

Sensory Characteristics of Therapeutic Juice Blends for Peptic Ulcer Management in Kenya

Abstract

Peptic ulcer disease (PUD) remains a significant public health concern in Kenya, where Helicobacter pylori infection, widespread nonsteroidal anti-inflammatory drug (NSAID) use, dietary transitions, and psychosocial stressors contribute to high disease burden. While pharmacological therapies are effective, access, cost, and long-term adherence remain challenges for many populations. Dietary interventions utilizing locally available functional foods offer a culturally acceptable and sustainable complementary strategy. This study formulated therapeutic juice blends using pawpaw (Carica Papaya), coconut water (Cocos nucifera), and pineapple (Ananas Comosus), fruits widely cultivated and consumed in Kenya, and evaluated their sensory characteristics and acceptability. Three juice blends with varying fruit ratios were assessed by 30 trained panelists using a 9-point hedonic scale. Sensory attributes evaluated included color, aroma, taste, texture, and overall acceptability. Results showed significant differences ($p < 0.05$) among blends for taste and overall acceptability, with the 50:30:20 pawpaw: coconut: pineapple blend receiving the highest overall scores. The findings demonstrate the feasibility of developing palatable, culturally relevant therapeutic beverages using local fruits and support their potential role as dietary adjuncts in peptic ulcer management in Kenya.

Keywords

Peptic Ulcer Disease, Functional Beverages, Kenya, Sensory Evaluation, Pawpaw, Coconut Water, Pineapple.

Introduction

Peptic ulcer disease (PUD) is a chronic gastrointestinal disorder characterized by erosion of the gastric or duodenal mucosa, resulting in symptoms such as epigastric pain, dyspepsia, nausea, and, in severe cases, complications including gastrointestinal bleeding and perforation. Globally, PUD remains a significant public health concern, particularly in low- and middle-income countries

Research Article

Louise Ngugi *

Department of Food Science and Nutrition Karatina University, Kenya.

***Correspondence:** Louise Ngugi, Department of Food Science and Nutrition Karatina University, Kenya. Email: luwngugi@yahoo.com

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where major risk factors persist. In sub-Saharan Africa, the burden of PUD is substantial, with pooled prevalence estimates exceeding 15%, and duodenal ulcers occurring more frequently than gastric ulcers [1]. In Kenya, PUD is commonly diagnosed in both rural communities and urban informal settlements, where delayed healthcare seeking and limited access to diagnostic services such as endoscopy contribute to continued morbidity.

A major etiological factor in PUD is *Helicobacter pylori* infection, which colonizes the gastric mucosa and compromises its protective mechanisms. Studies from East Africa report *H. pylori* prevalence rates exceeding 60% among adults, with even higher rates among patients presenting with dyspeptic symptoms or confirmed ulcers [2,3]. Poor sanitation, overcrowding, and inadequate access to clean water-conditions still prevalent in many parts of Kenya-facilitate early acquisition and persistent transmission of *H. pylori*.

The burden of PUD in Kenya is further aggravated by widespread and often unsupervised use of non-steroidal anti-inflammatory drugs (NSAIDs). These drugs are commonly used for pain management due to their affordability and availability without prescription. However, NSAIDs in-

hibit prostaglandin synthesis, weaken the gastric mucosal barrier, and increase susceptibility to ulcer formation and bleeding [4]. When NSAID use coexists with *H. pylori* infection, the risk of ulcer development and complications rises significantly. Socioeconomic stressors, food insecurity, and lifestyle changes associated with urbanization also contribute to disease progression. Dietary transitions from traditional high-fiber diets to refined, acidic, and highly processed foods may increase gastric irritation and acid secretion, thereby worsening ulcer symptoms and delaying healing [5].

Standard management of PUD involves eradication of *H. pylori* using combination antibiotic therapy, suppression of gastric acid with proton pump inhibitors, and avoidance of ulcerogenic agents such as NSAIDs where possible [6]. However, dietary management is increasingly recognized as a critical supportive component of care. Appropriate dietary choices can reduce gastric irritation, improve nutrient intake, and enhance patient comfort during recovery. In Kenya, traditional dietary practices have long relied on plant-based foods, fruits, and herbal preparations to manage digestive ailments. While these practices are culturally embedded, scientific validation of their role in PUD management remains limited. Nonetheless, emerging evidence suggests that diets rich in antioxidants, fiber, and anti-inflammatory compounds may support mucosal protection and gastrointestinal health [7,8].

