Original Research Article

Proximate and Mineral Composition of Ripe Plantain Peels, Palm Oil Mill Slurry Obtained from Different Locations in Edo State, a part of Southern Nigeria

Abstract

This study was initiated to investigate the proximate and some mineral compositions of ripe plantain peels and palm oil mill slurry obtained from some locations in Edo State, Nigeria. Results showed that the ripe plantain peels collected from Auchi, Ekpoma and Benin gave crude protein (CP) of 10.50, 11.08 and 10.50 % respectively; EE of 24.03, 25.02 and 23.84% respectively, Ash of 11.93, 12.47 and 11.00 % and 30.73, 34.87 and 37.15 % for NFE respectively. The results also showed that CF and NFE were significantly ($P<0.05$) different with regard to Locations as the highest value 10.66 % were obtained from Benin City, which significantly ($P<0.05$) differ from Ekpoma (7.99 %) and close to the value 9.59 % recorded for Auchi. The proximate composition of the palm oil mill slurry (POMS) from OKOMU, PRESCO, UDO and Benin City revealed crude protein (CP) values of 2.62, 2.04, 3.79 and 3.21 % respectively, EE of 15.76, 17.59, 12.50 and 17.62 % respectively. The comparison between local processor and industrial processor revealed that the locally processed oil palm slurry gave higher crude protein content of 3.50 % compared with 2.33 % from industrially processed slurry and the locally processed slurry had higher crude fat content. This may be accounted for by the efficiency of industrial facilities and processing methods.The results of this study has shown the proximate composition of ripe plantain peels and palm oil mill slurry as non-conventional feedstuffs that can be used effectively as animal feed to reduce production cost.

Key words: **Ripe Plantain Peels, Palm Oil Mill Slurry, Proximate and Mineral Composition, Location.**

Introduction

Plantain peels are by-products of the plantain processing industry, which are normally dumped in landfills, rivers or unregulated grounds (Osma *et al.,* 2012). The peels are mostly regarded as waste and consequently posing a threat to the environment (Auta and Kumurya, 2015; Baiyeri *et al.,* 2011). The Plantain peel which accounts for about 40 % of the total fruit weight (Gilver and Liliana, 2017) has reportedly been shown to have potential as a promising raw material which could find useful industrial applications especially in the agro-based industries. The peels have been considered for use as organic fertilizers in places like Somalia to enrich soils and enhance better crop production and yield (Eun-Hye *et al.*, 2010; Okareh *et al.*, 2015). (Omole *et al*., 2010) reported that the peels has the potentials of replacing corn starch in the diet of snail, while the bracts, fruit stalk and leaf at times are left in the farm as wastes. Ekhorotomwen and Nwokoro (2022) reported ripe plantain to be 10.50 % Crude protein, 23.84 % Crude fat, 10.66 % Crude

fibre ,(%) 11.00 % Ash, 37.15 % NFE. Ighodaro (2012) reported ripe plantain peel to be 22.30 % ash, 14.31 % fibre, 6.22 % crude fat, 42.95 % carbohydrate and 7.18 % crude protein; while the unripe plantain peel contains 6.89 % crude protein, 48.18 % carbohydrate, 3.67 % crude fat, 16.20 % fibre, 17.59 % ash. Odenigbo *et al*. (2013) also reported that unripe plantain had protein content of between 5.00 and 6.47 %; fat, 0.41 and 0.70 %; ash, 2.03 and 3.16 %; and from 89.66 - 92.31 % for carbohydrate. Also, the ripe plantain was reported to have protein of between 4.76 and 6.52 %; fat, 0.25 and 0.65 %; ash, 2.13 and 3.16 %; and carbohydrate from 89.37 - 92.70 %. Ekhorutomwen and Nwokoro (2023) reported that ripe peels in combination with palm oil mill slurry coded *MUSARPOMS*, can successfully be a substitute for maize in the diet of growing pigs in order to reduce cost of feed consumed by the animal. Meanwhile, in the chemical industry, the peels have shown potential for the generation of important chemicals like ethanol and also alkali for the manufacturing of soap (Andres *et al.,* 2015).

Palm oil production has been recognized for its contribution towards the economic growth and sustenance of most palm oil producing communities in Nigeria. Despite its economic benefits, it has also contributed to environmental pollution due to the production of huge quantities of by-products from the extraction process (Imo and Ihejirika, 2021) Palm oil mill slurry is basically a waste material from the palm oil mill industry, it is the remains after the palm oil has been carefully removed in an oil extraction process (Ekhorutomwen and Nwokoro, 2022). Palm oil and its by products are also used in the manufacturing of soaps, cosmetics, detergents, lubricants, biofuels, etc. (Ibiyemi *et al*., 2022). Numerous attempts have being made to convert palm oil mill slurry into a viable animal feed resource. While artificial drying methods have been discontinued, due to excessive fuel cost and the large capital investment required, the conversion of fresh palm oil mill effluent into a potential feedstuff now involves fermentation (Abiola-Olagunju *et al*., 2014; Ekhorutomwen and Nwokoro, 2022).

