

BAP -25

Hydrogen Cyanide and Phytate Content of Cassava Peel Meal Fermented with Different Levels of Baker's Yeast

I.U. Obasi¹, E.N. Obasi², C.T. Ezeokeke¹ and E.B. Etuk¹

¹Department of Animal Science and Technology, Federal University of Technology, Owerri

²Department of Animal Breeding and Physiology, Michael Okpara University of Agriculture, Umudike.

Abstract

This study determined the hydrogen cyanide (HCN) and phytate content of cassava peel meal fermented with Angel® baker's yeast (*Saccharomyces cerevisiae*). Fresh cassava (CPM) were milled and divided into four groups. Each group was randomly assigned to Angel® baker's yeast at 0.00%, 0.20%, 0.40% and 0.60% respectively. Each group was further assigned to 0hour, 24 hours, 48 hours and 72 hours fermentation duration, respectively in a 4 x 4 factorial arrangement of a completely randomized design (CRD) experiment. Results showed that HCN content of the cassava peel meal fermented with baker's yeast ranged from 5.86mg/kg for 0.40%/24hours to 13.29mg/kg for 0.20%/0hour. Baker's yeast level showed no significant ($p>0.05$) effect of CPM fermentation, fermentation duration effect on CPM indicated a significantly different ($p<0.05$) value at 24hrs fermentation duration. Phytate content ranged from 1293.33mg/kg to 3136.66mg/kg with treatment 0.20%/24hours and 0.40%/48hours recording the lowest and highest values. Baker's yeast level effect on phytate content indicated a significant ($p<0.05$) increase at 0.40%. The baker's yeast level effect showed decreased HCN level with increasing levels of baker's yeast.

Keywords: Cassava peel, hydrogen cyanide, phytate, anti-nutritional factors

Introduction

Cassava peels can represent 5 to 15% of the root and like most agricultural wastes are made up of polysaccharides which are widespread in nature (Gardnea, 1974; Nwokoro *et al.*, 2005; Aro *et al.*, 2010). The peels are obtained after the tubers have been water-cleansed and peeled mechanically (Aro *et al.*, 2010) and may contain high amounts of cyanogenic glycosides and other anti-nutritional factors than other tuber parts (Tewe, 2004). Generally, cassava peels have low protein content (< 6% DM) and high and variable fibre content (10-30% DM) (Heuzé *et al.*, 2014). Indeed, the use of most agricultural by-products such as cassava peels is plagued by their high levels anti-nutrients such as hydrogen cyanide (HCN), phenols (tannins), phytate and low protein (Taabu *et al.*, 2015). The fallout of these constraints on non-ruminants animal feeding includes low digestibility, poor feed intake and reduced animal performance (Adegbola and Oduoza, 2002). In order to reduce the cyanogenic glycoside, sun-drying, ensiling, and soaking have yielded some satisfactory results (Adegbola and Asaolu, 1985; Tewe, 1992; Salami and Odunsi, 2003). Nevertheless, solid fermentation of a mixture of cassava peels and waste water from fermented cassava pulp with *Saccharomyces cerevisiae* and *Lactobacillus* spp. has been reported to result in a product with lower cyanogenic glycosides, lower phytate content and higher protein content (Obob, 2006; Ubalua, 2007).

Detoxification of anti-nutrients in cassava peels especially cyanide, tannins and phytate by fermentation have been reported (Obob and Akindahunsi, 2003). Obob and Akindahunsi (2003) reported increased digestibility of cassava peels fermented with yeast. This makes fermentation a processing method with multiple potential of reducing anti-nutrients and improving nutrient content and digestibility of cassava peels in non-ruminant diets. Based on this and widespread availability of cassava peels, it became important to evaluate a simple procedure of fermenting cassava peel meal with commercial baker's yeast to determine anti-nutritional content.

This study therefore, determined the content of hydrogen cyanide and phytate content of cassava peel meal fermented with different levels of Angel® baker's yeast.

Materials and Methods

Fresh cassava peels were collected from cassava processing centres around Eziobodo in Owerri West LGA. The fresh peels were milled using 2mm grater sieve, baker's yeast, 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 Angel® baker's yeast (*Saccharomyces cerevisiae*) 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, 0.4g baker's yeast/kg CPM and 0.6g

baker's yeast/kg CPM. The required quantity of yeast/kg CPM for each treatment group was dissolved in 40cm³ of Eva®water to form a consistent yeast solution and thereafter, thoroughly mixed with cassava peel meal in a plastic container. Each treatment group was then fermented for 0hour, 24hours, 48hours and 72hours in three replicates of 1kg CPM 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 0hour fermentation. The samples were sundried in replicates within 2days to a crispy state, pulverized to a fine powder and samples for analysis taken on the replicate basis. Hydrogen cyanide was determined using spectrophotometric method as outlined by AOAC (1979), while phytate was determined using AOAC (1996). Data collected was 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

