MINERAL AND FUNCTIONAL PROERTIES OF LOCAL SNACKS (ALKAKI) PRODUCED FROM WHEAT, RICE AND BENINSEED FLOUR BLENDS

NDALIMAN M.B[1]; & **BELLO H.K**

[1]Department of Nutrition Dietetics, the Federal Polytechnic, Bida [2]Department of Hospitality and Management, the Federal Polytechnic Bida

Introduction

Food minerals are solid, crystalline chemical elements that cannot be decomposed or synthesized by ordinary chemical reactions. They are classified as macro-and micro minerals. The macro minerals include calcium, phosphorus, sodium, potassium and chloride, and of these, calcium and phosphorus are needed in large quantity. The micro minerals include magnesium, manganese, zinc, iron, copper, molybdenum, selenium, iodine, cobalt and chromium which are required by the body in minute quantity for normal metabolic activities. Although minerals represent a small portion of food com they play major roles in food chemistry and nutrition (Kadan et al., 2003). Minerals such as iron and calcium are added to foods for improvement of its nutritional value (Camire, 1993). Elements such as iron (Fe), copper (Cu), magnesium (Mg) and calcium (Ca) act as catalyst for enzymes during normal metabolic processes, while Fe is essential for the prevention of anaemia, Ca is required for bone health (Camire, 1993). But despite the huge importance of minerals in human health, and wide application in food processing, relatively few studies has examine mineral stability during cooking, probably because they are stable in other food processing techniques (Camire, 1993). Minerals are heat stable and are unlikely to become lost during processing (Kadan et al., 2003). But Alonso et al., 2000 reported that iron content of flour increased after processing, while Singh et al., Kadan et al., 2003 reported that when wheat bran is incorporated into a broken rice flour. There was increase in the calcium, phosphorus, iron and copper contents, which they attributed to cooking during processing exercise. They recommend further research in this area, particularly if the local snacks foods are produced as vehicle for mineral fortification (Kadan et al., 2003).

Materials and Methods

Preparation of samples

Rice flour was prepared according to the method adopted by Nwosu et al., 2011. The Rice grain (3 kg) was cleaned, sorted and washed. Clean rice sample was soaked in water for 4 hours, drain and sun dried. The dry rice was milled using attrition milled.

Thereafter it was then sieve using 300µm mesh to obtain the flour. Benniseed was cleaned to remove dirt and other foreign particles and soaking was carried out for 1hours after that the water was drained out then Benniseed was spread on mat, allow to germinate for 72hours and sun-dried. The dried sesame was dulled then milled to obtain fine flour. Two kilogrammes (2kg) of wheat was clean, sort and washed then drained and dried in a hot air oven at 60^0 c for 2 hours. The wheat was grind into a fine powder. Thereafter, it was blended together and packaged until required for use.

Table 1: Formulation of Blends for the Production of Local snacks (Alkaki) using wheat, Rice and Benniseed

Sample	Wheat	Benniseed	Rice
A	100%	0%	0%
B	90%	10%	0%
C	80%	20%	0%
D	0%	0%	100%
E	5%	10%	85%

Keys
A= 100% Wheat Alkaki
B= 10% Benniseed and 90% wheat
C= 20% Benniseed and 80% wheat
D= 0% Benniseed and 100% Rice and 0% Wheat
E= 5%Wheat and 10%Beninseed and 85% Rice

Functional properties

The water absorption capacity, bulk density, swelling index, oil absorption was determined by the method described (by Obaroakpo et al., (2010).

Mineral Analysis

Zinc (Zn), Iron (Fe), Calcium (Ca), Sodium (Na), Potassium (K) and Magnesium (Mg) were determined by Atomic Absorption Spectrophotometers (AAS); according to the method of AOAC (2003).

Statistical Analysis

Data was analyzed using analysis of variance ANOVA and Duncan multiple range test to test significant differences between means $p>0.05$. Data analysis was done using statistical package for social sciences SPSS version 20.0.

