PROXIMATE, PHYSICAL AND SENSORY CHARACTERISTICS OF ENRICHED CAKE PRODUCED FROM WHEAT AND TIGER NUT FLOUR BLENDS

ABSTRACT

Consumers' attention is shifting towards dietary fiber as more information about its health benefits is unfolding. In Nigeria, owing to the high level of dietary fibre and other inherent nutrients of tigernut, it has been identified as one of the underutilized crops which could be incorporated into cake production. In this study, the effect of substituting tigernut flour for wheat flour on the proximate, physical and sensory properties of cake quality were evaluated. The proximate composition increased with increasing levels of tigernut flour. Crude fibre increased from 1.04 to 2.25%, ash from 2.03 to 3.22, crude fat from 4.17 to 7.21 and protein from 10.02-14.53% resulting in a nutritious cake. The physical properties of the cake from the composite flour blends were affected significantly ($P \leq 0.05$) by tigernut substitution. The hardness, cohesiveness, springiness, weight and volume of cakes decreased with increasing tigernut level substitution. Suitable composite cakes which could reduce the incidence of protein-energy malnutrition can be made with up to 20% tigernut flour substitution.

Keywords: Cake, wheat, tiger nut, proximate composition.

1. INTRODUCTION

The most commonly used flour in cake production is wheat flour (*Triticum aestivum*) due to its unique baking properties [1]. However, high gluten content which often causes allergic reaction particularly in gluten intolerant people is a drawback in the use of wheat flour in cake production [2]. In addition, cake is a baked dessert on special occasions such as birthdays, weddings, or anniversaries in Nigeria. However, for climatic reasons, the price is relatively on the high side, being made from wheat which is not grown in the tropics ([2]; [3]). The use of composite flour promises delivery of a nutrient-dense food to a large segment of people at cheaper cost utilizing indigenous crops such as tigernut.

"Tigernut (*Cyperus esculentus*) is a cosmopolitan perennial crop found all over the world. It's commonly known as *Aya*, yellow nut sedge and earth almond. Tiger nut has been recognized for its health benefits as they are high in fibre, protein, and natural sugars. They have a high content of soluble glucose and oleic acid, along with high energy content (starch, fats, sugars and proteins), they are in rich minerals such as phosphorous and potassium and in vitamins E and C. Tiger nuts are believed to help prevent heart attacks, thrombosis and cancer especially of the colon" [4]. "The very high fibre content combined with its delicious taste makes tigernut ideal for healthy eating. Furthermore, tiger nut has been reported to be toxicologically safe for human consumption, and bakery products such bread, tidbits, gluten-free cookies have been prepared using tigernut seed and its by products" [5]; [6]; [7]).

Enrichment of cereal-based products like cake with plant proteins is gradually gaining acceptance as food ingredients. These are often used to enhance value of foods formulated from carbohydrate-based ingredients such as wheat. The progressive increase in the consumption of cake and other baked products in many countries the potential to conserve foreign exchange, provide nutritious food to more people at affordable and widen the utilization of indigenous crops in food formulation. Therefore, the purpose of this work is to prepare cakes from wheat and tiger nut composite flour blends and to analyze thequality characteristics of the produced cakes which included the proximate, physical and sensory properties of the product.

2. MATERIALS AND METHOD

Wheat flour (Golden penny) and dried tiger nut (brown variety) and other major ingredients were purchased from *Waso* local market in Ogbomoso, Oyo State, Nigeria. All other equipment to be used for analysis and production obtained from the Food Processing Laboratory, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Oyo state.

2.1 Sample Preparation

The method of Adeyemi [8] was used in the preparation of tiger nut flour. Dry tiger nuts was sorted to remove unwanted materials like stones, pebbles and other foreign seeds, before washing with tap water. The cleaned tigernuts were dried in a cabinet dryer at 60^{o}c for 24 hours to a moisture content of about 13%. The dried tiger nuts was milled and sieved through 600 µm aperture size. Four proportions (100:0, 90:10, 85:15, 80:20) of Wheat flour and tiger nut flour were mixed respectively and 100% wheat flour as the control sample was used in the production of the cake sample.

