METABOLISABLE ENERGY VALUE AND ANTI-METABOLITES OF CASSAVA PEELS PRODUCTS IN POULTRY

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ABSTRACT
The metabolisable energy value and antinutrient composition of cassava peel products were determined in this study. Four cassava peel products namely; coarse cassava peel mash (CCPM), fine cassava peel mash (FCPM), whole cassava peel mash (WCPM) and sundried cassava peel meal (SCPM) were processed from fresh cassava peels. The products were assessed for energy values and antimetabolites. Results showed that CCPM had significantly higher ($P<0.05$) gross energy (3577.20KKcal/Kg), while FCPM had the highest apparent metabolisable energy (2862.7) Kcal/Kg). The SCPM contained the highest ($P<0.05$) cyanide, oxalate, tannin, saponin and alkaloids which ranged from 14.52-20.63mg/100g (cyanide), 28.24-68.58mg/100g (Phytate), 6.15-9.13mg/100g (oxalate), 67.79-286.97mg/100g (tannin), 1.21-3.83mg/100g (saponin) and 5.97-10.08mg/100g (alkaloids). It was concluded that processing of cassava peels helped to reduce antinutrient composition of cassava peel products and increased metabolisable energy of cassava peel products.

Keywords: Nutrients, Chemical composition, Anti-nutritional factors, Agro-industrial by-products

INTRODUCTION

The increasing cost of feedstuffs has resulted in amplified search and use of alternative ingredients, particularly, as energy and protein sources. The increased search is largely caused by poor yield, reduced annual rainfall and increase cost of raw materials. Morgan and Choct (2016) have attributed increased drought and competitions between human and animal industry as contributors to high raw materials cost. Recently, the price of maize and soya increased by 78 and 100% in December 2020, from an initial price of 90 and 110 naira in January 2020, respectively.

The average usage of maize in commercial poultry feed is between 50-60% while soybean meal, between 20-30%. Significant saving would be made if the usage of maize is reduced. Cassava tuber and cassava peels are one of the products that could help reduce the consumption of maize (Morgan and Choct, 2016; Etuk *et al.,* 2017). Cassava peels are less competed for by human industry and is an Agro-Industrial By-products (AIBs) from cassava tuber processed for human industry.

Sundried cassava peels is the most common form of cassava peel presentation of cassava peel. However, authors have suggested that different processing methods such as fermentation, boiling and physical methods could help to reduce the antinutrients and microbial toxins (Okike *et al.,* 2015; Etuk *et al.,* 2017) level of the cassava peels. Okike *et al.* (2015) submitted that combination of physical processing methods using similar machinery for garri production could help to address the challenge. Three products named fine, whole and coarse cassava peel mash were developed from cassava peels. The new products need to compare with the conventionally known sundried cassava peel.

The usage and preference of any cassava peel products require adequate knowledge of metabolisable energy and anti-nutrients. There is therefore the need to determine the metabolisable energy of cassava peel products and anti-nutrient, which is the reason for this study.

MATERIALS AND METHODS

Test Materials

Four cassava peel products namely sundried cassava peel meal (SCPM), fine cassava peel mash (FCPM), coarse cassava peel mash (CCPM) and whole cassava peel mash (WCPM) were used for this study. Fresh cassava peels were obtained from garri processing plant. A fraction of the fresh cassava peel was sundried for 3-5 days, plate milled and named SCPM. The remaining cassava peels were grated, dewatered using hydraulic press overnight. The cake obtained was pulverised and sundried was named WCPM. A fraction of the cake was also pulverised and sieved to obtain the coarse and fine fraction. Both fractions were then sundried to obtain CCPM and FCPM.

Experimental Site

The study was carried out at the Poultry Unit, Teaching and Research Farm, University of Ibadan, Ibadan. Laboratory analyses were undertaken at the Department of Animal Science Laboratories, University of Ibadan.

Determination of Antinutrients in Cassava peel products

The anti-nutrients determined were cyanide (Bradbury *et al.*, 1999; Egan *et al.*, 1998), phytate (Wheeler and Ferrel, 1991), oxalate (Oke, 1969), saponin (Harborne, 1984) and alkaloids of each cassava peel products in quadruplicate.

Apparent Metabolisable Energy of Cassava Peel Products Determination

Apparent metabolisable energy determination of FCPM, WCPM, CCPM and SCPM were determined using 108, 21-day old Abor Acres broiler chicks; practical diet replacement method of Hills and Anderson (1958) as explained by Mandal *et al.* (2006) was employed in a completely randomized design.

Nine groups of broiler chickens were offered nine dietary treatments. They were replicated 6 times with 3 birds per replicate. Diet I was conventional reference grower diet, while diets II, III, IV, V, VI, VII VIII and IX had maize in reference diets replaced with 20% and 40% CCPM, FCPM, SCPM and WCPM.

The average feed intake was determined before feeding. The quantity consumed was used to calculate the average feed consumption during this period and the average feed to be consumed for the next three days of data collection.

Total excreta was collected and used. The excreta were oven-dried, the gross energy of feed, excreta was determined with e2K model of Oxygen bomb calorimeter. The metabolisable energy and dry matter of the seven diets were calculated.

