International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Chemical Composition of Cassava Peels Collected from Four Locations (Koko, Warri, Okada and Benin City), Brewers` Spent Yeast and Three Grades of "Caspeyeast"

***Idugboe[1], O. D., Nwokoro[2], S. O., Imasuen[2], J. A.**

[1]Moist Forest Research Station, Forestry Research Institute of Nigeria (FRIN), Benin City, Nigeria
[2]Department of Animal Science, Faculty of Agriculture, University of Benin, Benin City, Nigeria
*Corresponding author, Email: oghoghoidugboe@yahoo.com, Tel: +2348037779595

Abstract: ***This study examined the proximate and mineral composition of cassava peels collected from Koko, Warri, Okada and Benin City as well as Brewers' spent yeast (BSY) from Bendel Breweries Nigeria Limited, Benin City, Edo State, Nigeria. Three grades of "caspeyeast" (CPY) (combination of cassava peel and Brewers spent yeast at 25 %, 50 % and 75 % grade) were developed and evaluation also. The cassava peels, "decanted" brewers spent yeast and various CPY grades were sun dried (30 – 35^{0}c) and milled for chemical analysis according to the AOAC (1999) procedures. The experiment was set up as completely randomized design (CRD) in four replications. The chemical analysis of the cassava peel revealed that all the parameters measured with the exception of K, Ca, and Mg were significantly (P < 0.05) affected by location. Generally, the crude protein (CP) ranged between 3.9 and 5.0 %, CF (11.50 and 12.75 %) while that of EE, Ash and NFE ranged from 1.30 to 2.12 %, 7.5 to 8.1 % and 65.2 % to 66.38 % respectively. The chemical composition of the brewer spent yeast revealed a CP value of 49.50 %, NFE of 35.90 % and 0.00 % CF. Among the CPY grades, the CPY$_{75\%}$ had the highest crude protein value of 35.30 which was significantly (P<0.05) different from values obtained for CPY$_{25\%}$ and CYP$_{50\%}$. The crude fibre values were also significantly (P < 0.05) different with CPY$_{75\%}$ having the lowest value of 3.00 % as against 8.10 % obtained for CPY$_{25\%}$. The values obtained for phosphorus in the respective grades were 9.56, 12.10 and 15.48 mg/kg, potassium (14.46, 20.8 and 24.03 mg/kg), calcium (11.20, 17.06 and 19.88 mg/kg) and magnesium (8.02, 13.34 and 14.30 mg/kg). Significantly (P<0.05) differences were observed in all the minerals evaluated among the CPY grades. Proximity and soil type of the locations seemed to play a role in the proximate and mineral composition of cassava peels; as observed with Warri and Koko which were not significantly (P > 0.05) different and same with Okada and Benin City. Generally, it was observed that increasing levels of BSY in the CPY grade formulations resulted in proportionate increase in the crude protein and mineral composition of the emerging ingredient ("Caspeyeast"). The CF and NFE values on the other hand, correlated inversely with increasing percentage of BSY of the "caspeyeast" grades.***

Keywords: Cassava peels, Brewers spent yeast, Proximate, Chemical, Analysis, Koko, Warri, Okada, Benin City

1. Introduction

The need for constant improvement of current popular protein sources as well as finding ways of exploiting the neglected and underutilized feed ingredients cannot be over emphasized. In view of the high prices of feed ingredients, especially those of protein origin, it is necessary to source for and develop alternative means of substituting or supplementing these ingredients with by-products which are not in competition with man for food. This will go a long way in assisting to reduce the present cost of feed especially for monogastric animals. At present, major protein and energy feed sources for livestock feeds production are extremely expensive and scarce (Tewe, 2004). It has become imperative to explore the use of other sources like Cassava peels, Cassava leaves, Rice bran, Brewers spent yeast and other ingredients considered as waste which are rich in energy and protein.

Fetuga (1977) stated that the formulation of an economic ration depends on the knowledge of nutrient requirement and effective use of available feedstuff; while Olomu (2011) clearly emphasized that feed ingredients can be manipulated to achieve the same goal that animals do not need ingredient as such but rather nutrients.

