# Effect of Ensiling Period on the Proximate Composition and Hydrogen Cyanide Content of Ensiled Wet Cassava Peels Meal

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***Abstract:*** **Cassava peel is an agro-waste product produced in the processing of whole cassava roots into different food and industrial products in Nigeria. The use of cassava peel as feed for non- ruminant animals is limited by its high crude fibre and hydrocyanic acid contents but low protein content. To improve its nutritional potential as energy source, an experiment was conducted to examine the effect of ensiling periods on the proximate compositions and hydrogen cyanide contents of wet cassava peel meals. Wet cassava peels were ground into meal using an attrition mill and divided into 4 batches. The first batch was sundried immediately after grinding while the second, third and fourth batches were sundried after ensiling in black polythene bags kept under room temperature for 7, 14 and 21 days, respectively. Ensiling significantly ($p<0.05$) increased the dry matter contents of the meals with the 14 days ensiled meal having the highest value. The un-ensiled and 7days ensiled samples had similar and significantly (p<0-05) higher crude protein values than the 14 and 21 days ensiled samples. The 21 days ensiled sample had lowest crude protein (3.36%) and ether extract (4.44%) values but highest crude fibre (17.10%), ash (20.19%) and NFE (54.09%) values that were significantly($p<0.05$) different from other treatment groups. The 14days ensiled sample had the highest calculated ME (2466.86kcal/kg) value that differed significantly ($p<0.05$) from the other treatment groups. HCN concentration was lowest ($p<0.05$) in the 21 days ensiled sample (0.20mg/kg). It is concluded that the period of ensiling wet cassava peels meal affected its proximate compositions and HCN contents, and that ensiling for 14 days resulted in higher DM, fat and energy values and should be encouraged.**

***Keywords*; Cassava peels, hydrocyanic acid, ensiling, proximate composition, processing.**

## I. INTRODUCTION

The poultry industry in most developing countries suffer differing degrees of feed challenges because conventional feedstuffs such as cereal grains, soybean meal and the like are scarce or hard to acquire as a result of high cost. In response, many Nutritionist and Feed manufacturers are focusing on neglected and underutilized resources in an effort to develop non-conventional feed sources and apply them as functional or nutritional ingredients. Several researchers have confirmed the suitability of cassava peels meal as a source of low-cost energy ingredient in poultry diets (Abubakar and Ohiaege, 2011**;** Bukola, 2013; ILRI, 2018)

Cassava peel is a waste product from the peeling of fresh cassava roots before processing into various products in Nigeria. It constitutes about 5 - 15% of the whole root when peeled mechanically (Aro *et al*., 2010) and 20 – 35% with hand peeling (Olanbiwoninu and Odunfa, 2012). Available data indicates that about 25 million tons of fresh cassava roots are used for garri, 6 million tons for local food products, 1.5 million tons for production of dried chips and 3.5 million tons are lost to wastage before or during peeling and processing of the tubers ( ILRN, 2017). This implies that about 50 to 150Kg and 200 to 350Kg of cassava peels are produced per ton of cassava roots from mechanical and hand peelings, respectively. The cassava peels so produced will be wasted if adequate measures are not put in place to convert them to animal feedstuff.

According to Tewe, (2004) the use of cassava peel as feed for non- ruminant animals is limited by its high crude fibre and hydrocyanic acid contents which is deleterious to their growth and development. Many processing methods including; sun-drying (Oboh, 2006; Akinfala *et al*., 2007), parboiling (Salami, 1999), soaking in water and retting (Salami and Odunsi, 2003), fermentation and boiling (Okah *et al*., 2017; Unigwe *et al*., 2018), and treatment with yeast and enzymes (Obasi *et al*., 2018; Dayal *et al*., 2018) among others have been used to reduce the anti-nutritive factors in cassava peels and enhance its feeding value for livestock and poultry. Of all these processing methods, drying has been found to be more effective with the only setback that, it takes approximately 3 to 5 days for the peels to properly dry, hence it is more feasible and effective during the dry season of the year (Adesehinwa *et al*., 2011). Tewe and Egbunike (1992) suggested the need for proper technology to produce cassava products of guaranteed quality that will meet the nutritional needs of the fast growing monogastric livestock.

