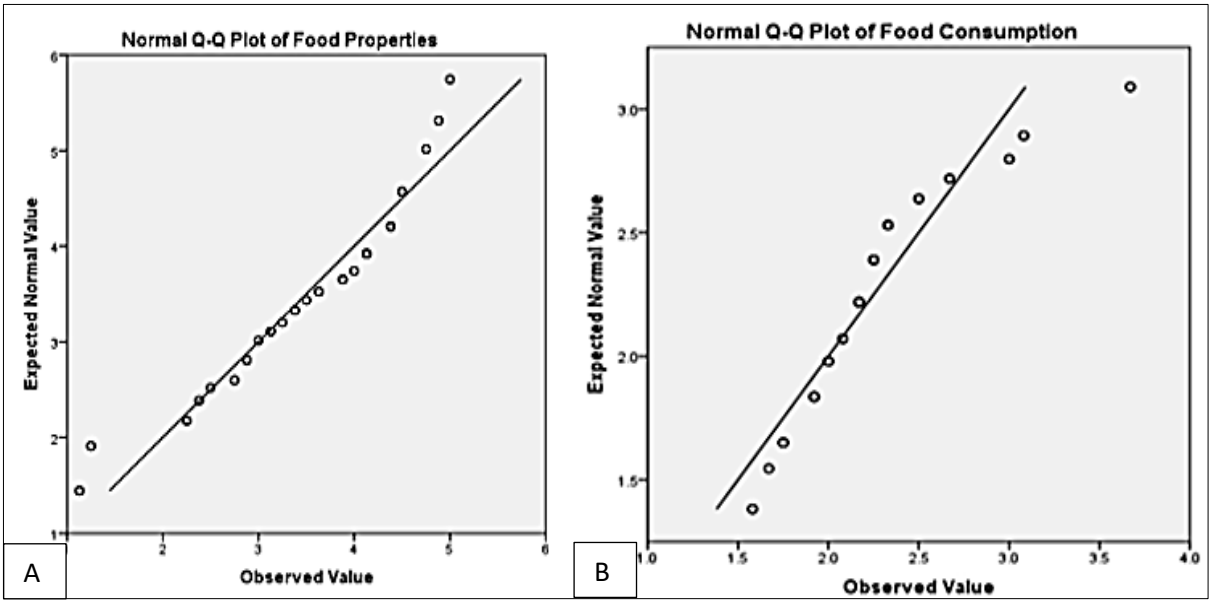

Figure 1 (A and B): Normal Q–Q plots for assessing normality of variables.

Having confirmed that all assumptions for multiple linear regression were satisfied, the analysis proceeded to estimate a model evaluating the influence of the sub-dimensions of food properties on inpatient food consumption. The regression model was specified as following, where Y=food consumption, α=intercept, μ=error term, β_1 to β_4=regression coefficients, X_1=variety, X_2=flavor, X_3=texture, and X_4=temperature.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \mu$$

The model was used to assess the individual and combined contributions of the four food property dimensions to the variance in hospital food consumption among inpatients in level four public hospitals in Nairobi City County.

Ethical considerations

Ethical approval for the study was obtained through a series of formal procedures to ensure compliance with research standards and participant protection. An introductory letter from Moi University (MU/STHE/PG/23) was secured, followed by a research license from the National Commission for Science, Technology and Innovation (NACOSTI/P/24/33450). These documents supported the application for ethical clearance from the Kenyatta National Hospital–University of Nairobi Ethics and Research Committee (KNH-UoN ERC) under reference number P377/04/2024. Additional approvals were granted by Nairobi City County (NCCG/HWN/REC/639), Mbagathi Hospital (MDH/RS/VOL.3/09/332), and Mama Lucy Kibaki Hospital (MLKH/ADM/RES/2). All participants provided informed consent after being explained on purpose of study it was voluntary, with the right to withdraw at any point without consequences. Consent was formally documented through signed forms prior to data collection. To ensure confidentiality, all data were anonymized and securely stored physical forms in locked cabinets and electronic data in encrypted files accessible only to the principal investigator. Ethical principles were strictly upheld throughout the research to maintain scientific integrity and protect participant welfare.