Materials and Methods

Sources of plantain peel and experimental location

In the study, samples of ripe plantain peels were collected from plantain processing Centers, from Edo North, Edo Central, and Edo South Senatorial District, Edo State, Nigeria. Palm oil mill slurry was collected from Industrial (OKOMU and PRESCO) and Local processor in UDO Community and Benin Sapele Road, Edo South, Nigeria.

Collection and preparation of plantain peels

Fresh ripe plantain peels collected from Benin City, Edo South, Nigeria were properly sun dried (30-35^{o}C), well ground and analyzed for proximate and mineral composition.

Proximate analysis

Using the method of AOAC (2010) samples of the dried and milled plantain peels and freshly collected palm oil mill slurry (POMS) were used for the determination of dry matter, crude protein, crude fibre, ash, ether extract, nitrogen free extract, Calcium and Phosphorus.

Experimental design and statistical analysis

Palm oil Mill Slurry comparison was done based on the processing technology (Industrial vs Local Processor). In the ripe plantain peels, means were separated based on agro-ecological

zones of Edo State (South vs Central vs North). Data collected were subjected to one way Analysis of Variance, using GENSTAT (2009) (12th Edition) package and means were separated using Duncan's Multiple Range Test (Steel and Torrie, 1980) at 5 % level of probability.

Results and Discussion

Table I: Proximate Composition of Ripe Plantain Peels Collected From Three Locations in Edo State

COMPOSITION	LOCATION			±SEM
	AUCHI	EKPOMA	BENIN	
Dry matter (%)	86.78^{c}	93.14^{a}	93.41^{b}	0.27
Crude protein (%)	10.50	11.08	10.50	0.67
Crude fat (%)	24.03	25.02	23.84	0.40
Crude fibre (%)	9.59^{ab}	7.99^{b}	10.66^{a}	0.51
Ash (%)	11.93	12.47	11.00	0.31
NFE (%)	30.73^{b}	34.87^{ab}	37.15^{a}	1.30
Ca (mg/kg)	86.12^{a}	72.67^{b}	62.15^{c}	0.67
Mg (mg/kg)	16.24^{a}	12.84^{b}	9.39^{c}	0.37
Na (mg/kg)	8.73^{b}	10.15^{a}	7.92^{a}	0.28
K (mg/kg)	202.86^{a}	183.22^{b}	179.46^{c}	0.97
P (mg/kg)	22.65^{b}	24.39^{b}	32.69^{a}	0.63
Pb (mg/kg)	0.34	0.35	0.42	0.03
Fe (mg/kg)	23.14^{a}	24.36^{a}	19.98^{b}	0.60

^{abc}means with different superscripts in the same row differ significantly (P<0.05). SEM - Standard Error of Means

The plantain peels collected from Auchi, Ekpoma and Benin (Table I) were not significantly (P >0.05) different in crude protein, crude fat and ash. The crude protein was 10.50, 11.08 and 10.50 % respectively; EE of 24.03, 25.02 and 23.84 respectively, Ash of 11.93, 12.47 and 11.00 % and NFE values of 30.73, 34.87 and 37.15 % respectively. As NFE, the CF was significantly (P<0.05) different with location as the highest value was obtained from Benin City (10.66 %) which significantly (P<0.05) differ from Ekpoma (7.99 %) and similar to Auchi (9.59 %). It was also observed that ripe plantain peels gave Potassium values of 202.86, 183.22 and 179.46 and mg/kg respectively, Calcium values of 86.12, 72.67, and 62.15 mg/kg and Phosphorus values of 22.65, 24.39 and 32.69 mg/kg respectively. The crude protein values obtained for Auchi (10.50 %) and Ekpoma (11.08 %) were similar to those reported by Okoeguale (2017). It was slightly higher than 9.19 % report by Akinmutimi *et al*. (2006) and 9.98 % reported by Fanimo and Odu (1996). The crude fibre value was 9.59, 7.99 and 10.66 respectively. It was higher than the 5.36 % CF value reported by Fanimo and Odu (1996), Akinmutimi *et al*. (2006) CF value (6.43 %) and 5.63 % value of Okoeguale (2017). The EE values of 24.03, 25.02 and 23.84% respectively where significantly higher when compared to the value as reported by Fanimo and Odu (1996), Akinmutimi *et al*. (2006) and Okoeguale (2017). The observed disparity may be attributed to the species (or ecotype) and soil properties of the location. The ripening stage may also have influenced the composition of the ingredient. The ash content value of 11.93, 12.47 and 11.00 were lower than 13.16 % reported by Fanimo and Odu (1996) and 16.83 % reported by Okoeguale (2017).