Fortunately, the technology of innovative processing of cassava peels by grating, pressing, sieving and drying of cassava peels developed by International Livestock Research Institute (ILRI 2015) to produce High Quality Cassava Peel

(HQCP) fine mash has reduced the drying time drastically from 3 to 5 days to about 6 hours, resulting in improvement of the product, in terms of quality and quantity. The innovative processing method substantially reduced the HCN content and dustiness in cassava peels based products but the low crude protein content, poor amino acid profile and high fibre content remained unchanged (Okike *et al.*, 2015). The method according to the author is not as efficient as when grating tubers but requires about 3 cycles of grating to achieve the desired particle size with fresh peels. The use of an attrition mill instead of grating mill for processing wet cassava peels and ensiling is expected to reduce the grating time, take care of older peels and improve its nutritive value. The present study was therefore designed to determine the proximate compositions and hydrogen cyanide content of differently ensiled wet cassava peels meals produced with an attrition mill.

## II. MATERIALS AND METHODS

*Sources and processing of test materials*

Fresh cassava peels were collected by going to small-to-medium scale processing plants and networks of producers, processors and marketers (supplying fresh tubers and selling finished cassava products) in and around Umuapu communities in Imo state, Nigeria. The packed peels were bagged and transported to the processing site. The fresh cassava peels were ground into meal using an attrition grinding mill, (as soon as it was collected). The meal was then divided into 4 batches. The first batch was sundried immediately after grinding while the second, third and fourth batches were bagged inside 3 black polythene bags, pressed to eliminate traps of air, sealed and stored under room temperature for 7, 14 and 21 days, respectively. The ensiled products were then sun dried for 1-2 days depending on the intensity of the sun to produce ensiled cassava peels meal, which was stored in air free room for two-three months.

*Proximate and Hydrogen cyanide Analysis of Samples*

Samples of the un-ensiled and differently ensiled cassava peel meals were analyzed for their proximate compositions and hydrogen cyanide contents. The proximate analyses of the samples were carried out according to the methods of Association of Official Analytical Chemist (AOAC 1996, 2010) while that of hydrogen cyanide (HCN) contents were determined, using the AOAC (2002) analytical methods. All analyses were done in triplicates.

*Data Collection and Analysis*

All the proximate and HCN values were expressed as mean ± standard deviation. Means were compared using the least significant difference (LSD) at 5% level of significance.

## III. RESULTS AND DISCUSSION

*Proximate Composition of ensiled wet cassava peels meals.*

The chemical compositions of un-ensiled and differently ensiled WCP meals are shown in table 1. Ensiling increased ($p<0.05$) the dry matter (DM) contents of the meals with the 14 days ensiled meal having the highest DM (92.81%) value. Extending the ensiling period from 14 to 21days decreased the value from 92.81 to 91.14%. The DM value of the 14 days ensiled meal was slightly higher than the value of 92.27% reported by Okike *et al*. (2015) for wet grated un-ensiled meal. This tend to show that ensiling had positive effects on the DM content of the meal but should be limited to 14 days for higher DM value.

The crude protein contents of the un-ensiled and ensiled samples ranged from 3.36 - 4.48%. The crude protein values decreased with increasing period of ensiling with 21 days ensiled meal having the lowest ($p<0.05$) crude protein value. The un-ensiled meal had the highest crude protein (4.48%) followed by 7days ensiled meal (4.47%) sample. The results tend to show that ensiling reduced the crude protein value of the meal possibly due to microbial use of nutrients. However, except for the 21 day ensiled meal all the crude protein values obtained in this study were higher than 4.0%CP reported for HQCP meal (Okike *et al*., 2015). The higher values recorded contrary to the earlier reports may be attributed to varietal differences and differences in the processing method adopted.

The ether extracts content of the products ranged from 4.44 – 7.43%. Ensiling significantly ($p<0.05$) increased the ether extract contents of the 7 and 14 days ensiled samples but decreased that of the 21 days ensiled sample when compared with the un-ensiled sample. Extending the ensiling period from 14 to 21days decreased the value from 7.43 to 4.44%. The values recorded were higher than 0.8 and 0.7% reported in literature for un-ensiled samples (Okike *et al*., 2015; Amole *et al*., 2019) thus indicating that ensiling had positive effect on the ether extract content of the meal.