Results and Discussion

The result of mineral composition of the samples showed that there were significant differences ($p \leq 0.05$) in all the parameters except phosphorus content. But unlike sample D had the highest sodium content (5.45±0.19) and sample C had the calcium content (8.40±0.07) while sample E had the highest magnesium (2.75±0.07 mg/100g) content, but when compared with Chima *et al.* 2012, the result showed that the mineral composition of the samples increased above the values of the control with increase in the addition of legumes. Thus, the addition of Benniseed improved the content of both the major and trace mineral ions. This observation may be as a result of proportional increment in the content of the minerals possibly as a result of enzyme solubilization and leaching of the anti-nutritional factors binding them through leaching. Minerals like iron, calcium and zinc are often added to food for the improvement of nutritional composition (Camire *et al.,* 1990). In this study, the result of both iron and zinc contents were observed to be statistically higher in all the samples. This increase could be attributed to destruction of antinutrients (phytic acid) during cooking. Similarly, iron and zinc act as cofactors for enzymes during normal metabolic processes (Agunbiadeand Ojezele, 2010). In addition, iron is needed for the prevention of anaemia; while zinc is a component of living cells and essential for assisting enzyme reaction and wound healing (Agunbiade and Ojezele, 2010).

Table 2: Mineral composition of Local Snacks (Alkaki) produced from wheat/rice and Benniseed flour blend

Parameters	Sample A	Sample B	Sample C	Sample D	Sample E
Sodium	5.31±0.75	4.26±0.19	4.24±0.02	5.45±0.19	3.12±0.19
Magnesium	3.80±0.12	1.48±0.17	5.68±0.04	2.40±0.07	1.2±0.04
Calcium	4.90±0.08	4.90±1.47	8.40±0.07	7.53±0.07	5.36±0.09
Phosphorus	2.12±0.03	2.81±0.18	3.54±0.03	3.74±0.19	3.00±0.10
Potassium	6.46±0.14	8.60±0.07	9.90±0.21	8.30±0.07	6.61±0.08
Iron	6.23±0.07	6.56±0.21	6.81±0.04	6.71±0.15	5.02±0.13
Zinc	4.04±0.96	5.17±0.35	5.66±0.49	3.05±0.07	3.33±0.03

Values are mean± SD. Values with different superscripts on the same row are significantly different at $p<0.05$.

Key: Sample A (100:0), Sample B (90:10), Sample C (80:20:0), Sample D (0:0:100), Sample D (5:10:85)

Bulk density serves as an important functional property which aids in assessing the bulk density of the products. (Filli *et al*., 2013). The processing methods strongly influenced the bulk density values as observed in this study, suggesting an optimum relationship since the lowest value of bulk density was observed. Similarly, high temperature have been linked to low bulk density which could be due to starch gelatinization under such conditions (Hagenimana *et al.,* 2006). Also, Ding *et al.* (2006) reported decrease the bulk density. The high dependence of bulk density and Swelling capacity would reflect its influence on elasticity characteristics of the starch-based material.

Water absorption index is a measure of starch digestibility and is dependent on the degree of gelatinization and dextrinization (Pardhi *et al.,* 2017). Thus, presence of polar head groups in the developed blend determines its interaction with water molecules. Cooking reduced the degradation of granules and increasing the water absorption index (Hagenimana *et al.,* 2006). Similarly, High temperature was reported to support low water absorption during cooking of starch based binders (Pan *et al.,* 1998). The amount of water associated to proteins is closely related with its amino acids and increases with the number of charged residues, conformation, hydrophobicity, pH, temperature, ionic strength and protein concentration (Suresh*et al.,* 2013).

Table 3: Functional Properties of Local Snacks (Alkaki) produced from wheat/rice and Benniseed flour blend

Parameters	Sample A	Sample B	Sample C	Sample D	Sample E
Bulk Density	2.57±0.05	2.69±0.07	2.71±0.02	2.78±0.07	3.00±0.07
Water Absorption	3.84±0.05	3.86±0.06	3.80±0.07	3.77±0.04	3.92±0.14
Oil Absorption	4.84±0.221	5.49±0.05	6.74±0.35	7.03±0.01	7.03±0.04
Swelling Capacity	19.40.±0.64	18.02.±0.67	16.92±0.11	15.39±0.71	15.09±0.27

Values are mean± SD. Values with different superscripts on the same row are significantly different at $p<0.05$.

Key: Sample A (100:0), Sample B (90:10), Sample C (80:20:0), Sample D (0:0:100), Sample D (5:10:85)

Conclusion

In this work, different samples Wheat/rice and Benniseed flour blends were produced. Out of the five samples prepared, sample C was enhanced in terms of functional and mineral properties value. In conclusion therefore, Local snacks can be produced from Wheat/rice and Benniseed blend using cooking method.

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