PROXIMATE AND GROSS ENERGY COMPOSITION OF CASSAVA PEEL MEAL FERMENTED WITH VARYING LEVELS OF BAKER'S YEAST

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ABSTRACT
This study was conducted to determine the proximate and energy composition of cassava peel meal fermented with baker's yeast. Fresh cassava peels (CPM) were milled and divided into four groups. Each group was randomly assigned to Angel baker's yeast at 0.0%, 0.2%, 0.4% and 0.6%, respectively. Each group was assigned to 0hours, 24 hours, 48 hours and 72 hours fermentation duration respectively. Results from this study indicated a significant (P<0.05) increase in crude protein (CP) content of CPM with increasing levels of yeast, resulting in T0.60 yeast level recording significantly (P<0.05) higher value (13.50%) than T0.00% (6.59%). The crude fibre content of cassava peel meal (CPM) treated with different levels of baker's yeast showed no significant (P>0.05) difference. Ether Extract (EE) decreased with increasing levels of baker's yeast from T0.20%). No discernable trend was recorded in the ash content of CPM at different levels of baker's yeast, though the control (T0.00%) recorded significantly (P<0.05) higher ash value (11.38%) than T0.20% and T0.60%. Baker's yeast levels effect showed a consistent decline in NFE values with increasing levels of baker's yeast, values for T0.00% and T0.20% were significantly (P<0.05) higher than those for T0.40% and T0.60%. The baker's yeast level effect showed increased gross energy with increasing levels of baker's yeast.

INTRODUCTION
In Nigeria, government policies in the last couple of years have been directed towards encouraging cassava production (Dambatta, 2004). This has resulted in an all year round availability of cassava, making Nigeria the world's foremost cassava producer with about 37, 504, 100 tonnes (FAO, 2013). More than 95% of cassava use requires peeling which generates up to 14 metric tonnes of waste annually (FAOSTAT, 2015). Furthermore, cassava starch production units processing tonnes of tubers per day are increasingly springing up as well as the already well established local processing of cassava into food products like *garri, fufu* etc. The first step in processing these tubers is the removal of the peels which are the two coverings of the tubers which merely end up as waste or sometimes as supplementary feed for ruminants (Adeyemi and Sani, 2013). Enormous quantity of cassava peels are therefore, produced from these cassava processing activities. This may cause environmental problems when left in surroundings of processing plants or carelessly disposed off. The common practice is to leave the cassava peels to rot away or burnt to create space for accumulation of yet more waste heaps. The heaps emit carbon dioxide and produces strong offensive smell (Aro *et al.*, 2010).

Pandy *et al.* (2000) reported that the use of cassava by- products as feed or as an alternative substrate for biotechnology is a positive way to alleviate these environment issues. Cassava peels like most agricultural wastes are made up of polysaccharides which are wide spread in nature (Gardnea, 1974). The fallout of these constraints on animal feeding includes low digestibility, poor feed intake and reduced animal performance (Adegbola and Oduoza, 2002). Egbunike *et al.* (2009) reported decreased performance with up to 5% inclusion of cassava peel meal in broilers diets and Osei *et al.* (1990) suggested that cassava peel meal should be used carefully in layers diets with inclusion rate of 5%.

Fermentation is one of the oldest technologies, having been used in food processing for over 600 years (Mortarjem, 2002). Fermentation enhances the nutrient content of food, the biosynthesis of vitamins, essential amino acids, protein quality and fibre digestibility. Fermentation of cassava peel with yeast has also been reported to increase protein content from 2.4% in non-fermented to 14% in fermented peels (Antai and Mbongo, 1994). Oboh and Akindahunsi (2003) reported increased digestibility of cassava peels fermented with yeast. The objective of this study therefore, was to determine the proximate and gross energy composition of cassava peel meal fermented with various levels of baker's yeast.

MATERIALS AND METHODS

This study was in the Department of Animal Science and Technology, Federal University of Technology Owerri, Imo State. Fresh cassava peels used for this study were collected from Cassava-processing centres around Eziobodo in Owerri West L.G.A. The fresh peels were milled through an Epic Agro® grater with 2mm sieve. Angels® baker's, Eva® bottled water were procured from reputable dealers in Owerri, Imo state. The freshly milled cassava peels labeled cassava peel meal (CPM) were divided into four groups of 3kg each and each group was randomly assigned to one level of baker's yeast which were thereafter labeled as treatments; 0.00%, 0.20%, 0.40% and 0.60% translating into 0.0g baker's yeast/kg CPM, 2.0g baker's yeast/kg CPM, 4.0g baker's yeast/kg CPM and 6.0g baker's yeast/kg CPM. The required quantity of yeast/kg CPM for each treatment group was dissolved in 40cm^3 of water to form a consistent yeast solution and thereafter thoroughly mixed with the cassava peel meal in a plastic container. Each treatment group was then fermented for 0 hour, 24 hours, 48 hours and 72 hours in three replicates of 1kg each in a 4x4 factorial arrangement of a completely randomized design (CRD) experiment. The samples were left to ferment in an aerobic condition for the required duration except the group on 0 hour fermentation. The samples where sundried in replicates until they became crispy, pulverized to a fine powder and samples for analysis taken on replicate basis. Proximate composition was determined using AOAC (2010), while gross energy was determined using the bomb calorimeter method as outlined by AOAC (1995). Data collected were subjected to analysis of variance (ANOVA) as outlined by Snedecor and Cochran (1978). Duncan New multiple Range Test (DNMRT) as outlined by Obi (1990) was used to separate the means where significant treatment effect existed, using R – Core Team (2012) application.

