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THE PROXIMATE ANALYSIS AND BIOCHEMICAL COMPOSITION OF THE WASTE PEELS OF THREE CASSAVA CULTIVARS.

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Abstract

The nutrients yields from three different cassava waste peels were investigated. The values varied slightly with the different cassava cultivars. Sample A (NR 07/0220) had the highest moisture value (72.36%) while sample B (TMS/419) had the lowest moisture value (66.08%). The percentage ash content of sample C (TMS/3055) was comparably higher than the other cultivars indicating that the mineral contents of sample C (TMS/3055) was higher than that of other cultivars. Sample A (NR 07/0220) had the highest protein value (6.86%) while sample B (TMS/419) had the lowest protein value (5.73%). All the three cultivars have appreciable high value of carbohydrates with the highest value found in sample B (TMS/419) at 89.25%. The waste peels of the three cassava cultivars examined have appreciable levels of nutrients and can make useful contributions in animal nutrition and bioethanol. The codes are descriptor characteristic code adapted from the international plant such as the manihot esculenta specie (TMS) while the NR describes the newly released pro-vitamin, a variety with yellow roots.

KEYWORDS

Waste cassava peels (NR 07/0220, TMS/419, TMS/3055), proximate compositions, animal nutrition, bioethanol.

1. Introduction

Cassava (*Manihot esculenta*) is a food cultivated mainly in the tropic and sub tropic regions of the world. It is one of the major crops in the world and it is ranked sixth as an important food crop [1]. Estimates of the food and Agriculture organisation of the United Nations [2] put world population of cassava at more than 230 million metric tonnes annually. The world major producers include Nigeria (37.5 million tonnes per annum), Brazil (24.5 million tonnes) and Thailand (24.5 million tonnes) [2, 3]. Cassava is an important component in the diet of more than 800 million people around the world [4] and is the third largest carbohydrate food source, within the tropical regions after rice and corn [5]. Cassava is therefore referred to as a food security crop which can be left in the ground for extended periods of up to two years until required [6]. Cassava is used mainly as a fresh food item and can be processed into various food and non food products such as starch, flour, beverage, animal feeds, biofuels, textiles, chemicals and pharmaceuticals [3].

There is much variation in the nutrient quality of cassava root [7]. In the tropical regions, cassava is the most important root crop and is a good source of energy. The calorific value of cassava is high compared to most starch crops [8]. The starch content of a fresh cassava root is about 30% and gives the highest yield of starch per unit area of any crop known [9]. The protein content is extremely low, however, and ranges between 1-3% [10, 11]. Cassava roots contain a number of mineral elements in appreciable amount that are useful in human diet. The root contains significant amounts of iron, phosphorus, calcium and is relatively rich in vitamin C [12].

There are several thousands of varieties of cassava and about hundred related wild species [13]. Cassava plants are generally categorised as bitter cassava or sweet cassava depending upon their cyanide content. The low Hydrogen cyanide or sweet cassava has less than 50ppm of cyanogenic equivalents and can be cooked and eaten as they are, while the high Hydrogen cyanide or bitter cassava has more than 100ppm of cyanogens and needs to be processed before being consumed [14, 15, 16].

During processing large amounts of liquid pulp and cassava peels are generated. Processing of 250 to 300 tonnes of cassava root results in approximately 1.16 tonnes of cassava peels, 280 tonnes of cassava pulp and 2655m^3 of starch wastewater [17]. In Nigeria alone, about 20-30% volumes of cassava peel wastes are generated from cassava tuber processing every year. Some of these wastes are used as animal feedstuff while others become solid municipal wastes [18, 19, 20]

In Nigeria the amount of wastes being produced by cassava processing factories are enormous and the impacts in the environment could be devastating thus giving rise to the need for proper management and discharge of these wastes. Good management practices of these cassava wastes involves analysis and evaluation of the nutrients composition and mineral contents of different varieties of cassava produced thereby providing documented information that will be useful in cassava waste management, production of improved varieties and raw materials for the production of animal feeds, bioethanol, chemical and pharmaceutical industries.

It will also help in creating jobs, increasing energy security and less dependence on foreign countries [21]. However, the liquid residue obtained from cassava processing can be collected and fermented to bioethanol. The sludge deposits obtained can be used as manure in improving the soil nutrients value [22].

This research therefore intends to determine the nutrients composition or proximate analysis of three varieties of cassava peel wastes. The results of this research will reveal the nutrient qualities and quantity of each of these cassava variety and their possible uses.

2. Materials and Methods

The three varieties of cassava root used for this study were obtained from Agricultural Development Programme (ADP) demonstration farm Otuasega, Ogbia LGA, Bayelsa State. They were transported in different polyethene bags to the central laboratory, Niger Delta University, Wilberforce Island, Bayelsa State for biochemical analysis.

