

An Assessment and Nutritional Quality of the Varieties of Roughage Feeds Sold in Selected Livestock Markets in Owerri and Port Harcourt Cities in Nigeria

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Abstract

Roughages are an indispensable component in ruminant nutrition because a proper balance of fibre and readily available carbohydrates is essential for efficient rumen function. Unlike feeds high in starches and sugars that digest very quickly with the attendant risk of bloating, fibrous feeds digest much slowly and provide the proper environment for rumen digestion. Fibrous feeds ensure higher quality of milk by increasing the contents of milk fat. This study was aimed at assessing the varieties and nutritional quality of roughage feeds sold for ruminant feeding in selected livestock markets in cities of Port Harcourt and Owerri. The study involved visits to the different markets and engagement of the traders in a face to face interview using structured questionnaires. The results of a survey of four markets in each of the cities revealed that groundnut haulms, cowpea haulms, cowpea husks, sorghum grain husks, sorghum brewers' grain (dusa) are feed materials on sale. The socioeconomic characteristics of the dealers revealed that 90% of them were youths aged between 21 to 50 years with limited education. Samples of some of the feed materials identified were subjected to proximate analysis and revealed dry matter range of 85.00-89.51% with sorghum grain husks (sorghum tops) having the lowest DM content and sorghum brewers grain having the highest. Groundnut haulms were the most common and had the highest crude protein content while sorghum grain husks (chaff) had the lowest crude protein content with values of 11.90 and 4.90%, respectively. Ether extract ranged from 0.41-5.5%, crude fibre ranged from 4.1% in sorghum brewers' grain to 33.40% in cowpea haulms. Sorghum brewers' grain had the lowest percentage ash with 4.23 and groundnut haulms had the highest value of 8.30%. There was absence of standard packaging of the roughage feeds on sale in the market. The feeds of variable particle lengths and sizes were packaged in grain sacs of variable nature, and without a product label. Conclusively, groundnut haulms had highest aggregate demand and also commanded highest market price followed by cowpea haulms. The proximate analysis also revealed marginally higher contents of crude protein for the groundnut haulms. Prices of the roughage feeds were greatly influenced by quality and cost of transportation since supplies came from the northern part of Nigeria. The market could be improved by standard packaging of the roughage feed materials in line with international best practices.

Keywords: Cowpea haulms, Cowpea husks, Groundnut hay, Roughage feeds, Sorghum husks

Running title: Nature and variety of roughage feed markets in Nigeria



Une Evaluation Et Qualité Nutritionnelle Des Variétés D'aliments Fibreux Vendus Dans Des Marchés De Bétail Sélectionnés A Owerri Et Port Harcourt Au Nigeria

Résumé

Les aliments fibreux sont un composant indispensable dans la nutrition des ruminants car un équilibre adéquat entre les fibres et les glucides facilement disponibles est essentiel pour un bon fonctionnement du rumen. Contrairement aux aliments riches en amidons et en sucres qui se digèrent très rapidement avec le risque de ballonnement qui en découle, les aliments fibreux se digèrent beaucoup plus lentement et fournissent l'environnement adéquat pour la digestion du rumen. Les aliments fibreux garantissent une qualité supérieure du lait en augmentant la teneur en matières grasses du lait. Cette étude visait à évaluer les variétés et la qualité nutritionnelle des aliments fibreux vendus pour l'alimentation des ruminants dans certains marchés de bétail des villes de Port Harcourt et Owerri. L'étude a impliqué des visites dans différents marchés et l'engagement des commerçants dans des entretiens en face à face à l'aide de questionnaires structurés. Les résultats d'une enquête sur quatre marchés dans chacune des villes ont révélé que les fanes d'arachide, les fanes de niébé, les cosses de niébé, les cosses de sorgho, les grains de brasseur de sorgho (dusa) sont des matériaux