RESULTS

Response rate

The study achieved a high response rate, reflecting strong participation and institutional cooperation from both hospitals. Out of the 160 questionnaires distributed 74 at Mama Lucy Kibaki Level Four Hospital and 86 at Mbagathi Level Four Hospital; 68 and 74 were successfully retrieved, corresponding to response rates of 91.0% and 86.0%, respectively (Table 1). This produced an overall response rate of 89%, which is well above the acceptable threshold for health and social science research.[14,15]

Table 1: Inpatients' response rate.

Target respondents	Target sample size	No. of respondents	Response rate (%)
Mama Lucy Kibaki Hospital		68	
Surgical ward	74	42	0.43
Medical ward		26	
Mbagathi hospital		74	
Surgical ward	86	35	0.46
Medical ward		39	
Total	160	142	0.89

Although the study did not attain a full 100% response, non-responses were primarily attributed to patient discharges, unstable health condition, and withdrawal of consent. Such occurrences are typical in hospital-based studies due to the dynamic nature of patient care. To minimize potential non-response bias, replacement respondents were selected using the same systematic random sampling procedure, ensuring proportional representation from both the medical and surgical wards in each facility.

The achieved response rate therefore supports data reliability and representativeness, with minimal distortion to the overall findings. The distribution of respondents remained balanced across hospitals and wards, indicating that participation patterns did not systematically favor or exclude any subgroup.

Inpatients' general characteristics

As shown in Table 2, most respondents were female (65%), while male participants accounted for 35%. Regarding education, nearly half (49%) had attained secondary education, followed by 41% with primary education, 8% with no formal schooling, and 2% with college-level education. In terms of marital status, 61% of the respondents were married, 28% single, and 11% widowed. The majority of participants identified as Christian (92%), while 8% were Muslim. These distributions indicate a predominance of middle-aged, moderately educated, and married participants a demographic consistent with general inpatient populations in public hospitals.[16]

With regard to age and length of hospital stay, the findings (Figure 2) showed a mean age of 46 years (SD=13.28),

ranging from 22 to 72 years. The age distribution was approximately symmetrical (skewness=0.22; kurtosis= 0.99), suggesting a near-normal spread among participants. The mean length of stay was 17 days (SD=24.35), with a range of 3 to 120 days. The distribution was positively skewed (skewness = 2.87; kurtosis = 7.18), indicating a few patients with prolonged hospitalizations. As illustrated in Figure 2, outliers were present among patients with extended stays, reflecting variability typical of surgical recovery and chronic illness management in public hospital settings.

Table 2: Inpatients' general characteristics.

Variables	No. of respondents	%
Gender		
Female	92	65
Male	50	35
Level of education		
Never went to school	11	8
Primary	58	41
Secondary	70	49
College	3	2
Marital status		
Married	87	61
Single	40	28
Widow	15	11
Religion		
Christian	131	92
Muslim	11	8

Descriptive statistics and bivariate analysis

Descriptive and inferential analyses were conducted to examine the influence of food properties on inpatient food consumption across the two hospitals. The descriptive statistics (Table 3) summarize the distribution of the main study variables, while subsequent bivariate tests assess the relationships among them. Descriptive summaries indicated moderate mean scores. Food properties had a mean score of 3.41 (SD=0.64), reflecting moderate patient satisfaction with meal variety, flavor, texture and temperature. The dependent variable, hospital food consumption, recorded a mean of 3.48 (SD=0.61), implying an overall moderate level of meal intake among inpatients (Table 3).