2.1.1 Preparation of cake

The method of Akubor and Badifu [9] was adopted for the preparation of cake. "The margarine and sugar were creamed manually for 2 min in a bowl until soft and fluffy. The egg was beaten for 3 min, added to the mixture and mixed manually for 3 min. Flour samples from various composite blends were separately sieved, and baking powder was then added and mixed lightly by hand until soft dough was formed. The dough was transferred to a greased baking pan and baked in a preheated oven at 200^{0}C for 30 min". [9]

2.2 Proximate Analysis

The proximate analysis of the cakes was carried out to determine the following: moisture content, ash content, crude fiber, crude protein, crude fat and carbohydrate [10].

2.3 Physical Test on Cake

The method of De la Hera *et al* [11] was employed to measure various textural properties of the cake, including hardness, springiness, and cohesiveness was carried out. The weight and volume were determined using the method described by Nwosu et al [12].

2.4 Sensory Evaluation

Sensory evaluation of cake samples from wheat-tiger nut composite flour was conducted using a trained 25 member panel cross-section of adult population (students and staff) of Ladoke Akintola

University of Technology, Ogbomoso, with panelists spread across a wide range of ages, education and income groups. The cake was prepared a day ahead of sensory evaluation and stored at room temperature. Samples were served in a randomized order on a tray, with portable water for rinsing the mouth in between tasting of samples to minimize rating errors, due to carry over of perceived attributes of the previous sample. One piece of each cake sample, randomly codified using three digits was presented to each panelists and were asked to evaluate each sample based onthe following parameters of appearance, softness, aroma, taste and general acceptability using 9 point Hedonic scale as described by Onwuka [13].

2.5 Statistical Analysis

All treatments were replicated twice for reproducibility and analysis was done in duplicate. The statistical analysis of the data was done with a statistical package for Social Science (SPSS, version 20). Statistically significant differences ($p< 0.05$) in all data were determined by analysis of variance while the least significant difference was used to separate the means.

3.0 RESULT AND DISCUSSION

The proximate analysis of the cake produced from blends of wheat and tiger nut seeds making use of wheat as the control is shown in Table 1. The moisture content ranged from 16.27 to 20.47% with 80:20 wheat-tigernut flour cakes having the lowest value and 100% wheat flour cake having the highest value. “The moisture content of the samples decreased as the ratio of wheat flour decreases. The lower the moisture content, the higher the amount of dry solids which leads to longer storage time” [14]. “The lower moisture content of cakes prepared from composite blends than 100% wheat flour may be attributed to the high water-binding properties of tigernut flour than wheat flour. The crude fat, ash, crude fibre and protein content of the cake ranged from 16.45 to 18.30%; 2.03-3.21%; 1.04-2.25 and 10.02 to 14.53%, respectively. The increment observed in value may not be unconnected with the additional effect of tigernut flour.

Furthermore, the increased protein content of cake from composite flours could also be attributed to the added ingredients such as eggs during cake preparation" [15]. The high protein content in the samples is in accordance with a high level of protein (9.4%to 15.1%) in tiger nut [5]. Values obtained in this work was comparable to a report of other researchers; 14.00-14.40% (moisture); 3.70-5.50% (ash), for wheat-African bean cake [16] while Akubor and Badifu[9] reported 1.00–24.70% (protein) for wheat-cowpea cake.

Table 1: Proximate Composition of the Cake

Samples	Moisture (%)	Ash (%)	Crude Fiber (%)	Crude Protein (%)	Crude Fat (%)	CHO (%)
A	20.47±0.06^{a}	2.03±0.01^{d}	1.04±0.02^{d}	10.02±0.02^{c}	16.54±0.05^{c}	49.91±0.01^{a}
B	18.03±0.04^{b}	2.72±0.03^{c}	1.45±0.06^{c}	11.88±0.04^{b}	18.30±0.03^{a}	47.62±0.05^{b}
C	18.21±0.04^{b}	2.91±0.02^{b}	2.06±0.03^{b}	14.32±0.15^{a}	16.45±0.03^{d}	46.06±0.12^{c}
D	16.27±0.3^{c}	3.22±0.03^{a}	2.25±0.00^{a}	14.53±0.35^{a}	17.53±0.00^{b}	46.20±0.35^{c}