d'alimentation en vente. Les caractéristiques socioéconomiques des commerçants ont révélé que 90 % d'entre eux étaient des jeunes âgés de 21 à 50 ans avec une éducation limitée. Des échantillons de certains des matériaux d'alimentation identifiés ont été soumis à une analyse proximale et ont révélé une teneur en matière sèche allant de 85,00 à 89,51 %, les cosses de sorgho ayant la teneur en MS la plus basse et les grains de brasseur de sorgho ayant la plus haute. Les fanes d'arachide étaient les plus courantes et avaient la teneur en protéines brutes la plus élevée tandis que les cosses de sorgho avaient la teneur en protéines brutes la plus basse avec des valeurs de 11,90 et 4,90 %, respectivement. L'extrait éthéré variait de 0,41 à 5,5 %, la fibre brute variait de 4,1 % dans les grains de brasseur de sorgho à 33,40 % dans les fanes de niébé. Les grains de brasseur de sorgho avaient le pourcentage de cendres le plus bas avec 4,23 et les fanes d'arachide avaient la valeur la plus élevée de 8,30 %. Il n'y avait pas d'emballage standard des aliments fibreux en vente sur le marché. Les aliments de longueurs et tailles de particules variables étaient emballés dans des sacs à grains de nature variable, et sans étiquette de produit. En conclusion, les fanes d'arachide avaient la plus forte demande globale et commandaient également le prix de marché le plus élevé, suivies des fanes de niébé. L'analyse proximale a également révélé des contenus légèrement plus élevés de protéines brutes pour les fanes d'arachide. Les prix des aliments fibreux étaient fortement influencés par la qualité et le coût du transport puisque les approvisionnements provenaient du nord du Nigéria. Le marché pourrait être amélioré par un emballage standard des matériaux d'alimentation fibreux conformément aux meilleures pratiques internationales.

Mots-clés : Fanes de niébé, Cosses de niébé, Foin d'arachide, Aliments fibreux, Cosses de sorgho

Introduction

The Nigeria livestock sector occupies a strategic position in the food supply value chain within the cities, towns and villages across the country contributing 8.1% of the agricultural GDP in 2019 (Ukeje, 2021). Cattle, sheep and goats are the commonly reared ruminants in Nigeria and constitute the bulk of livestock on sale in the markets. In terms of market share, cattle, sheep and goats control a major part of the market since meat from cattle, sheep and goats command the highest aggregate demand among Nigerian consumers (Aborishade and Caprio, 2017). In addition, animal protein in the form of meat, milk, eggs and fish, is unarguably the costliest component on the menu of the average Nigerians household food budget at 16.8% cumulatively (NBS, 2019). There is a growing demand for roughage feeds by livestock marketers who must feed their animals in order to maintain or improve their body condition until animals are sold. In some instances, for markets in peri-urban areas, animals are grazed in nearby range or fallow lands during the day and brought in for sale in the evenings. However, for livestock markets within urban areas, access to pasture is difficult hence animals must be fed *in situ*. Hence the demand for conserved ready-made crop residues due to their longer shelf life and less labour demand compared to daily harvesting fresh forages. Crop residues refer to left over

components of a crop plant after the harvest and removal of the main crop. According to Akinola *et al.* (2015), crop residues are used for feeding and mulching and 75% of leguminous crop residues are used for ruminant feeding compared to 25% of cereal crop residues in Kano state Nigeria. The major crop residues which are grazed or stockpiled for ruminant feeding in Nigeria are millet and sorghum stalks, cowpea vines, cowpea husks, maize stover, maize husk, and groundnut haulms, pigeon pea hay, soya bean hay etc (Akinola *et al.* (2015). Although residues of cereal crops are generally nutritionally inadequate to produce high yields of meat and milk, the potential of cereal crop residues as animal feed can be enhanced if fed in combination with legume residues and agro-industrial by-products such as sorghum brewers' grain. Unfortunately, the roughage feed market in its current form, is lacking in standards in terms of uniformity and packaging as a result, quality may be subjective. Unlike other livestock feeds, these category of feeds appear to be out of the watch and monitoring of the regulatory agencies in Nigeria. Recently, many states in southern Nigeria have passed legislation prohibiting open grazing of animals on fallow lands, hence the need has arisen for the proper development of the forage value chain for convenience and enhanced productivity and peaceful coexistence of livestock dealers and host farming communities. In many parts of

