QUALITY ASSESSMENT AND CONSUMERS' ACCEPTABILITY OF BUNS PRODUCED FROM WHEAT-TIGER NUT COMPOSITE FLOUR

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ABSTRACT

This study evaluated the quality and consumer acceptability of buns made from wheat-tiger nut composite flours based on proximate, mineral composition and sensory characteristics. The proximate composition results show significant differences, $p<0.05$, within samples for moisture, protein, fat, ash, fiber, and carbohydrate contents. Sample A (control sample -100 wheat flour) has the highest protein (9.06%) and carbohydrate content (58.73%), while Sample B (90% wheat flour; 10% tiger nut flour) contains the highest fat content (24.67%). Concerning the physical characteristics or volume, specific volume, density, and yield show marked variation in samples. Sample D (70% wheat flour; 30% tiger nut flour) had the highest volume (53.1 cm^3) and density (0.71g/cm^3). Mineral contents ranged from calcium, phosphorus, and iron. Sample C (80% wheat; 20% tiger nut flour) showed the highest in all three minerals, calcium (201.01mg/g), phosphorus (402.02mg/g) and iron (0.32 mg/g). Sensory attributes of the samples, such as taste, colour, aroma, appearance, and overall acceptability, were evaluated and found to be comparable to Sample A. The results indicate that wheat-tiger nut composite flour buns possess variable compositional characteristics, with Sample A being the most acceptable by the panelists. These findings suggest that incorporating tiger nut flour with wheat flour can significantly enhance the nutritional quality of baked goods without compromising consumer acceptance.

Keywords: Buns, Quality assessment, Consumer acceptability, Wheat-tiger nut flour, Sensory characteristics

INTRODUCTION

Buns are popular baked snacks widely consumed for their taste, convenience, and affordability (Wang, 2022). Traditionally, buns are made from wheat flour, which is high in gluten and provides the necessary structure for baked goods (Bascuas et al., 2021). However, there has been a rising interest in incorporating alternative flour to enhance the nutritional profile of snacks, especially among health-conscious consumers (Dereje et al., 2020). One such flour is tiger nut flour, derived from *Cyperus esculentus*, known for its high fiber, healthy fat, and prebiotic content (Yu *et al*., 2022).

The growing demand for nutritious and convenient food products has led to an increased interest in functional snacks that provide health benefits beyond basic nutrition (Vignesh *et al*., 2024). Producing buns from wheat-tiger nut composite flour can offer a nutritious alternative with enhanced dietary fiber content, catering to health-conscious consumers and those with gluten intolerance (Kwaghsende et al., 2019). Recent studies have focused on composite flour blends, combining wheat flour with other nutrient- dense flours to improve the overall nutritional value of snacks like buns while maintaining their sensory appeal (Ho, 2018). Composite flours have been shown to offer benefits such as enhanced protein content, improved dietary fiber intake, and reduced glycemic index (Olagunju, Abimbola & Oluwatobi, 2021). Tiger nut flour, in particular, is gluten-free and offers potential health benefits, including improved digestion and cardiovascular health due to its rich content of dietary fiber and unsaturated fats (Bamigbola, Ojo & Adetunji, 2020). Understanding the optimal wheat- tiger nut blend that ensures high-quality buns, while meeting consumer preferences, is crucial for developing a product that can compete with conventional snacks in the market. Therefore, this study aims to evaluate the quality characteristics and consumer acceptability of buns produced from wheat-tiger nut composite flour, providing insight into its potential as a healthier snack alternative.

MATERIALS AND METHODS

1. Sources of materials

Wheat flour was purchased from Shoprite supermarket, Ibadan. Tiger nuts and other ingredients were purchased from a local market in Ogbomoso, Oyo State, Nigeria. The equipment used was obtained from the Owodunni Food Processing Laboratory, Ladoke Akintola University of Technology, Ogbomoso. The chemicals used were of analytical grade.

2. Production process of buns

Wheat-tigernut flour (Figure 1), nutmeg, and baking powder were poured into a clean bowl and mixed very well. After this, an egg was mixed with the dry ingredients evenly. Butter and evaporated milk were also added and mixed thoroughly. Water was also added and stirred to make a dough. The dough was moulded into small circular portions and fried in deep hot vegetable oil until it turned golden brown, removed from the hot vegetable oil and allowed to cool at room temperature before being packaged into a high-density ziplock bag for storage until the buns were analysed. This process was repeated for all other formulated flour samples (Abiodun *et al*., 2017). The wheat-tiger nuts composite flour was formulated in the following ratios: 100, 90:10, 80:20, 70:30 and 60:40, respectively.