RESULTS AND DISCUSSION

Fermentation duration effects on the proximate composition of CPM are presented in Table 1. Crude protein (CP) value decreased up to 48hours fermentation duration and the control (0hr) produced the highest value. This result was at variance with the report of Boonnop (2014). Crude fibre showed a consistent reduction up to 48hours fermentation duration but increased at 72hours fermentation duration.Fermentation duration effect did not show any consistent effect on the ether extract content 1 though the highest value was obtained at 72hours fermentation duration. Oboh and Elusiyan (2007) reported an increased fat and reduced carbohydrate content of cassava flour treated with *S. cerevisae*. Increase in fat might have been as a result of the secretion of microbial oil during fermentation (Akindumila and Glatz, 1998; Oboh and Akinahunsi, 2003). NFE value increased with duration of fermentation up to T48hrs with the control (0hr) recording a significantly ($P<0.05$) lower NFE value (56.78%) than the other groups. The report of Oboh and Akindahunsi (2003) seem to corroborate the observed pattern in this study with unfermented cassava peel recording 64.6%, naturally fermented, 67.3% and inoculated fermented, 60.5%. Ash content of CPM indicated a consistent decrease up to 48hrs fermentation duration with the control (0hr) recording a significantly ($P<0.05$) higher value (11.50%) than other groups. Gross energy increased with increasing fermentation duration resulting in the control (0hr) and 72hrs recording the lowest and highest values, respectively.

The baker's yeast level effect (Table 2) indicated an increase in CP content of CPM with increasing levels of yeast, resulting in 0.60% yeast level recording significantly ($P<0.05$) higher value (13.50%) than the 6.59% obtained for the control (0.00%). Oboh and Akindahunsi (2003) similarly, reported 11.1% protein for naturally fermented and 14.0% for inoculated fermented compared to 8.2% protein for unfermented cassava peel meal. Ether extract value decreased with increasing levels of baker's yeast from 0.20%. Baker's yeast levels effect did not follow any discernable pattern though the control (0.00%) recorded significantly (P<0.05) higher ash value (11.38%) than 0.20% and 0.60%.

Conversely, baker's yeast levels effect produced a consistent decline in NFE values with increasing levels. NFE values for 0.00% and 0.20% were significantly (P<0.05) higher than those for 0.40% and 0.60%. The decrease might be attributed to the fungi/bacterial complex which hydrolyzed starch into glucose for use by the microorganisms to synthesize fungi/bacteria biomass rich in protein (Oboh *et al,* 2002; Osman, 2011). Similarly, gross energy increased with increasing levels of baker's yeast.

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Table 1: Fermentation duration effect on the proximate composition and gross energy of cassava peel meal fermented with baker's yeast

Parameters	Duration of fermentation (hours) 0	24	48	72	SEM
Dry Matter (%)	84.28^{b}	84.47^{b}	84.77^{b}	87.47^{a}	0.33
Crude protein (%)	10.59^{a}	10.44^{ab}	9.78^{b}	10.15^{ab}	0.40
Crude fibre (%)	20.31^{a}	19.70^{a}	16.66^{c}	18.94^{b}	0.28
Ether extract (%)	0.79^{a}	0.93^{b}	0.83^{a}	0.94^{b}	0.03
Ash (%)	11.50^{a}	10.25^{b}	10.07^{b}	10.34^{b}	0.18
Nitrogen free extract (%)	56.78^{c}	58.63^{b}	62.54^{a}	59.50^{b}	0.53
Gross Energy (Kcal/kg)	3288.71^{c}	3366.33^{b}	3337.10^{bc}	3457.11^{a}	16.49

^{abc} Means within a row with different superscripts are significantly different (P<0.05)

Table 2: Baker's yeast levels effect on the proximate composition and gross energy of fermented cassava peel meal

Parameters	Levels of baker's yeast (%) 0.00	0.20	0.40	0.60	SEM
Dry Matter (%)	84.99^{ab}	84.58^{b}	85.57^{a}	85.85^{a}	0.33
Crude protein (%)	6.59^{d}	9.37^{c}	11.48^{b}	13.50^{b}	0.40
Crude fibre (%)	18.96^{ab}	18.53^{a}	19.53^{b}	18.60^{a}	0.28
Ether extract (%)	0.93^{a}	0.95^{a}	0.89^{ab}	0.72^{b}	0.03
Ash (%)	11.38^{a}	10.04^{b}	10.43^{ab}	10.31^{b}	0.18
Nitrogen free extract (%)	52.88^{a}	51.95^{a}	49.18^{b}	48.94^{b}	0.53
Gross Energy (kcal/kg)	3297.80^{b}	3346.52^{ab}	3391.25^{b}	3413.68^{a}	16.48

^{abcd} Means within a row with difference superscripts are significantly different (P<0.05)