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# Formulation and Development of a Feed Stock Code-Named *Musarpoms* from Locally-Derived Non-Conventional Feed-Stuffs for Animal Production

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**ABSTRACT:** Plantain peels and palm oil mill slurry are discarded as waste from the processing industry in our locality, which accumulates and thereby constituting menace to the environment. The current rising cost of grains and concentrates used in the production of livestock feeds, has led to the alternative use of non-conventional feed stuffs such as ripe plantain peels and palm oil mill slurry, amongst others. The objective of this study was to formulate and develop a feed stock from locally derived non-conventional feed stuffs for animal feeds production code-named *MUSARPOMS* using appropriate standard technique. The major ingredient for *MUSARPOMS* is ripe plantain peels and palm oil mill slurry. The results revealed that $MSP_{25\%}$ recorded highest crude protein (CP) value of 22.17 %, it was not significantly (P>0.05) different from the CP values (20.42 %) obtained from $MSP_{50\%}$ but significantly (P<0.05) different from $MSP_{75\%}$ value of 19.25 %. The crude fibre (CF) values were not significantly (P >0.05) different among the different grades. Ash and NFE values differ significantly amongst treatment. $MSP_{75\%}$ recorded highest Ash and NFE value of 8.28 % and 515.60 % respectively. It was observed that the reducing levels of *MUSARPOMS* fermented mixture grade formulations, resulted in proportional increase in the crude protein of the emerging ingredients. 25% *MUSARPOMS* grade had a higher crude protein value of 22.17 % compare to 50% *MUSARPOMS* value of 20.42 and 75% *MUSARPOMS* value of 19.25 % and far above the 10.69 % of the plantain peels.

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Considering the high and rising cost of grains and concentrates used to produce animal and livestock feeds; kitchen wastes, garbage, leftover food and other non-conventional feed stuffs can be used to feed pigs. The ability of pigs to consume a wide variety of these feeds increases its profit potentials as a business (FAO, 2013). According to Okareh *et al.* (2015) Plantain peels are discarded as waste after the inner fleshy portion has been eaten, thereby constituting menace to the environment, especially where its consumption is common and in urban areas where goats and sheep are not allowed to roam about (Oyedeji *et al*., 2015). Ripe or unripe plantain wastes can be used to feed livestock or in the production of local soap but in the areas where these are not feasible, these wastes end up polluting the environment, Williams (2001). Ajasin *et al.* (2004) reported that plantain peel contains about 12 % crude protein, 16 % crude fibre and 1,300 $kcalkg^{-1}$ energy on dry matter basis. Ighodaro (2012) also gave the proximate composition of ripe and unripe plantain peels to be respectively; 7.04 and 7.47 % moisture, 22.30 and 17.59 % ash, 14.31 and 16.20 % fibre, 6.22 and 3.67 % crude fat, 42.95 and 48.18 % carbohydrate, 7.18 and 6.89 % crude protein. It was however observed from these reports and some others that the nutritional compositions differ slightly, which could be attributed to sampling locations. Ripe plantain peel meals replaced up to 31 % of maize in growing pig diet without adverse effect on growth performance (Calles *et al*., 2000). Ironkwe and Oruwari (2012) reported that maize can conveniently be replaced with plantain peel meal in broiler finisher diet up to 50 % inclusion. However, above 50 %

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inclusion level of plantain peel, feed intake was reduced (Ironkwe and Oruwari, 2012). It is predictive that the usability of the plantain peels can be enhanced by combination with palm oil mill slurry. According to Abiola-Olagunju *et al*. (2014) fermentation process in cassava peels and palm oil mill mixture enables the breaking down of the fibre contents through microbial metabolic activities has help to improve the quality of the feed. Furthermore, these two agro by-products are abundant, constitute a waste and are capable of compromising the ecosystem when improperly disposed. Therefore, the objective of this study was to formulate and develop a feed stock from locally derived non-conventional feed stuffs for animal feeds production code-named *MUSARPOMS*.

## MATERIALS AND METHODS

*Collection and Preparation of Plantain Peels:* Fresh ripe plantain peels were collected from Benin City. This were properly sun dried (30-35ºC), ground and analyzed for proximate and mineral compositions.

*Collection of Palm Oil Slurry:* Fresh Palm oil mill slurry (POMS) was collected in a plastic container from Industrial and Local Processor, Edo South, Nigeria. Using the method of AOAC (2010) sample freshly collected palm oil mill slurry (POMS) were used for the determination of chemical components; dry matter, crude protein, crude fibre, ash, ether extract, nitrogen free extract, Calcium and Phosphorus.