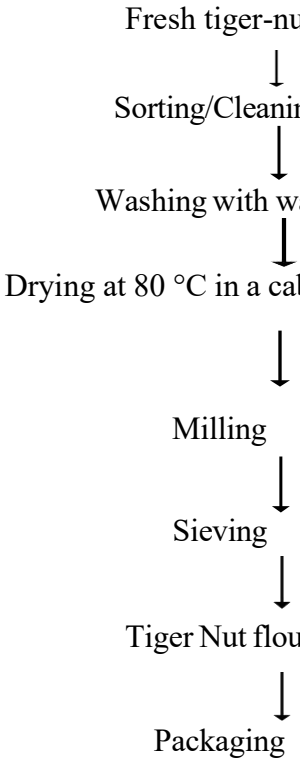

Figure 2.1 Flow chart for the production of tiger nut flour

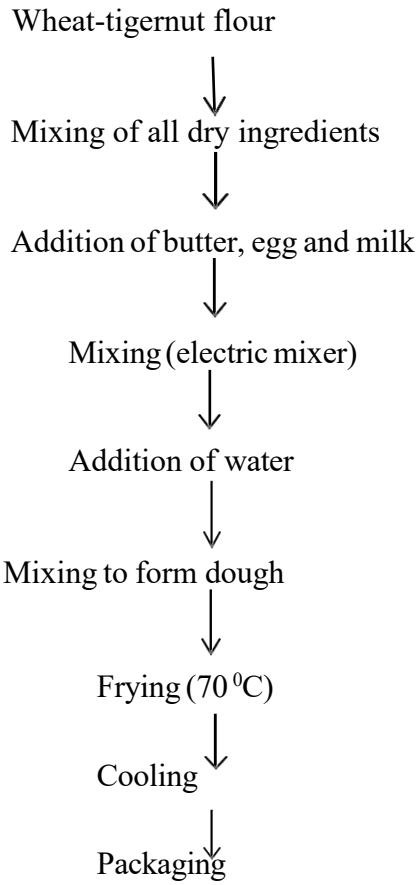

Figure 2.2: Flow chart for the production of buns

3. Chemical properties of the tiger-nut flour

The bun samples were analysed according to the method described by AOAC (2010) for moisture, ash, crude fibre, protein and crude fat contents, while carbohydrate content was determined by difference. Some selected minerals (calcium, phosphorus and iron) were determined using the procedures of AOAC (2010).

4. Sensory Evaluation Analysis

The sensory evaluation of the samples was carried out by fifty untrained sensory panellists comprising both staff and undergraduate students of the Department of Food Science, Ladoke Akintola University of Technology, Ogbomoso, Nigeria. The attributes assessed were colour, taste, aroma, and overall acceptability using the 9-point hedonic scale with 1= dislike extremely and 9 = like extremely.

5. Statistical analysis

All data obtained were subjected to Analysis of Variance (ANOVA) using SPSS version 21. The means were separated by Duncan's multiple ranges at a 5% level of probability.

RESULTS AND DISCUSSIONS

1. Proximate composition of Buns samples

The nutritional content (moisture, protein, fat, ash, fiber, and carbohydrate) of the different proportions of wheat-tiger nut flour buns is presented table 1. The control sample, which consisted of 100% wheat flour, contained a lower percentage of moisture content; this therefore might indicate the potential to have a longer shelf life than the other samples (Ojewumi, Omoba & Awolu, 2022). On the contrary, with the higher moisture level, the 40% tiger nut can potentially spoil more often than any of the other samples (Yusif et al., 2024). With the increasing addition of tiger nut flour, there was a decrease in protein content because tiger nut contains low protein level (Aremu et al., 2015). However, the dietary fiber increased with the addition of tiger nut, the high tiger nut fiber content in the buns samples may support good digestion, although excessive consumption of fiber can cause discomfort (reference). Fat content, which usually contributes to flavor and texture, was found highest in the sample containing 10% (sample B) tiger nut, probably because tiger nut contains higher oil content (Zhang & Sun, 2023). Ash content was found higher in buns with more tiger nuts; hence, essential minerals were increased but possibly risky for overload (Banach et al., 2020). Carbohydrate content decreases with the addition of tiger nut flour, the low carbohydrate content food might help control blood sugar levels (Gambo & Da'u, 2014).

Table I: **Proximate Composition of** Buns Samples

Samples	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Fibre (%)	CHO (%)
A	18.97±0.76^{a}	9.06±0.04^{e}	11.87±0.83^{b}	0.57±0.12^{a}	0.81±0.00^{a}	58.73±1.30^{c}
B	19.20±0.20^{a}	7.36±0.04^{b}	24.67±1.01^{e}	1.43±0.12^{b}	0.65±0.00^{b}	46.69±0.96^{a}
C	25.13±0.23^{b}	8.49±0.04^{d}	16.10±0.95^{d}	0.50±0.00^{a}	0.76±0.00^{d}	49.02±1.14^{b}
D	30.13±0.91^{c}	6.22±0.04^{a}	5.57±0.25^{a}	0.50±0.00^{a}	0.55±0.00^{a}	57.03±0.78^{c}
E	30.90±0.50^{c}	7.57±0.04^{c}	14.13±1.51^{c}	0.50±0.00^{a}	0.67±0.00^{c}	46.22±1.52^{a}

Values are mean ± Standard deviation of triplicate determinations. Mean values along the same column with different superscripts are significantly different ($p \leq 0.05$).

