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Effect of Sprouting Periods on the Proximate Composition, Functional Properties and Mineral Content of Malted Sorghum Flour

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Abstract:
Effect of sprouting period on proximate, functional and mineral properties of malted sorghum flour was evaluated. The study was carried out to determine the proximate, functional and mineral properties of sprouting period on malted sorghum flour produced. The malted sorghum flour was obtained by sorting, weighing, washing, steeping, draining, germination, drying, dry milling, sieving. Malted sorghum flour was evaluated for proximate composition, functional properties and mineral contents. Moisture, protein, fat content, crude fiber, ash contents and carbohydrate of 24 and 48 hours, were in the range of 10.50-11.0%, 11.17-11.17%, 1.50-4.00%, 2.50-1.50%, 1.50-1.54% and 73.15-70.79% respectively. Bulk density ranged between 0.64 and 0.59g/ml, water and oil absorption capacities ranged between 139.3 and 150.0 and 217. and 222.7mg/100g respectively. Calcium, Magnesium, Zinc, Iron and Manganese were also in the range of 12.5-12.5mg/100g, 59.3-60.0mg/100g, 3.22-3.25mg/100g, 3.80-3.90mg/100g and 3.22-3.25 mg/100g respectively. The results indicate that the germination of red sorghum resulted in the enhancement of the nutritional quality and its functional properties.

Keywords: *Sprouting, sorghum, malted sorghum flour, cabinet dryer*

1. Introduction

Cereals are the cheapest of food and majorly consumed by human beings. They contain high percentage of calories and protein. Cereals such as wheat, rice corn, sorghum are commonly cultivated. Sorghum is a cereals crop and it is a genus of flowing plants in the grass family Poaceae and is a major food crop that is used for food. The yield and quality of sorghum produced is affected by biotic and abiotic constraints [viii, xv]. Sorghum is used primarily as poultry food and secondary as cattle food. In brewing applications sorghum is used in the same way as barley to produce "malt" that can form the basis of the mash [xv].

Malting is a processing in which cereals grains undergo a controlled germination and drying processing, the primary objective being to promote the development of hydrolytic enzyme which are not present in the ungerminated grain. Malting induces important beneficial biochemical change in grains. Malting yield higher proportions of hydrolytic enzymes such as α and β amylases which may be wither completely soluble or largely insoluble depending on the variety [xiv]

Processing techniques such as germination and fermentation have beenformed to improve the quality of cereals due to chemical change that enhance organoleptic response [ix] contains of free sugars protein and vitamins as well as bioavailability of minerals [x] and results in the shakedown of some of the anti-nutrient endogenous compounds Germination is a natural biological process of plants which the seeds come out of latency stage. Germinated seeds are good sources of minerals and vitamins. However, the present work aims at determine the effect of sprouting minerals content on malted sorghum flour.

2. Materials and Methods

Diseased free sorghum grains of the red variety (Sorghum bicoder) were purchased from a local market in Ilaro, Yewa south local Government area of Ogun state, Nigeria and transported to the laboratory of Food Technology, Federal Polytechnic, Ilaro for analyses.

Germination of sorghum: Sorghum grains (2kg) were cleaned, sorted for foreign matters and were steeped in tap water for 24hours as ambient temperature. The steeped water was changed every 6 hours to avoid fermentation as well as removing dirts and husk. The grains were drained and spread out thinly on juke bag saturated with water, covered with another jute bag. A portion of the germinating grain was allowed to sprout for 24hours while the other portion sprouted for 48hours. Each sprouted grainwas dried in the cabinet dryer at 100^0C for 4 hours allowed to cool milled using milling machine,

sieved through 600μm aperture and then packaged separately, then stored in a cool dry place for subsequent analyses. The reagents used were analytical grade. A control was also set (Sprouted sorghum flour).

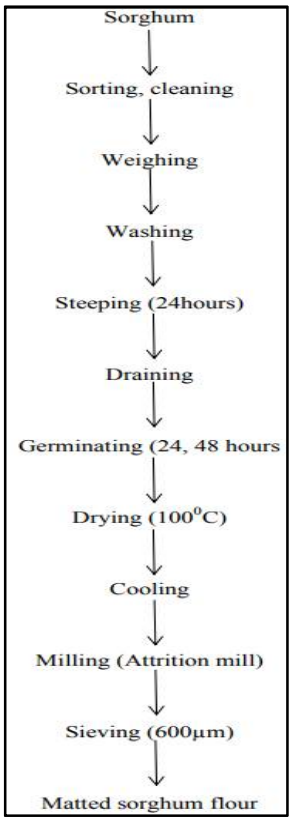

Figure 1: Flow chart for the production of matted sorghum flour

3. Analytical Procedure

Proximate analysis of the sample was determined using procedure described by [i] far moisture content, ash and protein. A Nitrogen to protein inversion faster of 6.25 was used. The standard methods described by [iii] were also used to determined fat and fibre contents. Total carbohydrate was calculated by the difference method. All determination was performed in triplicates.

Potassium and sodium content of samples were determined using jenway digital flame photometer (PFP7) model while the level of calcium and iron in the samples were determined by atomic absorption specrophotmetric (Perkin-Elma model 403, Norwalk, C.T, USA) after digestion with concentrated nitric acid [i]. Potassium was determined calorimetrically using spectronic 20 (Gallenkap, U.K) with KH_2PO_4 as standard.Water absorption capacity and oil absorption capacity were determined as cited by [xiii]. The method by [vi] and [iv] were used to determine the bulk density and swelling capacity respectively

Statically Analysis, Data generated were generate were subjected to analysis of variance (ANOVA) and Duncan Multiple Range Test was used to separate means.