MUSARPOMS Development: Fresh palm oil mill slurry was used to mix the ground Ripe plantain peels properly. The component mixture was weighed and mixed at different proportion to produce the *MUSARPOMS* 25 %, *MUSARPOMS* 50 % and *MUSARPOMS* 75 % grades**.** These were then spread on flat trays and allowed to age before drying. The sundried *MUSARPOMS* grades were milled and bagged for chemical analysis. Samples of each *MUSARPOMS* grade (25 %, 50 % and 75 %) after drying were taken for proximate analysis (crude protein, crude fibre, ether extract, ash and nitrogen free extract) using AOAC (2010) procedures. The mineral content of the plantain peel were determined using the flame photometer. *MUSARPOMS* were also examined for some physical characteristics (colour, smell, etc).

MUSARPOMS 25% Grade: This contained 25 % ripe plantain peels and 75 % Palm oil slurry. The fresh Palm oil mill slurry (POMS) was collected in a plastic container. 250 g of the milled ripe plantain peels (91.11 % DM) mixture was measured out in a wide plastic bowl and then 750 g of the palm oil mill slurry (26.48 % DM) were weighed out and put in the bowl while stirring thoroughly. The palm oil slurry and the plantain peels were thoroughly mixed. The mixture was dispensed into containers for ageing at 3 days with intermittent turning and overturning, when completely dried, the *MUSARPOMS* 25 % grade was milled and bagged.

MUSARPOMS 50 % Grade: This Contains 50 % plantain peels and 50 % palm oil mill slurry (POMS). The procedure for development was exactly the same as in the formulation of *MUSARPOMS* 25 % except that 500 g palm oil mill slurry was measured out and mixed with 500 g ripe plantain peels.

MUSARPOMS 75 % Grade: This contains 75 % plantain peels and 25 % palm oil mill slurry (POMS). Also 750 g ripe plantain peels was measured out and mixed with 250 g palm oil mill slurry. The procedure for development was exactly the same as in the formulation of *MUSARPOMS* 25 %.

*Experimental design and statistical analysis:* Data collected were subjected to a one way Analysis of Variance using, GENSTAT 2009 (12th Edition) package. Means were separated using Duncans Multiple Range tests (Steel and Torrie, 1980) at 5 % level of probability.

## RESULTS AND DISCUSSION

*Proximate Composition and Mineral Analysis of Ripe Plantain Peels:* The results of the proximate composition of ripe plantain peels are presented in Tables 1. The proximate composition of ripe plantain peels obtained from Benin City (Table 1) showed that Crude protein (CP) was 10.50; crude fibre 10.66; ether extract 23.84; Ash 11.00; and NFE 37.15. The crude protein value obtained was similar to that reported by Okoeguale (2017). However, it was slightly higher than 9.19 % reported by Akinmutimi *et al*. (2006).

**Table 1:** Chemical Composition of Ripe Plantain Peels

| PARAMETERS | COMPOSITION |
|---|---|
| Dry matter (%) | 93.41 |
| Crude protein (%) | 10.50 |
| Crude fat (%) | 23.84 |
| Crude fibre (%) | 10.66 |
| Ash (%) | 11.00 |
| NFE (%) | 37.15 |
| Ca (mg/kg) | 62.15 |
| Mg (mg/kg) | 9.39 |
| Na (mg/kg) | 7.92 |
| K (mg/kg) | 179.46 |
| P (mg/kg) | 32.69 |
| Pb (mg/kg) | 0.42 |
| Fe (mg/kg) | 19.98 |

The crude fibre value of 10.66 reported was higher than 6.43 % reported by Akinmutimi *et al*. (2006) and 5.63 % by Okoeguale (2017). In the same vein, the EE value of 23.84% was significantly higher when compared to the value as reported by Akinmutimi *et al*. (2006) and Okoeguale (2017). The observed disparity in both CF and EE values 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 11.00 was lower than 16.83 % reported by Okoeguale (2017).

*Proximate Composition and Mineral Analysis of Palm Oil Mill Slurry (POMS):* The result of the proximate composition of Palm Oil Mill Slurry is as presented in Table 2. From the Table 2, analysed samples of oil palm slurry revealed a crude protein value of 3.21 % and Crude Fat (17.62 %). The Crude Fat recorded was observed to be lower than value of 32.01% obtained by Abiola-Olagunji *et al*., 2014. This could be attributed to the processing methodology adopted, variety of oil palm fruit, and maturity stage of oil palm fruit at ripening, among others. The ash composition also followed the same trend, with a higher value of 7.10% by the same author as against that obtained in the current study (4.66%).