The crude fibre contents of ensiled wet cassava peel meals ranged from 13.88 - 17.10%. The 7 days ensiled products had the lowest ($p<0.05$) crude fibre value while the 21 days had the highest value when compared with the other treatment groups. The crude fibre values recorded in this study were lower than 18.14% reported in literature for un-ensiled samples (Okike *et al*., 2015). The results tends to show that the longer the ensiling period the higher the crude fibre value due possibly to use up of nutrient by microbes.

The Ash contents ranged from 18.42 – 20.19 %. The 14 and 21 days ensiled products had the lowest and highest ash values, respectively. The ash values recorded irrespective of the ensiling period were higher than 4.13 and 6.4% reported in literature for non-ensiled samples (Okike *et al*., 2015; Amole *et al*., 2019). The high ash values recorded may be attributed to the sand present in the un-sieved cassava peels as against the sieved peels used in earlier reports.

The Nitrogen free extract (NFE) values ranged from 46.29 – 54.09%. The 21 days ensiled sample had the highest value followed by the 14 days ensiled sample. The results revealed a slightly increased NFE values with increasing ensiling period. This tends to show that ensiling wet cassava peel meal up to 21 days had positive effects on the calculated NFE value.

Table 1.: Effect of ensiling period on proximate compositions and hydrogen cyanide contents of wet cassava peel meals (DM)

| Parameter (%) | 0 day | 7days | 14days | 21days | SEM |
|---|---|---|---|---|---|
| Dry matter | 90.98[d] | 91.54[b] | 92.81[a] | 91.14[c] | 0.14 |
| Crude protein | 4.48[a] | 4.47[a] | 4.23[b] | 3.36[c] | 0.09 |
| Ether extract | 6.27[b] | 7.10[a] | 7.43[a] | 4.44[c] | 0.22 |
| Crude fibre | 14.61[b] | 13.88[c] | 14.77[b] | 17.10[a] | 0.23 |
| Ash | 19.33[b] | 19.30[b] | 18.42[c] | 20.19[a] | 0.12 |
| NFE | 46.29[c] | 46.79[c] | 47.96[b] | 54.09[a] | 0.60 |
| *ME( Kcal/kg) | 2321.94[c] | 2407.22[b] | 2466.86[a] | 2407.71[b] | 18.88 |
| Cyanide(mg/kg) | 1.98[a] | 0.94[b] | 0.82[b] | 0.20[c] | 0.12 |

Means in the same row with different letters are significantly different ($p < 0.05$)

*Metabolizable energy values were calculated using the method 37×%CP +81.8 × %fat +35.5 × %NFE for poultry (Fisher and Boorman, 1986)

The calculated metabolizable energy (ME) values of un-ensiled and differently ensiled wet cassava peels meals samples ranged from 2407.22 – 2466.86 Kcal/kg. Ensiling slightly increased the ME values of the samples irrespective of the ensiling period when compared with the un-ensiled sample. However, extending the ensiling period from 14 to 21days decreased the value from 2466.86 to 2407.71kcal/kg. This shows that ensiling wet cassava peel meal above 14 days decreases its ME value.

*Hydrogen cyanide content of ensiled wet cassava peels meals*

The HCN values of the un-ensiled and differently ensiled wet cassava peel meals ranged from 1.98 - 0.2mg/kg. Ensiling irrespective of the period decreased ($p<0.05$) the HCN content of the meals. Similarly, comparing HCN contents at any ensiling time reveals a gradual decrease in HCN content as the ensiling time increased. The 21 days ensiled product had the lowest HCN value followed by the 14 days ensiled sample. The values recorded were lower than 10.6 and 2.4mg/kg reported in literature for un-ensiled samples (Okike *et al.*, 2015; Amole *et al.*, 2019). This again confirmed the beneficial effect of ensiling in reducing the HCN contents in cassava peels.

## IV. CONCLUSIONS

The results of this study shows that wet milling and ensiling of cassava peels meal may be considered as a processing method and that ensiling the meal for 14 days enhanced the DM, fat and energy values and appreciably reduced the HCN content. Further studies to determine the effect of the ensiled wet cassava peels meal on growth performance of non-ruminants is suggested.

*Competing Interest*

No competing interest throughout the research periods

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