4. Results and Discussion

PARAMETERS	SAMPLES (%)		
	Sorghum Flour	Malted Sorghum flour 24hr	Malted sorghum flour 48h
MOISTURE	10.00±0.02	10.50±0.05	11.00±0.12
PROTEIN	10.20±2.40	10.85±0.02	11.17±0.02
FAT	3.30±0.02	1.50±0.03	4.00±0.02
FIBER	2.00±0.01	2.50±0.04	1.50±0.02
ASH	1.34±0.02	1.50±0.02	1.54±0.03
CARBOHYDRATE	73.16±3.50	73.15±0.03	70.79±0.03

Table 1: Proximate composition of both control and malted sorghum flour
Values are means of triplicate± SD for Proximate composition

PARAMETERS	SAMPLES	
	Malted Sorghum flour 24hr	Malted sorghum flour 48h
Bulk Density(g/ml)	0.64±0.01	0.59±0.01
Water Absorption Capacity (g/100g)	139.3±1.89	150.0±1.63
Oil Absorption Capacity (g/100g)	217.3±6.55	22.7±3.09
Swelling Capacity (%)	2.66±0.10	2.10±0.01
Water Binding(g)	124.3±2.36	115.3±2.34

Table 2: Functional Properties of Malted Sorghum Flour
Values are means of triplicate determination of ±SD for functional properties.

PARAMETERS	SAMPLES	
	Malted Sorghum flour 24hr	Malted sorghum flour 48h
Calcium (mg/100g)	12.5±0.15	12.5±0.00
Magnesium (mg/100g)	59.3±0.93	60.0±2.00
Zinc (mg/100g)	3.22±6.55	3.25±0.03
Iron (mg/100g)	3.80±0.01	3.90±0.00
Manganese (mg/100g)	3.22±0.12	3.25±0.03

Table 3: Mineral Content of Malted Sorghum Flour
Values are means of triplicate determination of ±SD for mineral content

5.Discussion

The result of the effect of sprouting period on the proximate composition of malted sorghum flour are as shown in table 1. The moisture content ranged from 10.00%-11.00% for the sample. [v] had reported that moisture content range for 6.00%-10.00% for germinated and ungerminated sorghum flour. The disagreement in result in this present work might be attributed to difference in the sprouting days. There was a gradual increase in the protein content from 10.20% to 10.85% to 11.00% for the control, malted sorghum flour germinated for 24 hours and 48hours respectively. [vii] reported an increase in protein content of sprouted present in the kernel that facilitates the metabolism of nitrogenous compounds form carbohydrate reserves, thus increasing the crude protein levels. This result also agreed with [x] who reported an increase in the protein content of soymilk form spoiled soybean.

The fat contents were 3.30% - 1.50% and 4.00% for all the samples under consideration. [xiv] reported an increase in the fat content of sorghum flour after germinations. However, as reported in a previous work, the defense in the values in this study could be due to botanical properties. The fibre content of the malted sorghum flour decreased from 2.5% to 1.50% for sorghum sprouted for 24hours and 48hours. As reported in a previous work increase in the activity of β-glucanase enzyme can lead to reduction in the fibre contents of these sorghum. The ash content was found to increase as the sprouting days increased in contrast to a similar work reported by [v]. The carbohydrate content obtained were 73.16%, 73.16% and 70.79% for control, 24hours sprouted sorghum and 48hours sprouted sorghum flours respectively. Sprouting leads to increase in the soluble sugar (carbohydrate) levels of sorghum and these changes could be attributed to the activities levels of sorghum and these changes could be attributed to the activities of hydrolytic enzymes within the seed during sprouting.

The effect of sprouting period on the functional properties of malted sorghum flour are shown in table 2. Bulk density of 0.63mg/l and 0.5mg/l were obtained from malted sorghum flour sprouted for 24hours and 48hours respectively. This agreed with a previous work by [x] Water absorption capabilities revealed 139.3% and 150% for the two samples. It was observed that an increased occurred for sprouted malted sorghum flour after 48hours. According to [xi] water holding capacity depends on the water biding capacity and the increase may be due to increased levels of protein as well as quality of protein leading to absorption capacity and the increase may be due to increased levels of protein as well as quality of protein leasing to absorption capabilities and increased mecractin, the water [xiv]. After 24hours germination, the oil absorption capacity increase from 217.3g/100g to 222.7g/100g at 48hours. According to a previous work by [ii] germination induced increased oil absorption capacity may be due to solubilization and dissociation of proteins leading to exposure of no polar constituents from within the protein molecules. [viii] reported that the longer the germination the more oil can be tied so the oil absorption capacity in increased. At 24hours of germination, the swelling index was 2.66mg/g while at 48hours of germination it was 2.10mg/g. The decreased capability of flour swelling volume was due to the fact that during germination, starch hydrolysis becomes sampler compounds. Water binding capacities of 124.3mg/g and 115.3mg/g were obtained after 24hours and 48hours of germination respectively.

Table 3 showed that mineral composition of malted sorghum flour calcium contents at 24 and 48hours were both 12.5mg/100g. Magnesium varied from 59.3mg/100g to 60.0mg/100g. At the end of germination iron ranged from 3.80mg/100g to 3.90mg/100g. Also, magnesium ranged from 3.22mg/100g to 3.25mg/100g. It was generally observed that these are no significant difference in all the levels of mineral contents from each other after 48hours of germination.

6.Conclusion

Sprouting of malted sorghum flour has generally led to increase and enhancement of its nutritional quality as seen by the increase in quality of protein.

7.References

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