northern Nigeria and other parts of West Africa, crop residues from legumes such as groundnut and cowpea are essential components of the crop-livestock system. During the dry season, cowpea haulms sell for 50% or more of the grain price hence after harvest, the vines are rolled into bundles and stored at roof tops for animal feeding (Larbi *et al.*, 1999; Akinfemi *et al.*, 2009).

Also, in order to maximize the potential of the small-holder livestock production system, the removal of barriers resulting from seasonal variations in the supply of livestock feed can be achieved by conservation of crop residues thereby ensuring year-round accessibility of feeds for livestock. Although some grasses contain 12-15% crude protein at early flowering, the quality suffer greatly when allowed to mature and dry out by the start of the dry season. Furthermore, although dried forages are typically low in essential elements like protein, sulphur, minerals, and vitamins as reported by Njidda (2010), leguminous crop residues with 12–15% crude protein, serve as an invaluable source of feed during the long dry season when the all the grasses and vegetation have dried out. Therefore, in view of the competition for land for estate expansion and human food production, the future of the livestock economy in Africa would depend on crop residues. The perennial conflict over resources between crop farmers and herders would likely escalate across the country thereby creating a demand pull for processed crop residues as more pastoral livestock keepers moved towards sedenterization. Therefore, this study attempts to identify the varieties of roughage feeds sold in the markets with potential for enhanced commercial value and the deficiencies associated with the present system and to suggest ways of improvement.

Materials and Methods

The study was carried out at livestock markets located in Eribe, Town, Mile 1 and Mile 3 markets, all within Port Harcourt, Rivers State, and Garki market Obinze, Ama Hausa, Egbu road and Avu slaughter livestock markets, all in Imo State. Both Rivers State and Imo States are in the humid rainforest agro-ecological zone, with annual rainfall of above 2220 mm (April to October). Also for these regions, the mean monthly temperature ranges from 22.5 to 33.7°C; while relative humidity

in the rainy season (late March to October) and dry season (November to early March) ranges between 63 to 96 and 55 to 84%, respectively. The survey of the four feed markets listed above, was conducted using structured questionnaire to determine, socioeconomic characteristics, distribution of the feedstuff as well as the price structure of the different roughage feed types. The questionnaire was administered to 20 respondents, all males, during a face-to-face interview.

A representative sample of the feeds was collected and subsequently milled for proximate analysis. Proximate analysis of the feed samples was carried out in accordance with standard procedures. The contents of dry matter, crude protein, crude fibre, ether extract and ash were determined according to (AOAC 1995) Nitrogen (N) content was determined by the standard Kjeldhal method and the amount of crude protein was calculated as (Nx6.25). NFE was calculated as $100 - (CP + EE + ash + CF)$

Data analysis

Data collected from the interviews were presented using descriptive statistics in percentages.

Results and Discussion

The socioeconomic characteristics of the respondents are shown in Table 1. According to the table, livestock roughage feed traded within the study areas within, Port Harcourt and Owerri cities, was dominated totally by men 20 (100%). This aligns with Adewuyi *et al.*, (2022), who attributed this monopoly to the bulky nature of the haulms, and the distance involved in the trade. According to research findings by Adewuyi *et al.*, (2022), the rigor involved in transporting the haulms to markets, sometimes lasting many days, may be too much for female traders to bear and as such the trade has become male dominated (Adewuyi *et al.*, 2022). Majority of the traders 14 (70%) of the traders were between 31 – 50 years of age, (20%) for 21 – 30 years of age, and (10%) for 51 – 70 years old. This specifically indicates that the trade is mainly dominated by youths. Majority of the men (60%) had primary education while (30%) indicated that they had no formal education while (10%) had secondary school education. This correlates with earlier studies by Samireddypalle *et al.* (2017), who observed that majority of livestock roughage feed traders have either formal or