Hydrogen Cyanide (HCN): HCN content of the cassava peel meal fermented with baker's yeast ranged from 5.86mg/kg for T_{0.40%/24hours} to 13.29mg/kg for T_{0.20%/0hour} (Table 1). The values obtained in some of the treatments were higher than the 10mg HCN level for cassava products by the FAO. Baker's yeast level showed no significant ($p>0.05$) effect of CPM fermentation in all the durations (Table 2). The HCN content obtained from this study was slightly lower than that reported by Oboh (2005) for cassava peels fermented naturally with a range of 6.2-23.5mg/kg HCN. The fermentation duration effect (Table 3) on CPM indicated a significantly ($p<0.05$) highervalue at 24hrs fermentation duration. A significantly higher HCN (10.37mg/kg) result was similarly, obtained by Oboh (2005) when CPM was fermented with a mixture of *Saccharomyces cerevisiae* and *Lactobacillus caryneformis* for 24hours. The residual cyanide level of cassava pulp from the report of Ahaoutu *et al.* (2013) increased within 24 hours to 48hours with *L. plantarum* and *G. candidum* peaking at 38mg HCN/kg at 48hours fermentation duration.

Table 1: Hydrogen cyanide and phytate in cassava peel meal (CPM) fermented with baker's yeast

Levels of baker's yeast (%)	Hydrogen cyanide and phytate in fermented CPM		
	Duration of fermentation (hours)	Hydrogen cyanide (mg/kg)	Phytate (mg/kg)
T0.00	0	9.87 ^{bc}	1440.00 ^d
	24	13.05 ^a	2277.66 ^c
	48	6.02 ^d	2573.33 ^{bc}
	72	6.25 ^d	1708.00 ^d
T0.20	0	13.29 ^a	2463.30 ^{bc}
	24	11.22 ^{ab}	1293.33 ^d
	48	7.22 ^{cd}	2176.67 ^c
	72	9.74 ^{bc}	1601.66 ^d
T0.40	0	6.25 ^d	1601.60 ^d
	24	5.86 ^d	1580.00 ^d
	48	12.48 ^{ab}	3136.66 ^a
	72	7.69 ^{cd}	1486.66 ^d
T0.60	0	9.93 ^{bc}	1520.00 ^d
	24	11.11 ^{ab}	2886.66 ^{ab}
	48	7.93 ^{cd}	1551.66 ^d
	72	9.84 ^{bc}	2553.33 ^{bc}
SEM		0.41	88.60

^{abcd} Means within a column with different superscript are significantly different ($p<0.05$)

Phytate: The phytate values of the CPM fermented with baker's yeast showed an inconsistency within the treatment groups ranging from 1293.33g/kg to 3136.66g/kg with treatments T_(0.20%/24hours) and T_(0.40%/48hours)

recording the lowest and highest values, respectively (Table 1). Phytate levels decreased from the 48hour fermentation duration across all the baker's yeast levels except at T0.20% baker's yeast level. Baker's yeast level (Table 2) effect on phytate content indicated a significant ($p<0.05$) increase at 0.40% compared to others. Fermentation duration effect showed similar ($p>0.05$) phytate content among the treatment durations (Table 3). These results did not agree with the report of Oboh and Elusiyan (2007) that phytate reduced from 339.5mg/100g to 129.2mg/100g for low cyanide cassava flour fermented with *S. cerevisiae*. It is possible that the lower level of phytate recorded in this study resulted from the secretion of the enzyme phytase by *S. cerevisiae* during the fermentation process. Phytase is known to hydrolyse phytate. (Oboh *et al.*, 2003).

Table 2: Baker's yeast level effects on the hydrogen cyanide and phytate content of fermented cassava peel meal.

Parameters	Levels of baker's yeast (%)				SEM
	0.00	0.20	0.40	0.60	
Hydrogen cyanide (mg/kg)	9.84	10.31	8.42	8.45	0.63 ^{ns}
Phytate (mg/kg)	1756.25 ^a	2009.42 ^a	2359.58 ^b	1837.42 ^a	146.08

^{ab} Means within a row with different superscripts are significantly different ($p<0.05$), ^{ns} = not significant

Table 3: Fermentation duration effect on the hydrogen cyanide and phytate content of cassava peel meal fermented with baker's yeast

Parameters	Fermentation duration (hours)				SEM
	0	24	48	72	
Hydrogen cyanide (mg/kg)	8.87 ^a	10.37 ^b	8.07 ^a	9.71 ^a	0.63
Phytate (mg/kg)	1999.75	1883.75	1951.25	2127.92	146.08 ^{ns}

^{ab} Means within a row with different superscripts are significantly different ($p<0.05$), ^{ns} = not significant

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