Sample A- Control Sample (100 wheat flour)
Sample B- 90% wheat flour and 10% tiger nut flour
Sample C- 80% wheat flour and 20% tiger nut flour
Sample D- 70% wheat flour and 30% tiger nut flour
Sample E- 60% wheat flour and 40% tiger nut flour

2. Mineral composition of Buns samples

The mineral composition was analyzed in buns made from the blends of wheat-tiger nut flours for calcium, phosphorus, and iron. In reality, the five samples varied with variable proportions of the buns samples reflected variance in the content of each selected mineral, while higher tiger nut flour proportions increased calcium, phosphorous, and iron content. The values of these minerals were highest in sample C, which was composed of 80% wheat and 20% tiger nut. Calcium is important for building bone (Reid & Bristow, 2019). Phosphorus is generally meant for energy uses within the human body, and iron is responsible for the transportation of oxygen (Savenko & Savenko, 2021). Sample A was the control, containing 100% wheat and thus having a lower mineral content, while tiger nut was seen to contribute to nutritional value. There were significant differences at $p<0.05$; thus, it established that tiger nut flour adds health-enhancing attributes to wheat-based buns.

Table 2: Mineral Composition of the Buns Sample

Samples	Calcium (mg/g)	Phosphorus (mg/g)	Iron (mg/g)
A	144.19±2.14^{b}	288.34±1.27^{b}	0.23±0.00^{b}
B	187.03±0.00^{d}	374.06±0.00^{d}	0.30±0.00^{d}
C	201.01±0.00^{e}	402.02±0.00^{e}	0.32±0.00^{e}
D	117.14±0.00^{a}	234.29±0.00^{a}	0.19±0.00^{a}
E	173.05±0.00^{c}	346.11±0.00^{c}	0.28±0.00^{c}

Mean in the same columns with different superscript were significantly different ($p<0.05$).

3. Sensory evaluation

The sensory analysis of buns produced from different blends of wheat and tiger nut flours indicated that the samples were rated significantly different in taste, colour, aroma, appearance and overall acceptability. The highest scores recorded for the control sample (100% wheat flour) suggest the preference of the panelists for traditional wheat-based buns. With 10% tiger nut inclusion, sample B shows a very slight reduction in sensory scores; hence, a small addition does not necessarily affect sensory acceptability. Taste, colour, and acceptability decrease with the higher percentage of tiger nut flour in samples C, D, and E, though within acceptable limits. This paper, therefore, shows that at a moment's interest, tigernut flour could be used in wheat buns, considering very minimal compromise on consumer acceptability; however, the substitution at higher levels, 20% and above, leads to sensory changes.

Table 3: Sensory Evaluation

Samples	Taste	Colour	Aroma	Appearance	Overall Acceptability
A	8.30 ± 0.66^{a}	8.15 ± 0.67^{a}	8.25 ± 0.64^{a}	8.20 ± 0.95^{a}	8.55 ± 0.69^{a}
B	7.60 ± 1.50^{ab}	7.50 ± 1.39^{ab}	7.75 ± 1.33^{ab}	7.70 ± 1.22^{ab}	7.80 ± 1.19^{ab}
C	7.15 ± 0.99^{b}	7.45 ± 1.05^{ab}	7.20 ± 0.95^{b}	7.55 ± 1.05^{ab}	7.65 ± 0.88^{b}
D	7.50 ± 0.89^{ab}	7.10 ± 1.12^{b}	7.45 ± 0.95^{ab}	7.35 ± 0.99^{ab}	7.70 ± 0.92^{ab}
E	7.40 ± 1.05^{ab}	7.05 ± 1.28^{b}	7.50 ± 1.36^{ab}	7.20 ± 1.11^{ab}	7.85 ± 1.13^{ab}

The mean in the same columns with different superscripts was significantly different ($p<0.05$).

CONCLUSION

Wheat-tiger nut composite flour represents a good alternative ingredient in the production of snacks, especially in nutritional fortification. Buns produced with different levels of substitution of wheat by tiger nut flours presented good overall sensory and physical characteristics; even at higher levels of tiger nut, consumer acceptance was acceptable. Specifically, buns with up to 20% tiger nut flour (sample C) substitution were acceptable, indicating that the wheat-tiger nut composite flour could produce health-conscious quality snacks. The addition of tiger nut flour levels in future research can result in improved nutritional and sensory quality of snack products.

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