**Table 2:** Chemical Composition of Palm Oil Mill Slurry (POMS)

| PARAMETERS | COMPOSITION |
|---|---|
| Moisture Content (%) | 71.96 |
| Crude Protein (%) | 3.21 |
| Crude Fat (%) | 17.62 |
| Ash (%) | 4.66 |
| NFE (%) | 2.56 |
| Ca (mg/kg) | 176.04 |
| Mg (mg/kg) | 156.16 |
| Na (mg/kg) | 21.39 |
| K (mg/kg) | 363.57 |
| P (mg/kg) | 9.86 |
| Pb (mg/kg) | 0.36 |
| Fe (mg/kg) | 29.93 |

*Proximate and Some Mineral Composition of MUSARPOMS Feed Stock:* The ripe plantain peel and palm oil mill slurry where prepared at 3 different mixing proportions and allowed to age for 3 days to produce the main feed material. The three grades produced are *MUSARPOMS* 25 % ($MSP_{25\%}$), *MUSARPOMS* 50 % ($MSP_{50\%}$) and *MUSARPOMS* 75 % ($MSP_{75\%}$). The proximate and some mineral composition of the three feed grades $MSP_{25\%}$, $MSP_{50\%}$ and $MSP_{75\%}$ are presented in Table 3

**Table 3:** Proximate and Some Mineral Composition of "MUSARPOMS" Feedstuff Grades (25 %, 50 % and 75 %)

| COMPOSITION | MUSARPOMS GRADES | | | ±SEM |
|---|---|---|---|---|
| | 25 % | 50 % | 75% | |
| Dry matter (%) | 91.98$^{a}$ | 89.46$^{b}$ | 89.15$^{b}$ | 0.37 |
| Crude protein (%) | 22.17$^{a}$ | 20.42$^{ab}$ | 19.25$^{b}$ | 0.75 |
| Crude fat (%) | 28.41$^{a}$ | 27.86$^{ab}$ | 27.20$^{b}$ | 0.29 |
| Crude fibre (%) | 18.95 | 18.71 | 19.13 | 0.31 |
| Ash (%) | 19.31$^{a}$ | 17.39$^{b}$ | 15.30$^{c}$ | 0.05 |
| NFE (%) | 3.32$^{a}$ | 4.99$^{b}$ | 8.280$^{c}$ | 0.39 |
| Ca (mg/kg) | 474.20 | 497.70 | 515.60 | 13.71 |
| Mg (mg/kg) | 272.50 | 335.20 | 196.80 | 56.80 |
| Na (mg/kg) | 0.10 | 0.14 | 0.11 | 0.06 |
| K (mg/kg) | 1136.00$^{a}$ | 1275.00$^{b}$ | 984.00$^{c}$ | 28.60 |
| P (mg/kg) | 631.80 | 924.30 | 591.50 | 170.70 |
| Pb (mg/kg) | 0.02 | 0.02 | 0.02 | 0.001 |
| Fe (mg/kg) | 535.10 | 427.00 | 569.80 | 134.90 |

*$^{abc}$ means with different superscripts in the same row differ significantly (P<0.05). SEM - Standard Error of Means, $MSP_{25\%}$ - 25 % MUSARPOMS, $MSP_{50\%}$ -50 % MUSARPOMS, $MSP_{75\%}$ - 75 % MUSARPOMS*

The results as presented in Table 3 above showed that $MSP_{25\%}$ recorded highest crude protein (CP) value of 22.17 %, it was not significantly (P>0.05) different from the CP values (20.42 %) obtained from $MSP_{50}$ but significantly (P<0.05) different from $MSP_{75\%}$ value of 19.25 %. The crude fibre (CF) values were not significantly (P >0.05) different among the different grades. Ash and NFE values differ significantly amongst treatment. $MSP_{75\%}$ recorded highest Ash and NFE value of 8.28 % and 515.60 % respectively. Some mineral composition of $MSP_{25\%}$, $MSp_{50\%}$ and $MSP_{75\%}$ are presented in Table 1. It revealed that the K values were significantly (P<0.05) different with $MSP_{50\%}$ recording the highest value of 1275.00 % while P, Ca and Mg content were not significantly (P>0.05) different from each other. It was observed that the reducing levels of *MUSARPOMS* fermented mixture grade formulations, resulted in proportional increase in the crude protein of the emerging ingredients. 25% *MUSARPOMS* grade had a higher crude protein value of 22.17 % compare to 50% *MUSARPOMS* value of 20.42 and 75% *MUSARPOMS* value of 19.25 % and far above the 10.69 % of the plantain peels. This result is in accordance with the established result by other authors (Adebiyi, 2006; Okpako *et al*., 2008;

Babayemi *et al*., 2010 and Abiola- Olagunji *et al*., 2014) that fermentation reduces the crude fibre and increases the crude protein of the feed. The mineral compositions of the ingredients generated were positively influenced by the inclusion levels of *MUSARPOMS.* Ca content however showed higher value in the $MSP_{75\%}$ which may be linked with the high composition in the ripe plantain peels as compared with the $MPS_{25\%}$.

*Conclusion:* The study showed that *MUSARPOMS* grades at 25, 50 and 75 % compared well with the conventional energy feedstuff. Hence, it can successfully substitute for maize in the diet of growing pigs in order to reduce cost of feed consumed by the animals. More studies are, however, necessary to determine the most suitable level of substitution in the diet.

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