EFFECT OF DIFFERENT PROCESSING METHODS ON THE NUTRITIVE VALUES OF MALTED SORGHUM SPROUT (MSP)

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ABSTRACT

The study was designed to investigate the effect of different processing methods on the nutritive value of malted sorghum sprout (MSP). The MSP was divided into three parts: raw (RMSP), alkaline (wood ash) treated (AMSP) and fermented (FMSP). The proximate composition, fibre fraction and the mineral contents were determined and all data obtained were subjected to one way analysis of variance. Results revealed that the observed values were significantly (P<0.05) influenced by the processing methods. The highest dry matter (82.34%), ether extract (1.76%), ash (15.52%), neutral detergent fibre (63.00%) and hemicellulose (39.00%) values were recorded in FMSP. Fermentation and alkaline treatments reduced the crude protein while it increased the ether extract and nitrogen free extract of the MSP. Ash had the highest percentage value in fermented malted sorghum sprout (FMSP) and the lowest in raw malted sorghum sprout (RMSP). The concentration (g/kg) of calcium (14.45) and phosphorus (67.92) and potassium (6.59 g/kg) were significantly (P<0.05) highest in FMSP. The concentration (mg/kg) of iron (947.50) and copper (21.50) observed in AMSP were significantly higher (P<0.05) than the values obtained in FMSP followed by RMSP. It was observed that fermentation and alkaline treatment employed reduced zinc concentration values. It can be concluded that fermentation processing method used in this study presented the best results in terms of the chemical and mineral composition values.

Keywords: Malted Sorghum Sprout, Alkaline treatment and Fermentation.

INTRODUCTION

Malted sorghum sprout (MSP) is a non-conventional feedstuff in the feed industry. The separated roots and shoots left after malt extraction from the young germinating sorghum seedlings are collectively called Sorghum sprout (Aletor *et al.*, 1998). Malted Sorghum Sprout has a lot of prospect as a feedstuff for the livestock industry. It is rich in organic nitrogen (Ikediobi, 1989). Malted Sorghum Sprout contains 88.79% dry matter, 26.38% crude protein, 2.35% ether extract, 5.21% ash, 51.06% nitrogen free extract, 49.57% neutral detergent extract, 31.25% acid detergent fibre, 3.92% acid detergent lignin, 18.32% hemicellulose and 27.33% cellulose (Saka *et al.*, 2016). anti-nutritional factors in MSP are tannin and hydrogen cyanide. Van Buren and Robinson (1969) reported that tannins affect the growth of animals in three main ways: they have an astringent taste, which affects palatability, and decreases feed consumption; they form complexes with proteins and reduce its digestibility and they act as enzyme inactivators. All these factors result from interaction of tannins and proteins to form soluble and insoluble complexes, an interaction that depends primarily on relative proportions of phenol and protein. Cyanide caused poisoning of the animal (Wheeler, 1994). Detoxification by means of processing might be a good means of reducing the level of anti-nutritional factors and increase the nutritive value of MSP. Fermentation of malted sorghum sprout has been reported to increase the relative value availability of limiting amino acids. Romo- Parada *et al.* (1985) reported a 92% reduction of tannin content of a high tannin sorghum cultivar as a result of fermentation while Hassan and El Tinay (1995) reported 63 and 61% for two cultivars of sorghum at the end of a 14 hour fermentation period. Alkaline treatment of high fibre roughages has also been investigated extensively and there are numerous reviews of their effect in improving feeding value of test ingredients (Wanapat *et al*., 1985). One economical alkaline source is wood ash. This study was therefore designed to investigate the effect of different processing methods on the chemical and mineral composition of malted sorghum sprout.

MATERIALS AND METHODS

Experimental site and duration: The experiment was carried out at the Teaching and Research farm of Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan.

Source and Processing of the test Ingredient.

The malted sorghum sprout (MSP) used in this study was the brown type as against the white one reported to be low in tannin (Dogget, 1988). The MSP was purchased in its dried form from Life care ventures limited, Sango Otta, Ogun State. It was then divided into three parts and processed. The processing was carried out according to the procedure of (Fanimo and Akinola, 2006). The first part was not treated (raw), the second part was alkaline (wood ash) treated and the third part was fermented naturally. The alkaline treatment was done by mixing 5kg of raw MSP with 300g of wood ash. The entire mixture was then mixed in 20 litres of water and left in a container for 72 hours with frequent stirring. The mixture was brought out, the water was allowed to drain out after which it was sun dried. Fermentation involved the use of water and polythene bag; water was mixed with the dried malted sorghum sprout at a ratio of 2:1 so that the entire sprout was moistened. The mixture was then transferred into an air-tight nylon and fermented under room temperature for 96 hours (4 days). Thereafter, it was spread on concrete floor for sun drying. The raw and processed MSP were stored in a dry place.

Chemical Analysis

Proximate and Fibre Fraction Analysis

Subsample of the raw and differently processed MSP were ground to pass a 1-mm sieve screen using laboratory summer mill and analyzed for crude protein, ether extract and Ash-contents (AOAC, 2000). Fibre fractions of neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were determined (Van Soest *et al.,* 1991). Cellulose was calculated from the difference between ADF and ADL while hemicellulose was calculated as the difference between NDL and ADL.

Mineral Determination

Individual samples of the raw and processed MSP were digested with nitric acid / perchloric acid mixture (4:1 v/v). Macro minerals (Ca, P, K and Mg) and micro minerals (Cu, Zn and Fe) in the digest except P were determined with atomic absorption spectrophotometry. The concentration of Potassium (K) was estimated with a flame photometer. The P was determined with vanadomehydrate and the colour red with spectrophotometer at 490mph. Concentration of Calcium, Phosphorus, Magnesium, Copper and Zinc was determined with atomic absorption spectrophotometry (Fritz and Schenk, 1979).