Cassava peel is one of the agro-industrial by-products that are readily available in countries where cassava is cultivated and processed into food for man. The peel accounts for between 10 to 13 % of tuber by weight. It contains about 5 % crude protein and reasonable amount of minerals (Tewe and Kasali, 1986). However, the use of cassava peel as feed for non- ruminant animals is limited by its high fibre content and hydro-cyanic acid which is deleterious to their growth and development (Tewe, 2004). Many processing methods that have been used to enhance the feeding value of cassava include sun-drying (Akinfala *et al*., 2007), Parboiling (Salami, 1999), Soaking in water and retting (Salami and Odunsi, 2003) among others. These have however achieved different level of success. Treatment of cassava peel with alkaline solution of lye (Oladunjoye *et al*., 2010), enzyme supplementation of cassava peels (Midau *et al*., 2011) are some of the available technical information for enhancing the nutritive value of cassava peels. Brewers` Dried Yeast may also have a placating effect on hydrocyanic acid in cassava peel. This achieved considerable success with cassava sievate (Pessu, 2004).

This study therefore investigated the proximate and mineral composition of cassava peels collected from Koko, Warri, Okada and Benin City as well as Brewers' spent yeast (BSY) from Bendel Breweries Nigeria

Limited, Benin City, Edo State, Nigeria. The study was also undertaken to develop and nutritionally evaluate the feed ingredient code named "Caspeyeast" which is a combination of cassava peel and Brewers spent yeast at 25 %, 50 % and 75 % grades.

2. Materials and Methods

Sources of cassava peel

In this study samples of cassava peels were collected from cassava processing centres Koko and Warri towns in Delta State and Okada and Benin City in Edo State Nigeria. Edo State Lies between latitude 6^{o} and 30^{1}N of the Equator and longitude 5^{o} 40^{1} and 6 ^{o}E of the Greenwich meridian in the rain forest zone, with mean monthly temperature of 27.6 ^{o}C. The area has an average annual rainfall and relative humidity of 2162 mm and 72.5 % respectively (Edo NAA, 2015). Delta State lies between latitude 5^{0} and 6 ^{0}E. The states have an average annual rainfall of about 2667 mm in coastal areas and 1905 mm in the Northern areas. Its natural vegetation can be demarcated into rainforest, freshwater forest and mangrove swamp forest.

Collection and preparation of cassava peels and brewers spent yeast

Fresh cassava peels collected from Koko, Warri, Okada and Benin City were properly sun dried, well ground. Fresh samples of Brewers spent yeast were collected into jerricans from Bendel Breweries (Nig.) Ltd. Ikpoba Hill, Benin City, Nigeria. This was allowed to settle overnight, separation occurred in which the solid portion (white in colour) settles at the bottom while a light brown liquid floats on top. The liquid were decanted and the residues were spread in flat trays to dry out completely. The sundried residue, (the brewers spent yeast) was then milled and bagged for analysis.

Caspeyeast formulation and preparation

The Cassava peels and Brewers spent yeast were weighed and mixed at different proportions to produce the "caspeyeast" 25 %, "caspeyeast" 50 %, and "caspeyeast" 75 % graded levels of feed as follows:

a. Caspeyeast 25 % = (75 % cassava peels and 25 % Brewers spent yeast mixture).
b. Caspeyeast 50 % = (50 % cassava peels and 50 % Brewers spent yeast mixture).
c. Caspeyeast 75 % = (25 % cassava peels and 75 % Brewers spent yeast mixture).

Chemical Analysis:

Dry Matter, Crude Protein, Crude Fibre, Ash, Ether Extract, Nitrogen Free Extract, Calcium and Phosphorus according to the method of A.O.A.C. (1990) were determined for the dried and milled cassava peels samples, the brewers spent yeast and the various "caspeyeast" (CPY) grades.

Statistical Analysis

Data collected were subjected to analysis of variance. The separation of means was carried out using the Duncan's multiple range tests (Steel and Torrie, 1980) at 5 % level of probability. Genstat, 2009 (12^{th} Edition) package was used.

3. Results and Discussion

The results of the proximate and some mineral compositions of cassava peels collected from four (4) locations (Benin City, Okada, Koko and Warri) and brewer spent yeast are presented in Table 1. The result of the cassava peel revealed that all the parameters measured with the exception of K, Ca, and Mg were significantly ($P<0.05$) affected by location. The crude protein values where significantly ($P < 0.05$) different, with the highest crude protein values obtained from Okada. The crude fibre, ether extract ash and nitrogen free extract from the four (4) locations where all significantly ($P<0.05$) different. The crude protein (CP) ranged between 3.9 and 5.0 %, CF between 11.50 and 12.75 % while that of EE, Ash and NFE ranged from 1.30 to 2.12 %, 7.5 to 8.1 % and 65.2 % to 66.38 % respectively.

The chemical composition of the brewer spent yeast (Table 1) revealed that the crude protein (CP) value to be 49.50 %, NFE of 35.90 % and 0.00 % CF.

