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PROXIMATE COMPOSITION OF SOME AGRO BY – PRODUCTS AND THEIR IMPLICATIONS FOR RUMINANT ANIMAL NUTRITION

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ABSTRACT

The study determined the proximate composition of yam peels , cassava peels , sweet potatoe peels, Tiger nut residue and egg shell meal and discussed their implications on ruminant animal nutrition. Samples of the five agro by products were collected , prepared and analysed for their proximate composition using standard procedures (AOAC, 2000).The proximate values were determined in triplicates and the mean values for each nutrient were taken. Values obtained were presented in simple percentages in a Table and comparisms were made. Nearly all the agro by-products tested were found to have good array of nutrients and therefore promising.A combination of these agro by-product in a complete diet will enhance the growth of ruminant animals ,boost the productivity and improve their health .Supplementation is recommended where these agro by-products fell short of the requirements for some nutrient in ruminant animal diets. Further research on the nutritive content of the other agro by-product is recommended. Further research should also evaluate anti nutritional factors in these agro by-products.

Keywords: Proximate, Agro by Products, Implications, Ruminant Animal , Nutrition

INTRODUCTION

The success of the livestock industry the world over depends greatly on feed quality and quantity (Rosegrant and Thornton 2008). For livestock to reach their genetic potential for milk, meat, wool, and hides production, it is important that they have sufficient source of energy carbohydrates, protein, , nitrogen, sulphur and essential minerals. Ocheja *et al* (2023) Animals receiving inadequate diets are more prone to diseases and fail to reach their genetic potential.

Inadequate nutrition has been the major factor limiting the expansion of animal production in Nigeria (Ocheja *et al* 2022). To salvage this nutritional problem, there is need for utilization of cheap and indigenous sources of protein and energy particularly those that attract no competition from man and other types of livestock animals (Ibrahim *et al* ,2022a ; Ibrahim *et al* 2022b). Crop residues such as yam and cassava peels are thus important because of the ability of ruminants to digest cellulose and other structural polysaccharides of plants origin. These tuber peels are regarded as 'waste product' that are ordinarily discarded, hence a cheap source of diet for the ruminant animals, most especially the domesticated ones(

In Nigeria, and most part of Africa, feed rations for ruminant animals are usually composed of discarded food/crop product and browse leaves.

For instance, it is uneconomical to feed yam to livestock, but yam peels which are often discarded are of great value as animal feed .. The importance of yam as an indigenous and cheap source of nutrition cannot be over-emphasized, hence the necessity to evaluate its dietary importance. Another cheap source of feedstuff for ruminant animals in Nigeria is cassava peels.

Cassava is a woody shrub native to South America and West Africa with Nigeria being the world's largest producer. It is extensively cultivated as an annual crop in tropical and sub-tropical region for its edible starchy tuberous root. Cassava peel regarded as 'waste' is readily available from the

local processing of cassava tuber for *garri* (a popular staple food in West Africa) and in the production of industrial starch. The cost of feed accounts for about 60% of the total intensive production cost compared to 40% value under extensive production system (Lakpini *et al* 2002). A large reduction in feed cost is achievable by the use of unconventional feed resources such as agro by products and kitchen wastes to bring about improvement in ruminant production efficiency in the resource poor developing countries like Nigeria (Okukpe *et al*, 2019; Ocheja *et al* 2011).

A number of Agro by products worldwide serve as alternative feedstuffs for livestock (Ammar *et al*, 2004). They have abundant biomass and are available all year round. They are considered palatable, highly digestible and as a result improved animal performance. The best of animal production have not been fully attained in Nigeria because of the constraints mentioned. As population increases, the availability of conventional feedstuffs for animal feeding is decreasing.

The main objectives of the study therefore are

i. To determine the proximate composition of the selected agro by products
ii. To discuss their implications in Ruminant animal nutrition

In the context of increasing human population in developing countries, decreasing land availability for forage crop production has an increasing dependence of ruminants on low quality basal feed resources and competition for the available protein meals. Agro by products are therefore increasingly seen as potential protein and energy supplements to increase productivity by ruminants.

These by-product are readily available within the study area and a times dumped indiscriminately thus constituting environmental hazard, hence their use for livestock feeds will help in cleaning the environment.

2.0 MATERIALS AND METHODS

2.1 Study Area

The study area is situated at the Southern part of Gombe Metropolis on Latitude 9^0 46' North of the equator and Longitudes 10^0 57' East of Greenwich meridian and 431 metres above sea level. It falls within the Sudan Savannah zone of Nigeria, which lies in the Dry Sub-Humid Azare-Gombe-Yola plain of Nigeria,(NGSA 2012). The area has average annual rainfall of 850mm and temperature of 32^0C. The area formed part of the Limestone and Shale of Pindiga formation. The land is relatively flat, the forest consists of Neem ,Locust bean trees etc. The grazing land consists of predominantly of very short grasses.