informal education. Since education has been identified as an essential tool for communication and interaction among traders and buyers, the possession of formal education would help the traders to relate seamlessly with customers and improve their trade. Large proportions of the

respondents (70%) were married and depended solely on the trade to meet their basic and routine family obligations. Hence developing the forage value chain would expand the market and create better employment opportunities for Nigerians interested in livestock forage trading business.

Table 1: Socio-economic characteristics of livestock roughage feed dealers within the study area, Owerri and Port Harcourt

Parameters	Class	Frequency	Percentage
Age	21-30	4	20
	31-50	14	70
	51-70	2	10
	Above 70	0	0
	Total	20	100
Sex	Male	20	100
	Female	0	0
	Total	20	100
Marital Status	Single	4	30
	Married	14	70
	Total	20	100
Level of Education	None	6	30
	Primary	12	60
	Secondary	2	10
	Tertiary	0	0
	Total	10	100
Primary Occupation	Farming	0	0
	Trading	20	100
	Public servant	0	0
	Total	20	100
Secondary Occupation	Farming	4	20
	Trading	16	80
	Public servant	0	100
	Total	20	
Engagement in Agriculture	Yes	20	100
	No	0	0
	Total	20	100

The product characteristics and frequency of availability of the various feedstuff in the various markets is shown in Table 2. Groundnut haulms was found in all the markets visited, showing that the groundnut haulm has wide acceptability and are the most preferred, hence its availability within the markets. This may be due to its higher protein content of 11.90% compared to the other feedstuff sold in the market. Most traders interviewed confirm that it is indeed a valuable feed material for maintaining their animals' body condition

especially when fed in combination with sorghum brewers' grain for the short period before the animals are sold. This agrees with previous reports by (Anyanwu, 2017) that reported that groundnut husks are priced higher than cowpea as dry season supplement in Northern Nigeria. In addition, groundnut haulms appear to retain more leaves than cowpea vines under traditional storage conditions. More so, leaf shattering decreases the leaf: stem ratio and thus the nutritional value. The economic value of cowpea haulms has prompted

cowpea breeders and livestock nutritionists to explore haulm fodder traits as additional selection and breeding criteria, for instance, in a study involving fifty dual-purpose cowpea genotypes cultivated across five locations in Nigeria in 2013 and 2014, grain and fodder yields were positively correlated showing that selection for fodder yield may not negatively affect grain yield (Samireddypalle *et al.*, 2017). Similarly, in a survey of fodder markets in Northern Nigeria, groundnut haulms were priced higher than cowpea haulms, probably because of their superior nutritive value and preference and palatability by animals. Also, the threshing of cowpea pods for grain gives rise to production of cowpea husks which is a highly fibrous material of low nutrient value, which are fed to cattle as bulk in addition to other more nutritious crop residues. Furthermore, groundnut haulm has been identified as an important feed source for livestock whether in

fresh or dry forms (Abadya *et al.*, 2021) especially in places with scarce grazing lands, like Ethiopia and other dry and semi-arid countries. According to Janila *et al.* (2016), the haulm contains minerals (9–17%), fat (1–3%), protein (8–15%), and carbs (38–45%). Also, Abadya *et al.* (2019), recognizes that these qualities make groundnuts valuable as a source of high-quality feed to add to livestock's diets. The nitrogen content, *in vitro* organic matter digestibility and metabolized energy are among its important quality indicators of groundnut haulm (Ahmed *et al.*, 2021). Among the cereal crops, sorghum presents different crop residues of interest namely, sorghum bran, sorghum gluten, sorghum tops and sorghum brewers/distillers grain which are invaluable feedstuff for feeding cattle, sheep and goats especially during the dry season. Cowpea haulms has become the most popular tradable commodities in fodder markets across Nigeria.