Table II: Proximate Composition of Palm Oil Mill Slurry (POMS) Collected from Different locations in Edo state, Nigeria.

COMPOSITION	LOCATION				±SEM
	OKOMU (I)	PRESCO (I)	UDO (L)	BENIN (L)	
Moisture Content (%)	74.23^{ab}	72.79^{bc}	75.11^{a}	71.96^{c}	0.519
Crude Protein (%)	2.62^{bc}	2.04^{c}	3.79 ^{a}	3.21^{ab}	0.25
Crude Fat (%)	15.76^{b}	17.59^{b}	12.5^{c}	17.62^{a}	0.34
Ash (%)	4.91^{ab}	4.16 ^{b}	5.16 ^{a}	4.66^{ab}	0.36
NFE (%)	2.48^{a}	3.42 ^{a}	2.92 ^{a}	2.56 ^{a}	0.71
Ca (mg/kg)	315.77^{a}	188.58^{c}	306.67^{b}	176.04^{d}	0.90
Mg (mg/kg)	281.93^{a}	175.52^{c}	241.76^{b}	156.16^{d}	1.04
Na (mg/kg)	11.65^{c}	14.94^{b}	15.06^{b}	21.39^{a}	0.41
K (mg/kg)	476.98^{a}	365.33^{c}	408.09^{b}	363.57^{c}	1.28
P (mg/kg)	27.54^{a}	9.95^{b}	10.53^{b}	9.86^{b}	0.26
Pb (mg/kg)	0.17^{c}	0.78^{a}	0.37^{b}	0.36 ^{b}	0.03
Fe (mg/kg)	10.97^{d}	18.02^{c}	21.26^{b}	29.93^{a}	0.43

^{abc}means with different superscripts in the same row differ significantly (P<0.05).SEM - Standard Error of Means, I - Industrial processor, L - Local processor

The chemical composition of the palm oil mill slurry from OKOMU, PRESCO, UDO and BENIN CITY (Table II) revealed crude protein values of 2.62, 2.04, 3.79 and 3.21 % respectively, EE of 15.76, 17.59, 12.50 and 17.62 % respectively. Samples from UDO gave the highest crude protein (3.21 %) and lowest crude Fat (12.50 %). These results are in line with previous study in Edo State (Abiola-Olagunji *et al*., 2014).

Table III: Proximate Composition of Collective samples of Palm Oil Mill Slurry (POMS) From Industrial and Local Processors

COMPOSITION	PROCESSING		±SEM
	LOCAL	INDUSTRIAL	
Moisture Content (%)	73.53	73.51	0.64
Crude Protein (%)	3.50^{a}	2.33^{b}	0.21
Crude Fat (%)	16.67	15.09	0.88
Ash (%)	5.13	4.54	0.30
NFE (%)	2.95	2.74	0.48
Ca (mg/kg)	241.00	252.00	28.8
Mg (mg/kg)	199^{b}	229^{a}	21.6
Na (mg/kg)	18.23	13.30	1.16
K (mg/kg)	386	421	19.0
P (mg/kg)	10.2^{b}	18.7^{a}	2.79
Pb (mg/kg)	0.37	0.48	0.10
Fe (mg/kg)	25.60	14.50	1.79
Ph	4.70^{a}	4.05^{b}	0.12

^{abc}means with different superscripts in the same row differ significantly (P<0.05) SEM - Standard Error of Means

The comparison between local processor and industrial processor revealed that the locally processed palm oil mill slurry gave higher crude protein content of 3.50 % compared with 2.33 % from industrially processed slurry and the locally processed slurry had higher crude fat content. This may be accounted for by the efficiency of industrial facilities and processing methods.

Plate 1 Palm Oil Mill (Local)

Plate 2 Palm Oil Mill (lndustrial)

Plate 3. Collection Process (Local)

Plate 4. Collection Process (Industrial)

Plate 5. Ground Ripe Plantain Peels

Plate 6. Fresh Ripe Plantain Peels

Plate 7. Dried Ripe Plantain Peels

Conclusion

The results from this study showed that the plantain peels collected from Auchi, Ekpoma and Benin were not significantly ($P > 0.05$) different in crude protein, crude fat and ash. The Crude Fat (CF) was significantly ($P < 0.05$) different with location. The locally processed palm oil mill slurry gave higher crude protein content of 3.50 % compared with 2.33 % from industrially processed slurry and the locally processed slurry had higher crude fat content. This may be accounted for by the efficiency of industrial facilities and processing methods.

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