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PROXIMATE AND ANTINUTRITIONAL COMPOSITION OF SOME SELECTED SORGHUM (*Sorghum bicolor* (L) Moench) VARIETIES

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ABSTRACT

A study was conducted to determine the chemical composition and anti-nutritional factors of Samsorg 17 (yellow), Samsorg 14 (white), Samsorg 40 (cream) and KSV-15 (red) varieties of *Sorghum bicolor*. The sorghum varieties were cleaned to remove husk, broken and discoloured seeds. The grains were then milled and taken to the laboratory for analyses. The proximate analysis results of the four sorghum varieties showed significant differences ($P < 0.05$) in Dry Matter (DM), Crude Protein (CP), Crude Fiber (CF) and Nitrogen Free Extract (NFE). The values obtained for DM ranges between 95.19 - 95.62 %, CP (10.13 – 10.68 %), CF (2.00 – 2.52 %), EE (2.22 – 3.41 %), Ash (1.85 – 2.01 %), NFE (83.81 – 85.64 %) and Metabolizable energy (3522 - 3663 kcal/kg). However, the range of values obtained for phytate and trypsin inhibitor were significantly different ($P < 0.05$). The values obtained for phytate (1.98 – 2.62 mg/100g) and trypsin inhibitor (0.52 – 0.78 mg/100g), tannin (0.63 – 0.82 mg/100g) and oxalate (0.98 – 1.44 mg/100g), respectively were within the tolerable levels for incorporation into animal feed. It was concluded that sorghum varieties can be used as an energy source during scarcity of other main energy sources (such as maize) and when there is hike in price during off season. It is also safe to be incorporated into animal feed.

Keywords: Chemical composition, Anti-nutrients, Sorghum varieties

INTRODUCTION

Feed is the most important input for poultry production and the availability of low-priced high quality feeds is critical for the expansion of the poultry industry and quality (FAO, 2003; Ismoyowati and Sumarmono, 2011). There is a need to expand the ingredient base to provide an array of alternative feedstuffs for poultry feed formulation (Dawfang and Shwarmen, 1996). Cereal grains are the major sources of energy in poultry diets in the tropics (Oluyemi and Robert, 2000) and form the largest part of energy source and inclusion level in a standard poultry diet (Olomu, 2011). Common cereals used in tropical countries include maize and guinea corn (sorghum) and to a less extent, millet and wheat (Olawunmi, 2013). Sorghum (*Sorghum bicolor* (L) Moench) grain is an important ingredient in poultry diets with approximately 95% of the nutritional value of maize (Dowling *et al.*, 2002; Black *et al.*, 2005). It is known as guinea corn in West Africa and locally called *Okababa*, *Dawa*, and *Okili* in Yoruba, Hausa and Igbo, respectively (Adegbola *et al.*, 2013). Sorghum is used for human consumption and animal production (Selle *et al.*, 2010) as well as industrial products such as alcohol (Shawrang *et al.*, 2011). Among alternative feedstuffs, sorghum presents adequate nutritional characteristics and it is often used to replace maize, particularly in semi-arid and tropical regions where sorghum crops present better nutritional yield per area (Ligeiro *et al.*, 2009). Farmers have the notion that sorghum has anti-nutritional factors such as tannin, phytic acid, oxalate and saponins which reduce its metabolizable energy value (2650 kcal/kg) compared to maize (3300 kcal/kg) which places it as a constraint in poultry diets. Tannin content in the pericarp is one of the most important factors affecting the feeding value of sorghum grain and adversely affects its metabolizable energy and protein utilization in poultry (Etuk, 2008).

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MATERIALS AND METHODS

Sources of sorghum: The four sorghum varieties used for this study were sampled from Institute of Agricultural Research (IAR), Crop Breeding Unit and were purchased from local farmers selling IAR sorghum varieties in Giwa market while the red sorghum was purchased in Samaru market all in Kaduna State. The sorghum was cleaned to remove the husk, broken and discolored seeds by winnowing and hand picking. The grain varieties were packaged separately in air tight bags and taken to the laboratory for analyses. The varieties used are given below:

Table 1: Guinea corn (*Sorghum bicolor*) varieties analyzed for chemical composition

S/N	Colour	Local Name	IAR Name
1	Yellow	Kaura	Samsorg 17
2	White	Farar fara	Samsorg 14
3	Cream	Mori	Samsorg 40
4	Red	Jan dawa	KSV-15

IAR = Institute of Agricultural Research

Determination of Chemical Composition and Anti-nutritional Factors of Sorghum Varieties:

The proximate compositions of the four sorghum varieties were analysed according to methods outlined by AOAC (2005) for DM, CP, CF, EE, Ash. Nitrogen Free Extract was determined by subtraction: $NFE = 100 - (\%CP + \%CF + \%EE + \%Ash)$; Metabolizable energy (ME) was calculated from the proximate composition values using the formula of Ponzenga (1985); $ME (kcal/kg) = 37 \times \% CP + 81.1 \times \% EE + 35.5 \times \% NFE$. The anti-nutritional factors such as tannin, phytate, trypsin inhibitors and oxalate were analysed according to AOAC (2005). Both analyses were carried out at the Biochemical Laboratory of the Department of Animal Science, Ahmadu Bello University, Zaria.

Statistical analysis: Data obtained from this study were subjected to analysis of variance (ANOVA) using SAS (2002). Significant ($P < 0.05$) differences among treatment means were compared and separated using Duncan Multiple Range Test.