Functional foods—defined as foods that provide health benefits beyond basic nutrition—have gained attention for their potential role in gastrointestinal health. Tropical fruits are particularly relevant in the Kenyan context due to their availability, affordability, and cultural familiarity. Pawpaw (*Carica papaya*), pineapple (*Ananas comosus*), and coconut (*Cocos nucifera*) are widely cultivated across Central, Eastern, and Coastal Kenya. Pawpaw contains papain, while pineapple contains bromelain—proteolytic enzymes associated with digestive support and anti-inflammatory properties [9]. Coconut water, rich in electrolytes and bioactive compounds, is traditionally consumed for hydration and digestive comfort. Although direct clinical evidence supporting the use of these fruits in peptic ulcer healing is limited, experimental and nutritional studies suggest potential cytoprotective and digestive benefits that may complement conventional therapy [10,11].

Despite their potential, limited research has examined the combined use of pawpaw, coconut water, and pineapple in blended juice formulations, particularly with respect to sensory acceptability and suitability for individuals with sensitive gastric conditions. Evaluating such blends is important

because excessive acidity, texture, or flavor intensity may worsen symptoms in PUD patients. Addressing this gap could support the development of culturally appropriate, food-based dietary interventions that complement medical treatment and improve quality of life for individuals living with PUD in Kenya.

Objectives

1. To formulate therapeutic juice blends using pawpaw, coconut water, and pineapple in varying proportions.
2. To evaluate sensory characteristics including taste, aroma, color, texture, and overall acceptability.
3. To assess the suitability of the juice blends as culturally acceptable dietary adjuncts for peptic ulcer management in Kenya.

Materials and Methods

Study Design

The study adopted an experimental design involving the formulation of juice blends followed by sensory evaluation using trained panelists. Sensory acceptability was emphasized as a key determinant of dietary compliance among individuals with gastrointestinal conditions.

Ingredients and Therapeutic Rationale

Ingredient	Therapeutic Role
Pawpaw (<i>Carica papaya</i>)	Rich in papain; aids digestion, reduces inflammation, improves gastric comfort
Coconut water (<i>Cocos nucifera</i>)	Mildly alkaline, soothing, hydrating, supports electrolyte balance
Pineapple (<i>Ananas comosus</i>)	Contains bromelain; anti-inflammatory, enhances palatability and aroma

Table 1: Therapeutic Rationale of Juice Ingredients

Juice Blend Formulation

Fresh, ripe fruits were sourced from local markets in Nyeri County to reflect typical consumer access. Fruits were washed, peeled, and processed under hygienic conditions. Three juice blends were prepared by varying ingredient proportions.

Blend Code	Pawpaw (%)	Coconut Water (%)	Pineapple (%)
Blend A	50	30	20
Blend B	40	40	20
Blend C	30	30	40

Table 2: Juice Blend Formulations

Sensory Evaluation

Thirty trained panelists from the Department of Food Science and Nutrition at Karatina University participated in the sensory evaluation. Panelists were trained on the use of a 9-point hedonic scale and standard sensory descriptors. Samples were coded and presented in randomized order to minimize bias.

Statistical Analysis

Data were analyzed using analysis of variance (ANOVA) to determine significant differences among blends at $p < 0.05$. Sensory scores were expressed as mean \pm standard deviation, and post-hoc tests were applied where appropriate.

Results

Three therapeutic juice blends were successfully formulated and evaluated for sensory acceptability. Blend A (50:30:20) recorded the highest scores across most sensory attributes, including taste (8.2), aroma (8.0), texture (8.5), appearance (8.3), and overall acceptability (8.3). Blend B (40:40:20) demonstrated moderate acceptability, while Blend C (30:30:40) recorded the lowest scores, particularly for taste and texture.

ANOVA revealed significant differences ($p < 0.05$) among blends for taste and overall acceptability, indicating that ingredient proportions directly influenced sensory outcomes. No significant differences were observed for appearance, suggesting consistent visual appeal across all formulations.