Table 1: Proximate Composition and some Minerals of Cassava Peels Collected from Benin City, Okada, Warri and Koko and Brewer's Spent Yeast

Parameter	Cassava Peels				Mean (X)	±SEM	Brewers' Spent Yeast
	Benin City	Okada	Warri	Koko			
Moisture Content (%)	8.500^{a}	7.200^{c}	7.967^{b}	8.000^{b}	7.917	0.307	6.10
Crude protein (%)	4.600^{b}	5.000^{a}	3.900^{c}	4.100^{c}	4.400	0.0646	49.50
Crude fibre (%)	12.00^{bc}	11.50^{c}	12.50^{ab}	12.7^{a}	12.175	0.1581	0.00
Ether extract (%)	1.300^{d}	1.817^{c}	2.123^{a}	2.000^{b}	1.81	0.0359	1.50
Ash (%)	7.500	8.1	7.517	8.000	7.7793	0.250	7.00
Nitrogen free extract (%)	66.10^{ab}	66.38^{a}	65.99^{ab}	65.20^{b}	65.92	0.307	35.90
Calcium (mg/kg)	0.3000	0.2993	0.3070	0.3233	0.3074	0.01104	6.38
Phosphorus (mg/kg)	0.2990^{b}	0.3106^{b}	0.3300^{ab}	0.3567^{a}	0.3241	0.01202	2.07
Potassium (mg/kg)	0.5430	0.5834	0.5790	0.5800	0.5713	0.01419	3.00
Magnesium (mg/kg)	0.2410	0.2138	0.2400	0.2403	0.0132	0.01315	4.56
Calculated Energy (Kcal/Kg)	2987.50	3060.84	3027.37	2992.52	3017.16		3,602.45

BSY= Brewers Spent Yeast
^{abc} means with different superscripts in the same row differ ($P<0.05$) significantly.

The cassava peels from Benin City, Okada, Warri and Koko showed significant ($P < 0.05$) difference in their proximate compositions (Table 4.1). In most of the parameters measured however, cassava peels from Warri and Koko were not significantly ($P > 0.05$) different. This was also observed with Okada and Benin City. This may be related to the similarity in their soil composition as imparted on the cassava. Variations in data obtained from Okada and Koko in all the parameters, were significantly ($P < 0.05$) different. Proximity seemed to play a significant role in this disparity. The minerals considered (except P) in this research were not significantly different. Oyenuga (1968) stated that crude protein levels of crops have been attributable to environmental factors and cultivar differences.

Development and chemical composition of "caspeyeast"

The proximate and some mineral composition of three feed grades $CYP_{25\%}$, $CYP_{50\%}$ and $CYP_{75\%}$ are presented in Table 2. The results revealed that $CPY_{75\%}$ had the highest crude protein value of 35.30 which was significantly ($P<0.05$) different from the crude protein values obtained for CPY 25 % and CYP 50 %.

The crude fibre values were also significantly ($P < 0.05$) different with $CPY_{75\%}$ having the lowest crude fibre values of 3.00 % as against 8.10 % obtained $CPY_{25\%}$. Some mineral composition of CPY 25 %, CPY 30 % and CPY 75 % are presented in Table 4.2. It reveals that the phosphorus, potassium, calcium and magnesium where significantly ($P<0.05$) different from each other.

Table 2: Proximate and some Mineral Composition of "Caspeyeast" Feedstuff Grades (25 %, 50 % and 75 %)

Parameters	$CPY_{25\%}$	$CPY_{50\%}$	$CPY_{75\%}$	±SEM
Moisture content (%)	8.200^{a}	8.000^{b}	8.200^{a}	0.01667
Crude protein (%)	19.25^{c}	27.20^{b}	35.30^{a}	0.1312
Crude fibre (%)	8.100^{a}	5.000^{b}	3.000^{c}	0.1188
Ether extract (%)	1.700	1.800	1.800	0.0328
Ash (%)	5.000^{c}	5.797^{b}	7.000^{a}	0.0339
Nitrogen free extract (%)	60.95^{a}	52.2^{b}	44.70^{c}	0.1616
Phosphorus (mg/kg)	9.56^{c}	12.10^{b}	15.48^{a}	0.1667
Potassium (mg/kg)	15.46^{c}	20.8^{b}	24.03^{a}	0.0438
Calcium (mg/kg)	11.20^{c}	17.06^{b}	19.88^{a}	0.1458
Magnesium (mg/kg)	8.02^{c}	13.34^{b}	14.30^{a}	0.1222
Calculated Energy (Kcal/Kg)	3,400.731	3,385.196	3,409.574	

^{abc}means with different superscripts in the same row differ ($P<0.05$) significantly.
$CPY_{25\%}$ = 25 % Caspeyeast, $CPY_{50\%}$ = 50 % Caspeyeast, $CPY_{75\%}$ = 75 % Caspeyeast

The brewer spent yeast (BSY) had 0.00 % crude fibre and high crude protein (49.5 %). This result is similar to the report of a previous worker (Pessu, 2004). The NFE of the BSY as well recorded high value of 35.90 %. This substantiates the report of Olomu (2011) that BSY is considered a proteinous ingredient. It therefore has a high prospect in livestock feeding particularly monogastrics.