Statistical Analysis

Data collected were subjected to one way analysis of variance (ANOVA) and significant means among variables were separated using Duncan multiple range test (SAS, 2001).

RESULT AND DISCUSSION

Presented in Table 1 is the effect of different processing methods on the chemical composition of MSP. The highest dry matter value obtained after fermentation process may probably be due to the soft and porous texture of the MSP resulting in maximum moisture loss. The microorganisms must have utilized some moisture for metabolic activities thereby increasing the dry matter content. The result obtained in this study was in line with the report of Saka *et al.* (2016). Fermentation and alkaline treatment reduced the level of crude protein while the Ash (15.52%) and Neutral detergent fibre (63.00%) values increased in the processed MSP. The decrease in crude protein values of the processed MSP compared to RMSP observed in the study was similar to results reported by (Fanimo and Akinola, 2006; Saka *et al.*, 2016). The FMSP recorded the highest ash value (15.52%) followed by those that were alkaline (11.25%) and the lowest value (7.13%) was observed in RMSP. The Crude protein of RMSP was higher while Ether extract, Ash and Cellulose contents were lower than the value reported by Aning *et al.* (1998). In addition to variation in method of processing and storage, a large proportion of the differences in chemical composition of the MSP used in this study compared to reported values of Aning *et al.* (1998), can be attributed to the varieties of Sorghum used. The chemical composition values of MSP obtained in this study were slightly different from the values reported by Saka *et al.* (2016). This could be attributed to the fact that they were not sourced from the same place, therefore affirming the difference in the varieties of sorghum used. Table 2 shows the effect of different processing methods on the mineral composition of MSP. Results indicated that there were significant ($P < 0.05$) differences between raw MSP and the differently processed MSP in all the minerals investigated. Fermentation and alkaline treatment employed in this study significantly increased the phosphorus, calcium, Iron and copper contents of MSP. However, FMSP recorded the highest value of phosphorus, calcium and potassium content compared to RMSP and AMSP. A significant ($P<0.05$) increased in phosphorus content was observed in AMSP (58.58 mg/kg) and FMSP (67.92 mg/kg) respectively. The calcium content of the RMSP was found to be lowest ($P<0.05$) at 0.64mg/100g and increased significantly ($P<0.05$) in AMSP and FMSP respectively. The highest magnesium content was observed in RMSP (10.15 g/kg) followed by AMSP (9.08 g/kg) and FMSP (7.55 g/kg) respectively. AMSP increased iron and copper contents significantly ($P<0.05$) in the sorghum sprout than other treatments. Zinc content was significantly decreased in AMSP and FMSP respectively, compared to RMSP content. Iron contents were higher ($P<0.05$) in AMSP and lower in RMSP. It was also observed that the processing methods employed significantly reduced zinc content of MSP. The improvement in mineral contents after processing may be attributed to degradation of tannin and dhuring which bind the mineral into low molecules. On the average in terms of major and minor mineral composition values obtained, fermented malted sorghum sprout gave the highest value.

CONCLUSION

It can be concluded that fermentation processing method among the processing methods used in this study presented the best result in terms of the chemical and mineral composition values.

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Table 1: Effect of different processing methods on the chemical Composition of MSP)

Parameter (%)	MSP	AMSP	FMSP
Dry matter	79.20±0.07^{b}	66.44±0.03^{c}	82.31±0.04^{a}
Crude Protein	27.55±0.06^{a}	20.40±0.08^{c}	23.20±0.09^{b}
Ether extract	0.31±0.02^{b}	0.31±0.01^{c}	1.76±0.04^{a}
Ash	7.13±0.03^{c}	11.25±0.05^{b}	15.52±0.03^{a}
Nitrogen free extract	36.11±4.65^{a}	15.71±0.09^{c}	28.26±0.08^{b}
Neutral detergent fibre	53.00±0.00^{c}	55.00±0.00^{b}	63.00±0.00^{a}
Acid detergent fibre	18.00±0.00^{c}	38.00±0.00^{a}	24.00±0.00^{b}
Acid detergent lignin	10.00±0.00^{c}	25.00±0.00^{a}	15.00±0.00^{b}
Hemicellulose	35.00±0.00^{b}	17.00±0.00^{c}	39.00±0.00^{a}
Cellulose	8.00±0.00^{c}	13.00±0.00^{a}	9.00±0.00^{b}

[a, b, c] Means in the same row with different superscripts are significantly different (P<0.05)

Table 2: Effect of different processing methods on the mineral composition of Malted sorghum sprout

Parameter	MSP	AMSP	FMSP
Macro mineral (g/kg)			
Phosphorus	30.38±0.38^{c}	58.58±0.33^{b}	67.92±0.09^{a}
Calcium	0.64±0.10^{c}	5.13±0.08^{b}	14.45±0.05^{a}
Magnesium	10.15± 0.03^{a}	9.08± 0.02^{b}	7.55± 0.05^{c}
Potassium	1.93 ± 0.02^{b}	0.62 ± 0.02^{c}	6.59 ± 0.01^{a}
Micro mineral (mg/kg)			
Iron	647.50 ±2.50^{c}	947.50± 12.50^{a}	880.0 ±20.00^{b}
Copper	11.25±0.75^{c}	21.50±0.50^{a}	14.75±0.25^{b}
Zinc	41.10±0.40^{a}	29.95±0.30^{b}	29.33±0.18^{c}

[a, b, c] Means in the same row with different superscripts are significantly different (P<0.05).