The cassava tubers were hand peeled with table knife to rid off the two outer coverings. The peels were collected, sorted and washed severally with tap water to remove sand and other dirt particles. The samples were sun dried for one day to remove the initial moisture and carefully spread out on a laboratory tray and dried in a moisture extraction oven at 105^0C until it was dry enough to be ground. The dried samples were milled with a blender to obtain smooth powdery samples. The powdery samples were collected and weighed using an electronic balance. These were packaged in three different labelled dry sample bottles for further analysis. The proximate analysis of these cassava waste peels were carried out by the methods based on [23].Moisture was determined in a thermostatic oven at the temperature of 105^0C until constant weight was obtained;

Ash was determined in a muffle furnace at 550^0C for 15 hours; Crude protein by kjeldahl method (N X 6.25); the lipids were extracted with petroleum ether using soxhlet extractor while the carbohydrate was determined using difference method.

3. Results and Discussion

Table 1. *Proximate analysis of waste peels of sample A (NR07/0220)*

Parameters / Sample Code	**% Moisture**	**% Ash**	**% Protein**	**% Lipid**	**% Fibre**	**% Dry Matter**	**% Carbohydrates**
Sample A (NR07/0220)	72.36	3.13	6.86	1.88	0.60	27.64	87.53

Table 2. *Proximate analysis of waste peels of sample B (TMS/419)*

Parameters / Sample Code	**% Moisture**	**% Ash**	**% Protein**	**% Lipid**	**% Fibre**	**% Dry Matter**	**% Carbohydrates**
Sample B (TMS/419)	66.08	2.90	5.73	1.56	0.56	33.92	89.25

Table 3. *Proximate analysis of waste peels of sample C (TMS/3055)*

Parameters / Sample Code	**% Moisture**	**% Ash**	**% Protein**	**% Lipid**	**% Fibre**	**% Dry Matter**	**% Carbohydrates**

Sample (TMS/3055)	C	68.78	3.25	5.95	1.64	0.88	31.22	88.28

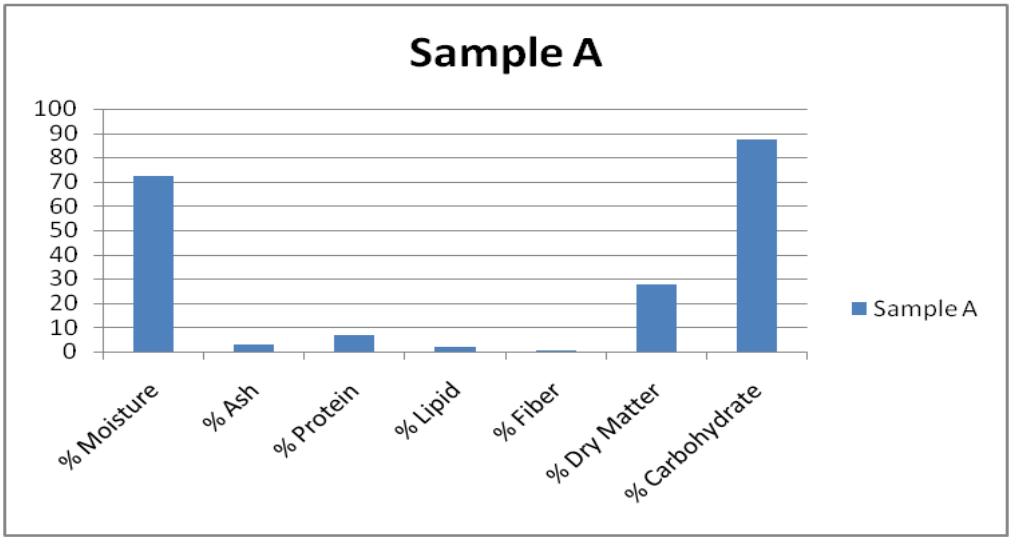

Fig. 1. *A bar chart showing the % yield of the nutrient value of sample A (NR07/0220)*