Table 2: Product characteristics and frequency of distribution of feed types sold in the markets visited in Owerri and Port Harcourt study areas.

Parameters	Class	Frequency	Percentage
Variety of roughage feeds in the markets	Groundnut haulms	4	100
	Cowpea haulms	2	50
	Maize stovers	0	0
	Sorghum grain husks	2	50
	Sorghum brewers' grain	2	50
	Millet stover	0	0
Animals fed crop residues	Cattle	4	100
	Sheep and goat	4	100
Standard packaging	Yes	0	0
	No	20	100
Product label	Yes	0	0
	No	20	100
Product improvement using technology	Improvement in packaging and standards	16	80
	Ban in open grazing of livestock	4	20
	Modified housing	0	0
		20	100

There is considerable variation observed in the quality of the various crop residues sold in the different markets, (Table 3). Depending on the harvest method, storage and on the proportions of plant materials included in the residue such as leaves, stems and residual pods. Like other legume hays, groundnut forage are subject to leaf shattering, which increases the proportion of stems

and diminishes its nutritional value (Myer, 2010). In order to reduce this, it is recommended that feeds should be baled to uniform weight with the right proportion of leaf to stem, and the minimum content indicated in the product label in addition to other nutritional information. Crop residues such as groundnut or pigeon pea haulms can provide up to

Table 3: Proximate composition of varieties of roughages sold in livestock markets in Imo and Rivers State in Nigeria

Proximate Composition (%)	Groundnut haulms	Cowpea husks	Sorghum husk	Sorghum brewers' grain
Dry matter	87.00	88.00	85.00	89.51
Crude Protein	11.90	11.87	4.90	10.75
Ether extract	1.31	0.75	0.41	5.5
Crude fibre	30.80	33.40	32.60	4.1
Ash	8.30	8.14	6.6	4.23
Nitrogen free extract	52.90	45.84	55.49	75.45

80% of livestock feed in densely populated areas of Nigeria (de Leeuw, 1997) thereby encouraging sedentarization

The result from this study, which indicate absence of standards and quality control in the roughage feed market, presents a compelling need to develop the forage value chain of the ruminant livestock industry in Nigeria and other livestock production zones of west Africa. The establishment of minimum quality standards through certified product labels with the relevant nutrient information, has become imperative. The recommended moisture content of the roughage and packaging material, which guarantees the durability of final product, should be emphasized by the relevant Government regulatory agencies. Over 95% of the world's supply of cowpea, groundnut and soya bean is produced in Africa, with west Africa as the dominant primary regional producer (Bawa, 2019). In the Gambia, groundnut hay is the traditional feed resource of choice, especially in urban areas. Protein content is on average, about 10-12% of DM, ranging from 6 to 17%. Fibre content is high, with crude fibre ranging from 15 to 51% of DM and lignin content

averaging 10% of DM. Since land, water, and grazing land are becoming increasingly scarce commodities, especially during the dry season, promoting the use of dual-purpose crop residue becomes an imperative thereby enhancing the integration of crop and livestock production in mixed crop-livestock systems. (Abadya *et al.*, 2021).

Conclusion and Recommendations

It can be seen that huge opportunities remain untapped in this sector to create wealth by production, processing and packaging of forage crops and the residues in Nigeria, especially towards the end of the rainy season for producers in southern Nigeria, for harvest during the dry season. The roughage forage market value chain would include the production of the fodder, transportation, drying or curing, processing, packaging, sales and delivery. Each activity in the chain attracting active players, with potential of promising rewards in value addition and wealth creation. In addition, standardization of products could give rise to supply chain segmentation for the cottage industries to serve the emerging market.

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