From Table 2, it is observed that increasing levels of BSY in the caspeyeast grade formulations resulted in proportionate increase in the crude protein of the emerging ingredient. This is connected with the high crude protein content of the BSY. The CF and NFE values correlated inversely with increasing percentage of BSY of the caspeyeast grades. The high energy and fibre of the cassava peel has a reflection in the observed results $CPY_{25\%}$, $CPY_{50\%}$ and $CPY_{75\%}$. The mineral compositions of the ingredients generated were positively influenced with levels of BSY inclusion.

From the present study, it can therefore be concluded that the seemly wastes – Cassava Peels and Brewers Spent Yeast – can be better utilized by the development of a feed resource referred to as "Caspeyeast". The resultant feed resource culminated into protein entity that is high in energy. Utilization of the "Caspeyeast" in livestock is recommended for further studies.

References

[1] A.O.A.C. (1999). *Official Methods of Analysis*, Association of Official Analytical Chemists. Washington D.C, U.S.A
[2] Akinfala, E.O., Matanmi, O. and Fatufe, A.A. (2007). Effect of residual cyanogenic glucosides in cassava based diets on serum metabolites of Cockerels chicks. *Proceedings of the 32nd Annual Conference of the Nigerian Society for Animal Production (NSAP)*, March 18–21. University of Calabar, Nigeria, Pp. 105–107.
[3] Edo NAA (2015). Metereology Unit of the Nigeria Airport Authority
[4] Fetuga, B.L. (1977). Animal Production in Nigeria and Feed Supplies. *Nigeria Journal of Agriculture* 2:2.
[5] Midau, A., Augustine, C., Yakubu, B., Yahaya, S.M., Kibon, A. and Udoyong, A.O. (2011). Performance of broiler chicken fed enzyme supplemented cassava peel meal based diets. *International Journal of Agricultural Sustainability*, 3: 1-4.
[6] Oladunjoye I.O., Ojebiyi O. and Amao O.A. (2010). Effect of Feeding Processed Cassava (*Manihot esculenta Crantz*) peel meal based Diet on the Performance Characteristics, egg Quality and blood profile of laying chicken. *Agricultura Tropica Et Subtropica* 43 (2)
[7] Olumu, J.M. (2011). *Monogastric Animal Nutrition Principles and Practice* 2nd Edn. A Jachem Publication, Benin City, Nigeria, P. 339
[8] Oyenuga, V.A. (1968). *Nigeria's Food and Feeding Stuffs. Their Chemistry and Nutritive Value*. Ibadan University Press, Ibadan Nigeria. P. 99.

[9] Pessu, E.R. (2004). *Development and Nutritional Evaluation of "Casiyeast" (A cassava Sieviate and Brewers Spent Yeast Combination) As a Feed Resource for Rabbits*. An M.sc. Thesis of the University of Benin, Benin City Nigeria. 135pp.
[10] Salami R.I. (1999). The Use of Two Empirical Methods of Substitution of Feedstuffs: Parboiled Cassava peel meal versus Maize in the Diets of Growing Cockerels. *Nigeria. Journal of Animal Production*, 26: 78–83.
[11] Salami, R.I. and Odunsi, A.A. (2003). Evaluations of processed cassava peel meal as substitutes for maize in the diets of layers. *International Journal of Poultry Science*, 2: 112-116
[12] Steel, R.G.D. and Torrie, J.H. (1980). *Principles and Procedures of Statistics*. McGraw-Hill Book Company Inc., New York.
[13] Tewe O.O. (2004). Cassava for Livestock Feed in Sub-Saharan African. Plant Production and Protection Division, Food and Agricultural Organization, Rome, Italy.
[14] Tewe O.O. and Kasali O. B. N. (1986). Effect of Cassava peel Processing on the Nutrient Utilization and Physiopathology of the African Giant Rat (Cricetomus gambianus. Water house). *Tropical Agriculture (Trinidad)*, 63 (2): 125–128