Blend Ratio (P:C:Pn)	Taste	Aroma	Texture	Appearance	Overall Acceptability
50:30:20 (Blend A)	8.2	8.0	8.5	8.3	8.3
40:40:20 (Blend B)	7.5	7.8	8.0	7.9	7.9
30:30:40 (Blend C)	6.8	7.0	7.2	7.1	7.0

Table 3: Mean Sensory Scores of Juice Blends

Acceptability								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	5	8.260	.1817	.0812	8.034	8.486	8.0	8.5

2	5	7.820	.1924	.0860	7.581	8.059	7.5	8.0
3	5	7.020	.1483	.0663	6.836	7.204	6.8	7.2
Total	15	7.700	.5555	.1434	7.392	8.008	6.8	8.5

Table 4: Descriptives

Acceptability					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.952	2	1.976	64.435	.000
Within Groups	.368	12	.031		
Total	4.320	14			

Table 5: ANOVA

Acceptability LSD						
(I) Blend	(J) Blend	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	.4400*	.1108	.002	.199	.681
	3	1.2400*	.1108	.000	.999	1.481
2	1	-.4400*	.1108	.002	-.681	-.199
	3	.8000*	.1108	.000	.559	1.041
3	1	-1.2400*	.1108	.000	-1.481	-.999
	2	-.8000*	.1108	.000	-1.041	-.559

*. The mean difference is significant at the 0.05 level.

Table 6: Multiple Comparisons

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	3.844	1	3.844	104.983	.000a
Residual	.476	13	.037		
Total	4.320	14			

a. Predictors: (Constant), Blend
b. Dependent Variable: Acceptability

Table 7: ANOVAb

Model		Unstandardized Coefficients		Standardize d Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta						Tolerance	VIF
1	(Constant)	8.940	.131		68.392	.000					
	Blend	-.620	.061	-.943	10.246	.000	-.943	-.943	-.943	1.000	1.000

a. Dependent Variable: Acceptability

Table 8: Coefficientsa

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.943a	.890	.881	.1914	1.750

a. Predictors: (Constant), Blend

b. Dependent Variable: Acceptability

Table 9: Model Summaryb

Discussion

The findings demonstrate that sensory acceptability is strongly influenced by fruit proportion, a trend consistent with previous functional beverage studies [12,13]. Coconut water played a critical role in moderating acidity and enhancing smoothness-attributes essential for individuals with gastric sensitivity. Its low acidity and electrolyte composition support gastric comfort and hydration, contributing to higher acceptability scores [14].

Pawpaw significantly contributed to viscosity, sweetness, and digestive support through papain, which aids protein digestion and reduces gastric workload [15]. Its soft texture aligns with traditional Kenyan dietary practices favoring easily digestible foods for gastrointestinal discomfort [16]. Pineapple enhanced aroma and flavor complexity but required careful moderation due to its acidity. Excessive inclusion reduced acceptability, supporting evidence that high-acid fruit formulations may exacerbate gastric irritation [17].

From a public health perspective, the use of locally available fruits supports affordability, sustainability, and alignment with Kenya Vision 2030 goals on nutrition and agricultural value addition [18,19]. Overall, the study underscores the importance of balancing sensory quality, cultural relevance, and therapeutic potential in developing dietary adjuncts for peptic ulcer management.

Recommendations

The formulation of therapeutic juice blends using pawpaw, coconut water, and pineapple in varying proportions has led to the recommendation of a 50:30:20 ratio, which shows promise for dietary management of peptic ulcers. In evaluating sensory characteristics such as taste, aroma, color, texture, and overall acceptability, fresh preparation and minimal processing are encouraged to preserve enzymatic activity and maintain the natural qualities that enhance consumer preference. To assess the suitability of these blends as culturally acceptable dietary adjuncts in Kenya, nutrition education programs should be implemented to promote the evidence-based use of functional foods, ensuring that communities understand both the health and cultural relevance of such intervention's bromelain and pineapple properties [20-22]. Finally, while sensory acceptability provides an important foundation, further clinical trials are necessary to establish therapeutic efficacy and validate the role of these juice blends in peptic ulcer management beyond their immediate sensory appeal.

Limitations and Future Research

This study focused on sensory evaluation and did not assess clinical outcomes. Future research should include gastric tolerance studies, biochemical analysis, and controlled clinical trials involving ulcer patients.

Conclusion

Therapeutic juice blends formulated from pawpaw, coconut water, and pineapple demonstrated high sensory acceptability, particularly the 50:30:20 formulation. The study highlights the potential of culturally relevant, locally sourced functional beverages as complementary dietary strategies for peptic ulcer management in Kenya.

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