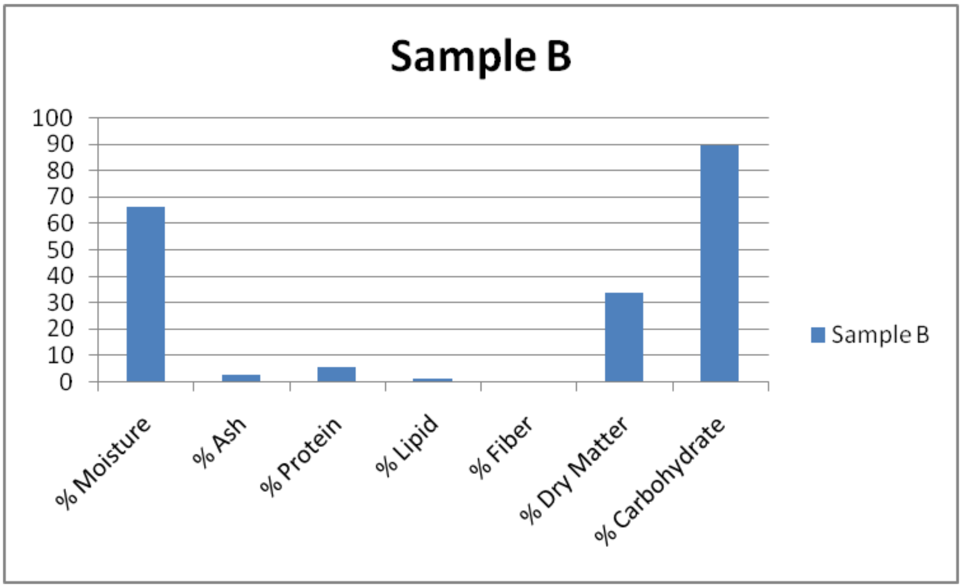

Fig. 2. *A bar chart showing the % yield of the nutrient value of sample B (TMS/419)*

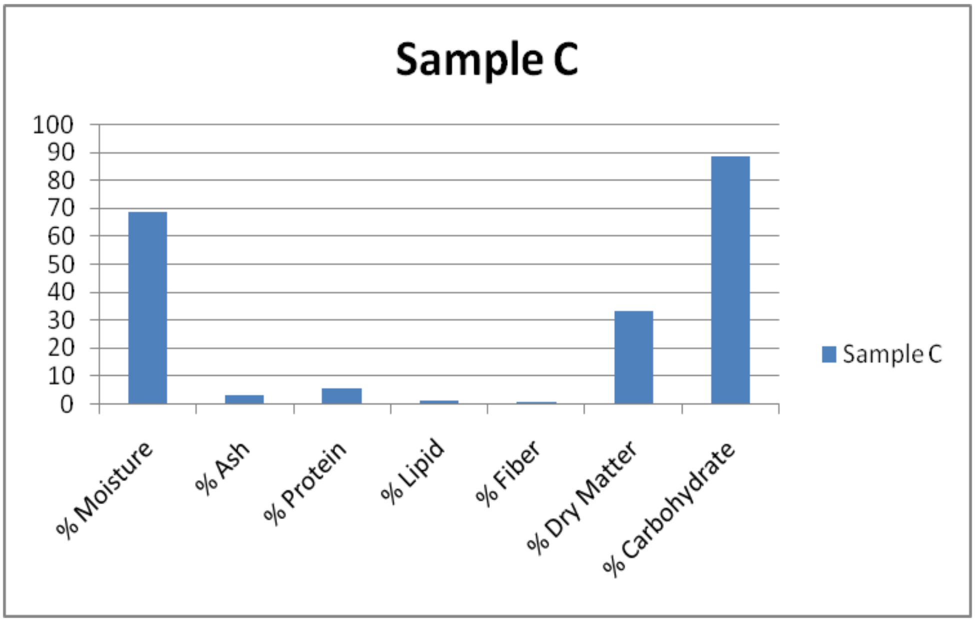

Fig. 3. *A bar chart showing the % yield of the nutrient value of sample C (TMS/3055)*