RESULTS AND DISCUSSION

The chemical composition result of the four varieties of sorghum (Yellow, White, Cream and Red) are presented on Table 1. Dry matter was significantly ($P < 0.05$) higher (95.62 %) in yellow variety, while the red variety had the lowest value (95.19 %). Crude protein was significantly ($P < 0.05$) higher (10.88%) in the cream variety which is slightly higher than the findings of Daramola *et al.* (2020) who reported the same varieties having a crude protein range of 9.14 – 10.80 % and also higher than the report of Oladipo (2015) who reported 8.53 – 9.27 % CP for yellow and red sorghum respectively. Higher values of 12.25 and 14.88% were reported by Okwu and Orji (2007) for red and white sorghum, respectively. The crude fiber contents ranged from 2.00-2.52%, which are a bit lower than the values of 2.56 – 3.91 % reported by Daramola *et al.* (2020) and those reported by Abubakar *et al.* (2017), Oladipo (2015) and Ibe (2014) that published crude fibre values ranges of 4.69 – 4.78 %, 3.63 – 4.39 % and 3.47 – 4.71 %, respectively. The low crude fiber levels obtained may be due to the relative low levels of polyphenols recorded in the sorghum varieties used, since polyphenols are known to contribute to the lignin fraction of the dietary fiber (Abubakar *et al.*, 2017). Statistically, there were no differences in the ether extract and ash contents obtained from this study. The nitrogen free extract (NFE) for the sorghum varieties ranged from 83.63 % - 85.64 %. These values were higher than the values of 78.52 – 80.28 % reported by Abubakar *et al.* (2017) and 78.06 – 79.54 % reported by Daramola *et al.* (2020) for NFE in sorghum. Metabolizable energy obtained were not statistically different between varieties. The values were higher than the ranges



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of 3280 – 3474 and 3379 – 3412 kcal/kg ME reported by Daramola *et al.* (2020) and Abubakar *et al.* (2017) respectively but comparable to the value of 3669 kcal/kg reported by Oladipo (2015). The variations in some of the chemical values of *Sorghum bicolor* from other authors could be due to differences in environment, soil type, agronomic practices and varieties as reported by (Abubakar *et al.*, 2017; Daramola *et al.*, 2020).

Table 1: Chemical Composition of Sorghum Varieties

Parameters (%)	Samsorg 17	Samsorg 14	Samsorg 40	KSV-15	SEM
Dry Matter	95.62 ^a	95.50 ^a	95.41 ^a	95.19 ^b	0.14
Crude Protein	10.13 ^c	10.68 ^b	10.88 ^a	10.13 ^c	0.02
Crude Fibre	2.28 ^b	2.14 ^b	2.00 ^b	2.52 ^a	0.08
Ether Extract	3.29	2.22	2.71	3.41	0.53
Ash	1.85	1.94	2.01	1.91	0.08
Nitrogen free extract	84.12 ^b	83.63 ^b	85.64 ^a	83.81 ^b	0.18
Metabolizable energy (Kcal/kg)	3627	3544	3663	3627	95.71

^{abc}: Means with different superscripts within the same row differs significantly ($P < 0.05$) SEM: standard error of mean

The result of the anti-nutritional factors of the four varieties of sorghum (Yellow, White, Cream and Red sorghum) is presented in Table 2. The phytate contents of the yellow and cream varieties were statistically ($P > 0.05$) the same but higher ($P < 0.05$) than the white and the red varieties which values were 1.98, 2.01, 2.50 and 2.62 mg/100g for the four varieties respectively. These figures are higher than the values (0.09 - 0.19 mg/100g) of the same varieties reported by Abubakar *et al.* (2020) but within the range (2.96 and 2.21 mg/100g) of the findings of Oladipo (2015) for yellow and red varieties respectively. There were no significant ($P > 0.05$) differences in tannin and oxalate contents for the four varieties of sorghum. The tannin result agrees with the findings of Beyer (2011) who reported that the colour of sorghum seed coat is not an adequate indicator of tannin content which disagrees with the findings of Sulan *et al.* (2014) who stated that coloured sorghum grains contain more tannin than the white ones. The values range of 0.98 mg/100g for oxalate in the cream variety to 1.29 mg/100g in red variety is lower than

Table 2: Anti nutritional factors in four (4) varieties of Sorghum

Sorghum Varieties					
Parameters (mg/100g)	Samsorg17	Samsorg 14	Samsorg 40	KSV-15	SEM
Phytate	2.62 ^a	1.98 ^b	2.50 ^a	2.01 ^b	0.28
Tannin	0.82	0.72	0.63	0.79	0.19
Oxalate	1.44	1.15	0.98	1.29	0.23
Trypsin inhibitors	0.73 ^a	0.78 ^a	0.52 ^b	0.60 ^b	0.08

^{abc}: Means with different superscripts within the same row differs significantly ($P < 0.05$) SEM: standard error of mean

the range of 6.72 – 13.44 g/kg reported by Reza and Edriss (1997) and also lower than the range of 0.19 – 0.45 mg/100g reported by Abubakar *et al.* (2020) in sorghum. Trypsin inhibitor was observed to be significantly ($P < 0.05$) higher (0.78 mg/100g) in the white variety while the cream variety had the lowest value (0.52 mg/100g). The differences observed in the anti-nutritional factors may be due to the soil type, variety, climatic condition under which the sorghum varieties were grown or cultivated as earlier stated.



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CONCLUSIONS

The result obtained from this study revealed the importance of knowing the proximate composition and anti-nutritional content of sorghum varieties before incorporating it as a sole energy source to avoid toxic effects. In terms of availability, cost and nutritive value, *Sorghum bicolor* is recommended as an alternative energy source during scarcity of other main energy sources and hike in price during off seasons.

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