Journal of Innovative Research in Engineering and Science 2(2), April, 2011.
ISSN : 2141-8225

Determination of Some Physicochemical Properties of Guinea Corn (*Sorghum vulgare)* *(pp. 62-66)*

O. Chukwu, B. A. Orhevba* and I. Abubakar
Department of Agricultural and Bioresources Engineering, Federal University of Technology, PMB 65, Minna, Niger State, Nigeria
*Correspondence e-mail: borhevba@yahoo.com)

Abstract: In this study, some physical and chemical properties of two cultivated varieties of guinea corn (brown and white) were studied. The physical properties are pericarp, colour, kernel size, 1000-kernel weight and moisture content. Standard laboratory procedures by Association of Official Analytical Chemists (AOAC) were followed to obtain chemical compositions such as oil, crude fibre, ash and protein from the two varieties of guinea corn. The results show that brown variety contains 5.03 % oil, 2.33 % crude fibre, 1.87 % ash and 10.80 % protein; while the white variety contains 3.03 % oil, 1.97 % crude fibre, 1.99 % ash and 10.00 % protein. Nitrogen free extracts were found to be 1.66 % and 73.97 % for brown and white samples, respectively. The amylose contents were 35.00% for brown and 21.67 % for white. Mineral contents such as calcium, potassium and phosphorus determined showed that the brown variety contains 0.14 % calcium, 0.19 % potassium and 0.16 % phosphorus while the white variety contains 0.27 % calcium, 0.21 % potassium and 0.12% phosphorus. The carbohydrate and energy values were obtained to be 72.12 % and 374.07 kcal/100g for brown and 73.98 % and 363.10 kcal/100g for white. From the results, even though the carbohydrate and energy values of guinea corn compare favourably well with those of other cereals, the mineral contents were lower than the previously reported values for cereals generally. Thus, in formulating animal feed or for human consumption it is recommended to mix the two varieties of guinea corn with protein rich foodstuff such as wheat or soyabean, so as to obtain the optimum dietary requirement needed by the body.

Key words: Guinea corn, pericarp, amylose, kernel weight, variety, kernel size

1 INTRODUCTION

Guinea corn is a cereal crop commonly known as grain sorghum which belongs to the general class of sorghum. Sorghum grain is the fifth most important cereal in the world after wheat, rice, maize and barley (FAO, 2008). In Africa, it comes second after maize in terms of production. According to FAO (2008) estimates, the average world production of sorghum grain between 1999 and 2003 amounted to 57.7 million tonnes per year from 42.6 million hectares of land. It has been an important staple food in the semi-arid tropics of

Asia and Africa for centuries. This crop is still the principal source of energy, protein, vitamins and minerals for millions of people in Africa (Okafor and Aniche, 1987).

The kernel of sorghum varies in colour, shape, size and certain anatomical components. The principal anatomical components are pericarp, germ or embryo and endosperm. The kernels of sorghum and pearl millet are of the caryopsis type, in which the pericarp is completely fused to the endosperm (Subramanian *et al.,* 1986). Nutritionally, sorghum protein, as other cereal proteins, is limited in some essential amino acids such as lysine, threonine and tryptophan.

The colour of sorghum grains varies from white to dark brown depending on the phenolic pigments present. Anthocyanogens have been detected in yellow millo and red kafir sorghum but not in white waxy or yellow endosperm varieties. Brown kernel sorghum grains usually have high tannin contents. These are preferred by farmers as they are less liable to bird damage. However, these pigments may be transferred to grits or to starch and gluten during milling causing bitterness of grain and finished products (Ihekoronye and Ngoddy, 1985).

Some well known cereals include sorghum, pearl millet, finger millet, foxtail millet, common millet, little millet, guinea corn, kafir corn, millo, rice, wheat and millo maize (Brink *et al*., 2006). Sorghum is grown in harsh environment where other crops grow or yield poorly. Sorghum is grown with a limited supply of water and usually without application of any fertilizer or other inputs by a multitude of small holder farmers. It is often referred to as coarse grain or poor people's crop because it is mostly consumed by less privileged people groups. It is not usually traded in international markets or even in local markets in many countries. Therefore, the farmer seldom has an assured market in the event of high production. This research was carried out to determine some physicochemical properties of guinea corn. This will assist in qualifying and quantifying the nutritional and food values of guinea corn in human diet and animal feed.

2 MATERIALS AND METHODS

The guinea corn samples (brown and white varieties) used to determine the physicochemical properties were obtained from Mokwa Modern Market in Niger State, Nigeria. They were decorticated and sorted to remove any dirt or foreign material present in them. The test analyses were carried out in the General Laboratory of National Cereals Research Institute (NCRI), Baddegi, Niger State, Nigeria and Food Sciences Laboratory, Institute of Agricultural Research, Ahmadu Bello University (ABU), Zaria, Kaduna State, Nigeria.

2.1 Determination of Physical Properties

Pericarp colour was determined by the reflex activity and absorptive capacity using a colorimeter when light was passed through a sample of guinea corn grains. Kernel size was determined by passing the sample through the sieve of numbers 7, 8 and 10 of USA standard (Brennan *et al.,* 1981). 1000 kernel weight was determined using electronic weighing balance. Moisture Content was determined using the Air oven method at 80 ^{o}C for 12 h.

2.2 Determination of Chemical Compositions

The procedure outlined in AOAC (1984) nutritional guidelines was used to determine crude fibre, crude protein, total ash, fat (oil), carbohydrate, amylose, potassium and phosphorus contents of guinea corn. Food energy value of the sample was determined according to the method described by Osborn (1972). The energy value (kcal/100g) is equal to (4 × protein) + (9 × fat) + (4 × carbohydrate). The content of nitrogen free extract of the sample was determined according to the method described in the Laboratory Manual for Nutrition Research as 100 − (moisture content + crude protein + crude fat + crude fibre). Calcium was determined by ethylene -dia-mono-tetra-acetic acid (EDTA) titration method.