Calculation of AME_N

The apparent metabolisable energy values of the diets were determined using the method of Hill and Anderson (1958) adopted by Mandal *et al.,* (2006). The apparent metabolisable energy values of the test cassava peel products were calculated using simultaneous equations: AME_n=0.80R+0.20T and 0.60R + 0.40T (where R is the AMEn of reference diet and AMEn of the Test ingredient is represented as T).

Statistical Analysis

The design was a completely randomized design. Data were subjected to analysis of variance using the procedure of SAS (2002).

RESULTS AND DISCUSSION

The anti-nutrients content and energy values of cassava peel products are presented in Tables 1 and 2. The results showed that anti-nutrients levels in cassava peel products were influenced. The SCPM had the highest (P<0.05) level of cyanide (20.63mg/100g), oxalate (9.13 mg/100g), tannin (86.97mg/100g), saponin (3.83 mg/100g) and alkaloids (10.28 mg/100g). Phytate (68.58 mg/100g) was highest (P<0.05) in WCPM. Anti-nutrients have been reported to influenced utilisation and absorption of nutrients with cyanide considered the most toxic anti-nutrients in cassava (Montagnac *et al.,* 2009). The cyanide levels of the cassava peel products were lower than European countries standard of less than 50mg/Kg of HCN (Okafor and Nwabuko, 2003).

The phytate levels obtained for all the cassava peel products were lower than value reported by Oboh (2006). The phytate levels were observed to be higher than cyanide levels in the products. Oxalates values reported for the cassava peel products were lower than 33mg/100g reported by Aro *et al.* (2010) and the values were lower than 100,000 mg/100g considered to be deleterious to animals (Matham and Sutherland, 1992). Higher tannin level has been reported to result in toxicity, poor nutrient utilisation and sometimes death (Garg *et al.,* 1992; Salinikowe *et al.,* 2001). Varietal differences could be responsible for the difference between anti-nutrient of the cassava peel products obtained to cassava peels figures reported by Aro *et al.* (2010).

Table 1: Anti-nutrients content (mg/100g) of cassava peel products

Parameters	Sundried cassava peel meal	Coarse cassava peel mash	Fine cassava peel mash	Whole cassava peel mash	SEM
Cyanide	$20.63^{a} + 0.47$	$14.52^{d} + 0.18$	$19.25^{b} + 0.31$	$15.62^{c} + 0.24$	0.76
Phytate	$28.24^{d} + 1.35$	$43.09^{c} + 2.38$	$61.37^{b} + 0.9^{4}$	$68.58^{a} + 2.46$	4.78
Oxalate	$9.13^{a} + 0.17$	$7.53^{c} + 0.26$	$6.15^{d} + 0.21$	$8.05^{b} + 0.10$	0.33
Tannin	$86.97^{a} + 0.29$	$67.79^{d} + 0.33$	$74.64^{c} + 0.06$	$81.35^{b} + 0.42$	2.17
Saponin	$3.83^{a} + 0.16$	$1.32^{c} + 0.02$	$2.09^{b} + 0.06$	$1.21^{c} + 0.03$	0.31
Alkaloid	$10.08^{a} +0.04$	$5.97^{d} + 0.14$	$7.50^{c} + 0.14$	$9.58^{b} + 0.07$	0.50

[abc] Means with the same superscripts in the same row are not significantly different (P>0.05)

Table 2 Energy content (Kcal/Kg) of cassava peel products

Parameters	Sundried cassava peel meal	Coarse cassava peel mash	Fine cassava peel mash	Whole cassava peel mash	SEM
Gross energy	3511.80^{b}	3577.20^{a}	3400.70^{c}	3377.30^{c}	24.89
AME	2581.84^{b}	2593.65^{b}	2862.70^{a}	2752.23^{a}	40.45

[abc] Means with the same superscripts in the same column are not significantly different (P>0.05) AME= Apparent metabolizable energy, SEM= Standard error of mean.

Saponin has been reported to prevent the absorption of cholesterol in the small intestine (Farell, 2013). Though, values obtained were lower than those reported by Aro *et al.* (2010) for cassava peel. Alkaloid contents were within the safety margin for consumption. McDonald *et al.* (2010) had reported that alkaloid content below 0.6g/kg was safe for consumption.
Energy indices are important tools in the measurement of available energy in feedstuffs. The cassava peel products studied has lower energy content compared to maize. The cassava peel products had lower gross energy compared to 3714Kcal/kg reported by Hoai *et al.* (2011) for cassava meal. The apparent metabolisable energy was highest in FCPM and was an indication that higher gross energy does not translate to higher metabolisable energy. This study also disagrees with Ravindran (2013) submission that 30% of ingested energy was lost as feaces. The lower apparent metabolisable energy obtained for SCPM could be due to the influence of higher anti-nutritional factors in it.

CONCLUSION AND RECOMMENDATION

Sundried cassava peel meal had the highest cyanide, oxalate, tannin, saponin and alkaloid content but phytate. The processing methods also improved the apparent metabolisable energy of the new products; FCPM recorded the highest apparent metabolisable energy.

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