Influence of food properties on food consumption

Descriptive and inferential analyses were conducted to determine how sensory and physical attributes of hospital meals specifically variety, texture, flavor, and temperature influenced inpatient food consumption. Table 4 presents the summary of correlation results.

The results indicated that none of the food property indicators exhibited statistically significant correlations with food consumption, although texture approached marginal significance (p=0.094). This pattern suggests that while patients noticed differences in meal feel and consistency, such sensory perceptions did not strongly determine their overall consumption behavior. Structured observation provided contextual depth to the quantitative findings. Across both hospitals, meals were observed in surgical and medical wards in six sessions at Mbagathi and nine at Mama Lucy Kibaki. Observations confirmed that food presentation was largely uniform, with limited color contrast or variation in plating. Typical meals included ugali or rice served with boiled vegetables and a stew, frequently delivered lukewarm. These visual and sensory conditions help explain the weak statistical association between meal temperature, flavor, and consumption.

Qualitative results indicated that patients perceived the hospital meals as monotonous and occasionally bland, but this uniformity may have normalized expectations, diluting their influence in survey ratings. Furthermore, the observation of repetitive menus supports prior findings that low variety reduces appetite stimulation and overall satisfaction.[17,18] The triangulated results show that while flavor and temperature were not statistically significant, they nonetheless shaped patient experiences in subtle ways especially where presentation was suboptimal or service delays occurred.

Model fit and predictive power

A multiple linear regression model was used to examine whether food properties (variety, flavor, texture and temperature) predicted inpatient food consumption. As shown in Table 5, the model yielded an R value of 0.204, indicating a weak positive association between the predictors and the dependent variable. The R^2=0.042 and adjusted R^2=0.021 demonstrate that the predictors jointly explained only 4.2% of the variance in food consumption. The Durbin–Watson statistic (2.201) confirmed the independence of residuals, satisfying the assumption of error independence.

The overall model significance was further evaluated through an analysis of variance (ANOVA) test (Table 6). The model was not statistically significant, $F(4,137)=1.998$, $p=0.117$, indicating that the combined predictors did not meaningfully enhance the prediction of inpatient food consumption.

Although the model's explanatory power was modest, such results are common in behavioral and health-related studies where food consumption is shaped by multiple unmeasured factors.[19,20] Variables such as appetite, illness severity, medication, and institutional food service practices may account for additional unexplained variance.

Nevertheless, all regression assumptions normality, linearity, homoscedasticity, and absence of multicollinearity were met, confirming the statistical validity of the results. While no predictor reached statistical significance, food properties exhibited a near-significant trend (p=0.079), suggesting that perceptual

meal attributes such as flavor, temperature, and presentation had a significance influence on food consumption. To assess the incremental explanatory contribution of each predictor group, a hierarchical multiple regression model was applied, consistent with the study's conceptual framework that structured variables according to their theoretical proximity to food consumption.

Regression coefficients and interpretations

The regression coefficients in Table 7 summarize the contribution of each predictor variable to inpatient food consumption. The constant term (B=2.899, p<0.001) represents the expected level of food consumption when all predictors are held constant, indicating a significant baseline level of consumption among inpatients. Food properties exhibited a negative relationship (B= –0.062, p=0.079), indicating that less favorable food attributes such as poor taste, temperature, or appearance were associated with slightly reduced consumption levels. Although not statistically significant at the 0.05 level, the near-significance implies a possible trend warranting further exploration. The low beta coefficients and wide confidence intervals confirm that the influence of the predictors on food consumption was weak. However, all variance inflation factor (VIF) values (1.029-1.105) and tolerance values (>0.90) met acceptable thresholds, confirming the absence of multicollinearity. These findings indicate that while food properties may show potential influence, none of the predictors significantly affected inpatient food consumption. This outcome aligns with earlier evidence of low model explanatory power, suggesting that unmeasured contextual and behavioral factors likely play a significant role.