2.2 Sample Collection

Samples for Cassava peels, Yam peels, sweet potato peels, egg shell, and tiger nuts were collected from within Gombe town and Kashere

Fresh tiger nuts were visually inspected and defective ones were manually removed and discarded. Hence, only matured healthy tigernut tubers were selected. Tigernut were weighed to 100 g, washed thoroughly in two changes of clean water and drained prior to use for the study. The weighed sample was carefully pounded using a mortar and pestle until a very fine consistency was obtained , pressed to remove the milk and stored in a refrigerator for further analysis. The tigernut seed were sundried for 4-5 days and passed through a hammer, to produce tigernut meal. The drying process was to reduce excess moisture so as to prevent rancidity of the material and growth of moulds.

Yam tubers, sweet potatoe tubers and Cassava roots were obtained and peeled , the peels were cleaned to remove dirt and clinging soil particles, washed with distilled water, placed in the oven at 90 C for 12 hours for drying. The dried samples were then blended and stored in air tight

containers before analysis Egg shells were collected washed, sun dried and pounded into a fine powder using a mortar and then sieved and kept in an air tight container.

2.3 Proximate Composition Determination Procedure

The proximate composition of each of the samples were determined in triplicates and the mean values taken

Moisture

The moisture content of feed sample was determined by heating it to constant weight at 1000C under atmospheric pressure the water content of feed is removed as vapour.

Crude protein

Crude protein was determined by the Kjeldahl method.

known quantity of sample was digested with sulphuric acid (H_2SO4 and $NaSO_4$ in the ratio of 1:20). The digested sample was then distilled after neutralizing excess acid with alkali (40% NaOH), and thus the ammonia was trapped either in N/10 (in macro) or in 2% boric acid solution. The distillate was collected in standard acid (N/10 H2SO4 or standard N/10 HCl) and titrated against standard alkali (N/10 NaOH), the distillate was collected in 2% boric(micro method) this was titrated against standard acid (N/100 H2SO4 and crude protein was calculated by multiplying by factor 6.25).

Crude fibre

This was estimated through digestion of dry and fat free amount of feed sample by boiling it in a weak solution of acids for 30 minutes, followed by boiling in weak solution of alkali for 30 minutes and then deducting the ash from the residue obtained.

Ether extract

It was estimated by extracting the amount of feed sample through fat solvents like petroleum ether for a period of 5-6 hours at 55-600C in specially made Sophlet apparatus.

Ash

Ash content of the sample was determined by the method described in AOAC (2000). The feed contains both organic and inorganic matter The sample was heated at 5500 ^{o}C for 5 hours. The organic matter got oxidized as CO_2. The remaining material left was the inorganic matter.

Nitrogen Free Extract (NFE): Contains soluble carbohydrate, hemicellulose, part of lignin and acid insoluble ash. Value of NFE was derived by deducting the total value of crude protein, crude fat, crude fibre, moisture and ash from 100. NFE = DM– (%Moisture + %CF + %CP + % EE + %Ash).

2.4 Data Presentation and Analysis

Values were presented in simple percentages in a Table and comparisons were made.

3.0 RESULTS AND DISCUSSION

3.1 Proximate Composition of the Agro-by products Determined

The proximate composition of the agro by-products determined is presented in Table 1.

3.1.1 Cassava Peels Meal

Proximate composition of cassava peel meal shows that NFE was highest as expected (61.39%) Ash(11.81%) crude fibre(11.63%) crude protein(6.72), EE(4.59%) and moisture content (3.36%).

Cassava is low in protein content, 0.7% to 1.3%(Ngiki thalus 2014) and higher energy content as reported by Promthong (2005) cassava have highly digestible starch compared to maize, cassava

starch contain 17% amylase and 83% amylopectin. Ether extract in cassava is very low as reported by Gomes (2005), He found that cassava contain about 0.1% of lipids.

Cassava peel meal is a high fibrous feed ingredient, suitable for incorporation in ruminant diets especially as a source of roughage and energy.

The low protein content (6.72%) limits it uses as a sole protein source hence it is commonly used in combination with other protein-rich ingredients in ruminant diets. This value is lower than 7-8% Critical protein content needed for adequate ammonia level in the rumen to guarantee normal rumen function (Lakpini *et al* 2002).