Means within the same column with different superscripts are significantly different ($p<0.05$)
Sample A= Cake made from 100% wheat flour
Sample B= Cake made from 90% wheat and 10% tiger nut flour
Sample C= Cake made from 85% wheat flour and 15% tiger nut flour
Sample D= Cake made from 80% wheat flour and 20% tiger nut flour

3.1 Physical Properties of the cake

The results for the physical properties of the cake samples are presented in Table 2. Significant differences ($p<0.05$) existed amongst the cake samples. The Hardness, cohesiveness and springiness of the cake samples vary due to the addition of the four main ingredients (sugar, butter, margarine and eggs). Hardness, cohesiveness and springiness of cakes were significantly depended on the ratio of ingredient combination. The variation in texture parameters could be due to the inclusion of ingredients combination and their techno-functionality. The weightof the cake samples ranged from 87.00 to 161.00 g. Cakes produced from all the flour blends had lower weights than the control (161.00g). The decrease in weight and volume of cakes with decreasing levels of

wheat flour may be attributed to the low moisture content of flour blends because as the wheat flour decreases, moisture content decreases. "However, the weights the cakes were higher than the values (25.73-26.59 g) obtained from previous researchers for cakes produced from wheat and bambara groundnut flours" [17]. The cake volume increased from 152.50 cm^3 to 198.90 cm^3 as the rate of substitution of wheat withtiger nut in the samples increased. This is because wheat flour has high gluten content, and tends to rise better than tiger nut flour. A Similar trend was observed by Emmanuel- Ikpeme *et al*., [18] for cake made from composite flour of wheat and beniseed.

Table 2: Physical properties of the cake

Samples	Hardness (g)	Springiness	Cohesiveness	Weight (g)	Volume (cm^3)
A	206.67±1.53^b	2.10±0.00^a	5.00±0.00^a	161.00±0.00^a	212.16±0.00^a
B	209.33±1.53^a	2.20±0.10^a	4.00±0.00^b	101.00±0.00^c	152.50±0.01^c
C	204.67±0.58^b	2.10±0.10^a	4.00±0.00^b	87.00±0.00^d	117.00±0.01^d
D	194.33±0.58^c	1.93±0.06^b	4.00±0.00^b	142.00±0.00^b	198.90±0.00^b

Values are of triplicates ± standard deviation. Value within the columns with different superscript are significantly (P<0.05) different.
A, B, C and D are as defined in Table 1

3.2 Sensory evaluation

Sensory evaluation of cake is shown in Table 3. There were no significant (P<0.05) differences in overall acceptability among samples. This is an indication that all cake samples well accepted by the panelist. However, sensory evaluation done by the panelist showed 90:10 (wheat: tigernut) cake had high sensory score and compared favourably with 100% wheat cake in terms of appearance, aroma, taste, softness and general acceptability.

Table 3: Sensory Evaluation of Cake

Samples	Appearance	Aroma	Taste	Softness	General Acceptability
A	7.40±1.23[a]	7.32±1.07[a]	7.76±1.23[a]	7.24±1.85[a]	7.96±1.21[a]
B	7.60±1.15[a]	7.44±1.26[a]	7.52±1.19[a]	7.28±1.74[a]	7.96±1.24[a]
C	7.56±1.56[a]	7.32±1.63[a]	7.48±1.69[a]	7.60±1.71[a]	7.64±1.68[a]
D	7.36±1.29[a]	7.24±1.23[a]	7.16±1.34[a]	7.00±1.85[a]	7.64±1.25[a]

Mean value ± standard deviation with different letters in each column are significantly ($P<0.05$) different from one another.
A, B, C and D are as defined in Table 1

4.0 CONCLUSION

It could be concluded from this research that production of nutritious and acceptable cake from wheat - tiger nut substitution is possible. Based on nutritional composition, 80:20 (wheat - tiger nut flour blends) is recommended as optimum formulation. The proximate, physical and sensory properties of the cake were enhanced as a result of tiger nut flour substitution. Cakes prepared from these kind composite flours could be a sustainable means of ameliorating the incidence of protein energy malnutrition and increasing the utilization of tiger nut in developing countries including Nigeria.

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