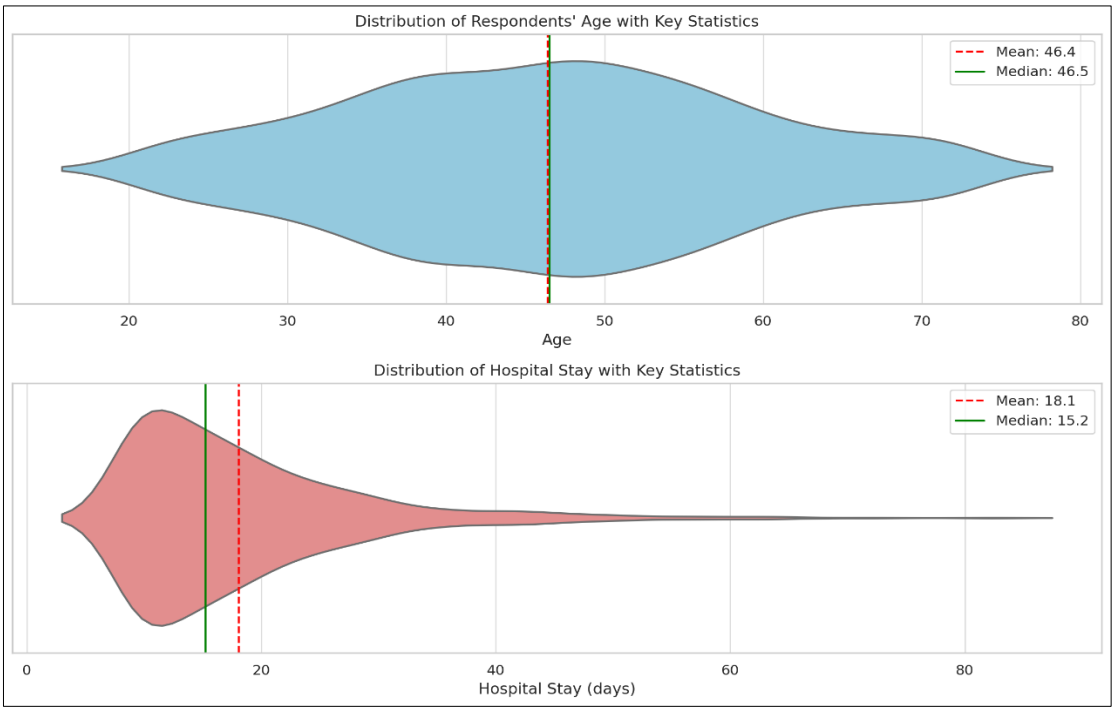

Figure 2: Age and length of stay of the inpatients'.

Table 3: Descriptive statistics for study variables.

Variables	N	Minimum	Maximum	Mean	SD
Food properties	142	1.8	4.8	3.41	0.64
Food consumption	142	1.9	4.7	3.48	0.61

Table 4: Correlation of food property indicators with inpatients' food consumption.

Food properties indicators	df	Value	P value
Variety	140	-0.127	0.1326
Texture	140	-0.141	0.0944
Flavor	140	-0.034	0.6906
Temperature	140	0.004	0.9607

Source: Data analysis (2025)

Table 5: Model summary for multiple linear regression predicting food consumption.

Model summary[b]										
Model	R	R square	Adjusted R square	Std. error of the estimate	Change statistics					Durbin-Watson
					R square change	F change	df1	df2	Sig. F change	
1	0.204[a]	0.042	0.021	0.39700	0.042	1.998	4	137	0.117	2.201

a=Predictors: (constant), variety, texture, flavor, temperature, b=dependent variable: food consumption

Table 6: ANOVA table for regression model predicting food consumption.

ANOVA[a]						
Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	0.945	4	0.315	1.998	0.117[b]
	Residual	21.750	137	0.158		
	Total	22.695	141			

a=Dependent variable: food consumption, b=predictors: (constant), variety, texture, flavor, temperature

Table 7: Regression coefficients for predictors of food consumption.