3.1.2 Yam peels meal

Yam peel meal in this study was found to be high in NFE of (56.74%) The others values were crude fibre (18.56%) Ash content (9.42) crude protein (8.26%) moisture content (4.00%) and EE (3.02%). The moisture content in this research is lower (4.0%) compared to value of 11.75% reported by Bashir (2014) The value of crude fibre, Ash content are also lower in this research 18.56%, 9.42% respectively compared to the values reported by Bashir (2014) who reported 41.00% and 10.00% respectively. The values of NFE ,EE and crude protein are higher in this study compared to that reported by Bashir (2014).These differences may be due to difference in plant variety and method of analysis employed.

Yam peels meal is also fibrous feed ingredient with moderate protein content suitable for ruminant feeding. The NFE and Crude fibre values of yam peels were adequate for ruminant nutrition based on (NRC1996) values. It's high ash content indicates it's potential as a mineral source in ruminant diets contributing to overall animal health and production.

3.1.3 Sweet Potato Peels Meal

The NFE of SPPM in this study is lower (65.00%) compared to the values reported by Abdulrazzaq (2021), who reported a value at 77.36%. All the remaining values were higher in research; moisture content 4.20%,ash 10.61%,crude fibre 11.06% crude protein 6.50% EE 2.63% while Abdulrazzaq (2021) reported lower values of 4.05%, 7.63% 3.05%,5.61%,2.30% for ash, crude fibre, crude protein, EE respectively.

Sweet potato Peels meal is a fibrous feed ingredient rich in energy and suitable for meeting ruminant energy requirement ,its sweet taste can improve feed intake in ruminants.

Similar to other by-product, its protein content necessitates its combination with protein rich ingredient in ruminant diets.

3.1.4 Egg Shell Meal

Egg shell meal was found to be very high in ash (80.50%) followed by nitrogen free extract at 12.06% and ether extract 3.00%, crude protein 2.00%, moisture content 1.50% and crude fibre 0.04%.

The result obtained in the study shows that egg shell meal if properly treated can serve as a source of calcium and phosphorus for ruminants to enhance healthy bone development., animal can meet their daily calcium requirement necessary for bone development and growth.

Egg shell meal is primarily used as a calcium supplement in ruminant's diets, helping to meet the animal calcium requirements. Egg shell meal is easier to prepare and cheaper than bone meal, so its use in ruminant and monogastric animal diets should be encouraged.(Ocheja 2020)

3.1.5 Tiger Nuts Meal

The values for NFE was (52.9%) others were crude fibre (21.00%), crude protein (8.80%), ash content (8.50%) and moisture content (3.30%) respectively. The NFE of the feed sample in this research was adequate as recommended for feeding of ruminant animals (NRC 1996).

The crude protein: value at 8.80 reported for tiger nut meal was within the critical range of 7-8% required by ruminants.(Lakpini *et al*, 2002)

The Ether extract content at 5.50 was within the maximum range of 5-6% reported by maithison *et al* 1997 for ruminants. Beyond this range, crude fibre digestion and appetite will be impeded. High levels of ether extracts (beyond 6%) can lead to milk fat depression in lactating animals , 2% is adequate for meat animals , this can be supplied by a normal ration

The moderate protein and ash content makes it is a suitable ingredient for balancing ruminant diets in combination with other feed ingredient.

Overall, the proximate composition of these agro by-products provides an insight into their nutrient composition, which allows formulating balanced ruminants diets by combining them with other feed ingredient to meet the animal's nutritional requirements.

Table 1: **Proximate Composition of Some Agro By-Products**

Samples	Moisture content	Ash content	Crude fibre (CF)	Crude protein (CP)	Ether extract (EE)	NFE
Cassava Peels Meal(CPM)	3.36	11.81	11.63	6.72	4.59	61.39
Yam Peels Meal (YPM)	4.00	9.42	18.56	8.26	3.02	56.74
Sweet Potato Peel's Meal (SPPM)	4.20	10.61	11.06	6.50	2.63	65.00
Egg Shell Meal (ESM)	1.50	80.50	0.40	2.00	3.00	12.06
Tiger Nut Meal (TNM)	3.30	8.50	21.00	8.80	5.50	52.9

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Nearly all the agro by-products tested have good array of nutrients and therefore promising.

A combination of these agro by-product in a complete diet will enhance the growth of ruminant animal ,boost the productivity and improve their health.

4.2 Recommendations

Supplementation is recommended where these agro by-products fell short of the requirements for some nutrients in ruminant animal diets.

Further research on the nutritive content of the other agro by-product is recommended.

Further research should evaluate anti nutritional factors in these agro by-products.

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