3 RESULTS AND DISCUSSION

The physical properties of guinea corn are presented in Table 1. Each parameter is the mean of three replicate determinations ± SD.

Table 1: Physical Properties of Guinea Corn as Mean ± Standard Deviations of Three Replicate Determinations

Cultivar	Pericarp colour	1000 kernel weight (g)	Moisture (%)	Kernel size (%) *7μm*	Kernel size (%) *8μm*	Kernel size (%) *10μm*
Guinea corn	Brown	0.353±0.02	10.09±0.49	74.10±0.15	24.60±0.12	1.30±0.01
Guinea corn	White	0.346±0.01	11.04±0.62	72.80±0.21	25.10±0.03	2.10±0.16

Pericarp colours identified were brown and white in the guinea corn sample used. The kernel size with a diameter between 7 and 8 μm has higher percentages. Preferably, the grain should be ground before use. The weight of the kernel was higher than that of pearl millet and acha, but less than that of wheat and maize (Kent, 1982; Akingbala, 1982). The moisture contents showed slight differences which were less than the moisture contents of maize, wheat and acha determined as 14 %, 12 % and 14 % respectively under similar conditions but greater than those of rice and pearl millet which were 9 % and 10 % respectively under similar conditions (Ihekoronye and Ngoddy, 1985). The chemical

compositions of guinea corn are presented in Table 2. Each parameter is the mean of three replicate determinations.

Table 2: Chemical Compositions of Guinea Corn as Mean ± Standard Deviation of Three Replicate Determinations

Component	Content (%) (Brown)	Content (%) (White)
Oil	5.03±0.06	3.03±0.13
Crude protein	10.80±0.31	10.00±0.43
Crude fibre	2.33±0.12	1.97±0.03
Ash	1.87±0.01	1.97±0.02
Nitrogen free extract	71.66±0.12	73.97±0.32
Carbohydrate	72.12±0.14	73.98±0.17
Energy value	374.07±0.64	363.10±0.58
Amylose	35.00±0.04	21.67±0.31
Calcium	0.14±0.02	0.27±0.12
Potassium	0.19±0.01	0.21±0.02
Phosphorus	0.16±0.03	0.12±0.01

There were differences in the amylose and calcium contents between the two varieties. The amylose content of the brown guinea corn is higher than that of white guinea corn which is also greater than that reported in the earlier study (USDA, 2006). The calcium content from this study is less than the previous study (www.Blackherbals, 2008.)

The energy values of both species are less compared to the study of Oyenuga (1968). The oil content reported in this study for both grains are higher than those of wheat and rice, but less than that of maize. However, the ash contents are lower than those of rice, wheat and maize (Oyenuga, 1968).The mineral compositions vary for the two varieties of guinea corn and are lower than the values reported in the study on sorghum and millet (USDA, 2006).This may be due to environmental conditions that prevailed at the growing region.

4 CONCLUSION

Evaluation of some physical and chemical properties of guinea corn (brown and white) revealed some basic differences between the two varieties. A 1000 kernel weight showed that the grain of guinea corn is heavier than those of maize and wheat. The mineral contents were lower than the previously reported values for cereals generally. The colour of the grains varies depending on the phenolic pigment present. Thus, in formulating animal feed or for human consumption it is recommended to mix the two varieties of guinea corn with protein rich foodstuff such as wheat or soyabean, so as to obtain the optimum dietary requirement needed by the body.

5 REFERENCES

Akingbala J.O (1982). Effects of physicochemical properties of sorghum starch and endosperm in the quality of a traditional African food. PhD dissertation, Texas A & M University College Station, TX, USA.

AOAC (1984). Association of Official Analytical Chemists. Official Methods of Analysis, 14th. Ed.,V.A. Arlinton. pp. 858

Brennan, J. C, Butler, J. R, Cowell, N. O and Lilly, A.E. V. (1981). *Food engineering operation* (2nd Ed.), Applied Science Publishers Limited London, UK. pp.1 – 50.

Brink, M., Purseglove, E., Belay, G., and Lemmens, R. H. (2006). *Plant Resources of Tropical Africa 1: Cereals and Pulses*. Prota Foundation/ Backhuys Publishers Wageningeon, Netherlands. Pp 169 – 174.

FAO (2008). *Amino acid content of food and biological data on proteins, FAO nutritional studies.* Food and Agriculture Organization of the United Nations, Rome, pp.285-289.

http: //www.blackherbals. Com/sorghum and millet I African nu.htm, Retrieved on 07/ 06/ 2008.

Ihekoronye, A.I. and Ngoddy, P.O. (1985). *Integrated Food Science and Technology for the Tropics*. Macmillan, pp. 249-252.

Kent, N. L. (1982).*Technology of Cereals* (3rd edition), Pergamon Press London, UK, pp. 277-295.

Okafor, N. and Aniche, G.N. (1987). Studies on the brewing of Lagos beer: *Nigerian sorghum. J. Food Science Technology,* 24:131-134.

Osborn, T.B. (1972). *The Vegetable Proteins* (2nd edition), Longmans and Green, New York, USA.

Oyenuga, V.A. (1968). Nigerian *Foods and Feedingstuffs: Their chemistry and nutritive value* (3rd Ed.), Ibadan University Press, Nigeria.

Subramanian,V.;Jambuna,S. and Ramaiah, C.D. (1986). Physical and chemical characteristics of pearl millet grains and their relationship to rot quality *Journal of Food science,* 51:1005-1020.

USDA (2006). National Nutrient Database for Standard Reference, Release 19 (2006).