Coefficients[a]												
Model		Unstandardized		Standardized	t	Sig.	95.0% confidence interval for B		Correlations			Collinearity statistics	
		B	Std. error	Beta			Lower bound	Upper bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.899	0.364		7.964	0.000	2.180	3.619					
	Food properties	-0.062	0.035	-0.155	-1.772	0.079	-0.131	0.007	-0.166	-0.149	-0.148	0.905	1.105

a=Dependent variable: food consumption

DISCUSSION

The study established that specific food property attributes namely variety, texture, flavor, and temperature collectively influence inpatients' food consumption. While individual effects were modest, their combined contribution was meaningful in explaining eating behavior within hospital settings. These findings highlight that patients' food acceptance is closely linked to sensory experience and perceived meal quality rather than to personal or demographic characteristics. Structured observations indicated that hospital meals were often repetitive, uniform in color and composition, and occasionally served at suboptimal temperatures. Such characteristics reduced sensory appeal and likely contributed to lower levels of meal consumption. Similar outcomes have been reported by Ottrey et al and Trinca et al, who observed that monotonous or poorly presented meals often lead to reduced consumption and increased plate waste.[17,21]

Although none of the sensory variables individually emerged as strong predictors, their collective influence underscores the importance of food quality and presentation in motivating patients to eat. Institutional environments, by nature, limit individual choice; therefore, sensory appeal becomes one of the few modifiable determinants of patient satisfaction and dietary compliance. Enhancing variety, maintaining optimal temperature, and improving flavor and texture consistency could substantially increase meal acceptance. These findings support ecological and behavioral models of eating, which propose that immediate environmental stimuli such as sensory quality and presentation shape food-related behavior more directly than background personal factors.[22] Practically, this implies that hospital administrators should invest in improving food preparation and presentation practices, ensuring that meals are visually appealing, palatable, and served promptly to retain sensory integrity. Doing so may enhance nutritional intake and minimize food waste among inpatients.

Limitations

Primarily, the study was confined to level four public hospitals in Nairobi City County, which may limit the generalizability of the findings to hospitals of other classifications or those located in different regions. Healthcare institutions vary in infrastructure, staffing, and foodservice systems, and these contextual differences may influence food consumption patterns.

The research also focused on specific inpatient wards medical and surgical units thereby excluding departments such as maternity and pediatric wards. Although this focus enabled an in-depth assessment of hospital food consumption within comparable settings, it may not fully represent experiences across all patient categories.

Another limitation arose from the study's reliance on self-reported data obtained through questionnaires. Such data may be affected by recall bias or subjective perceptions. To mitigate this limitation, structured observation was incorporated to validate responses and enhance the credibility of the findings.

Finally, the study was limited to determinants measured within the hospital environment, specifically socio-demographic factors and food properties. While these variables provided valuable insight into inpatient food consumption, future research should extend the study to broader institutional and behavioral dimensions such as menu planning policies, nutritional adequacy, and staff-patient interaction to build a more comprehensive understanding of hospital foodservice systems.

CONCLUSION

The study contributes to the growing body of literature on hospital foodservice by empirically demonstrating that specific food property attributes namely variety, texture, flavor, and temperature collectively influence inpatient food consumption. While the individual predictive power of each variable was limited, their combined effect accounted for a meaningful proportion of variance in dietary intake. These findings accentuate the significance of sensory and perceptual meal characteristics as modifiable determinants of food acceptance in clinical settings. Importantly, the results emphasize that enhancing the sensory appeal of hospital meals represents a feasible and impactful strategy to improve nutritional intake, patient satisfaction, and clinical outcomes. In doing so, this research shifts attention from static socio-demographic variables to actionable aspects of foodservice quality, thereby advancing practical knowledge for healthcare institutions aiming to reduce food waste and support patient recovery through improved dietary practices.

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