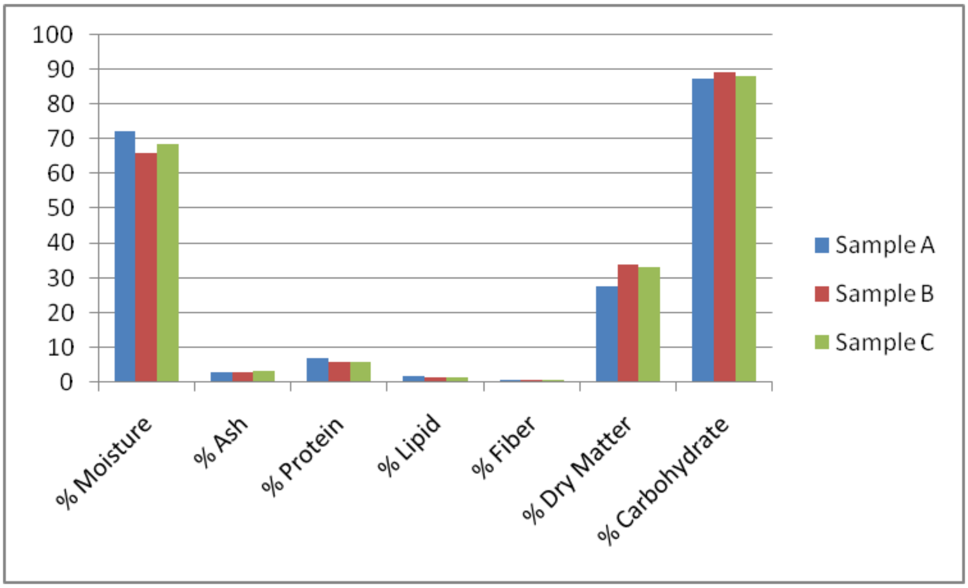

Fig. 4. *A bar chart showing the % nutrient yield of the three samples A, B and C (NR07/0220, TMS/419 and TMS/3055).*

Analysis of biochemical composition of the three varieties of cassava peel wastes revealed that the samples were moderately rich in nutrients.

The moisture contents of the peel wastes of the three cassava varieties were very high. NR07/0220 has (72.39%), TMS/419 (66.08%) and TMS/3055 (68.78%). NR07/0220 has the highest moisture value while TMS/419 has the lowest moisture value; hence, TMS/419 is more suitable for long storage of their roots than those with high moisture value [24].

The ash contents varied from NR07/0220 (3.13%), TMS/419 (2.90%) and TMS/3055 (3.25%). The percentage ash content gives an indication of the total mineral contents of the three varieties of cassava and is similar to that of [25] and more recently, [26], who reported ash contents for cassava root crop averaging 2.78%. The low ash content is indicative of the low mineral contents for the cassava peel wastes [16].

The protein values of the waste peels of the three cassava cultivars under investigation were high compared with the values reported by other researchers. NR07/0220 has a protein value of (6.86%), TMS/419 (5.73%) and TMS/3055 (5.95%) thus making them good sources of protein for animal feed stuff. These values are comparably higher than those of [26], who reported (1.20 - 2.10) % protein in tubers pulp of six cassava varieties and [27], whose investigation of protein in peeled cassava tubers ranged from (0.9 - 1.4)%.

The crude fibre values for the cassava peel wastes under investigation were quite appreciable. NR07/0220 has (0.60%), TMS/419 (0.56%) and TMS/3055 (0.88%). The values are in agreement with those reported by [28], with range of fibre values between (0.74 - 1.49) % for fresh cassava roots. The mean value of % lipid obtained from this study is 1.69 and is higher than the average value of 0.18% lipid obtained by [25] and a range of (0.20 - 0.41)% result obtained by [26].

A diet providing (1 - 2)% of its caloric energy as fat is said to be sufficient for human beings and animals as excess fat consumption is related to certain cardiovascular disorders such as atherosclerosis, cancer and ageing [29].

Dry matter contents of NR07/0220 is (27.64%), TMS/419 (33.92%) and TMS/3055 (31.22%). These values are similar to values for cassava varieties as reported by severally researchers [30, 31, 32, 26] who recorded dry matter content with an average of 34.5% and 36.6%.

The dietary fibre of NR07/0220 has (0.60%), TMS/419 (0.56%) and TMS/3055 (0.88%). The dietary fibre values of these samples are reasonable compared with some tubers and root crops reported by [25]. Dietary fibre can be digested by animals (ruminants), as they play useful roles in providing roughages that aid digestion [33].

The carbohydrates values of NR07/0220 has (87.53%), TMS/419 (89.25%) and TMS/3055 (88.28%). They are very high when compared to other nutrients thus, making the samples very good energy sources in animal feed stuffs and in production of bioethanol.

4. Conclusion

The study reveals that the waste peels of the three cassava varieties examined i.e. (NR07/0220, TMS/419 and TMS/3055) have appreciably levels of nutrient compositions. The % moisture values of the three samples are within the normal % moisture range found in literatures. The protein values are high when compared with reports found in literatures showing that the waste peels of NR07/0220, TMS/419 and TMS/3055 can make useful contributions in animal nutrition and health. Also, the high protein and carbohydrates contents are clear evidence that these cassava waste peels are improved varieties when compared with the varieties analyzed by [26, 34] and can be used as alternative substrate for yeast fermentation in bioethanol production.

Carbohydrates are biochemical important substances which play an essential part in the metabolism of all living organisms. Starch is the principal form in which energy is stored and cellulose being the principal structural material of plants. The monosaccharides such as glucose, fructose and disaccharides such as sucrose and lactose are instant sources of energy for human body.

The mass cultivation of these cassava varieties in Nigeria is therefore recommended considering the benefits accruing from its waste peels with respect to bioethanol production as a result of the high carbohydrate content.

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