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Preliminary Investigation of Some Serum Biochemical Parameters of Confined Nigerian Cattle Breeds in Ibadan, South-West Nigeria Fed with Some Conventional and Non-Conventional Feedstuffs

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Abstract
Unavailability of adequate livestock feeds is a long term constraint to the expansion of livestock industry in Nigeria. Cattle production needs high quantity feeds requirement but hampered by high cost and dwindling herbage in Nigeria.This preliminary investigation determined the combined effects of conventional {Elephant Grass (EG), Guinea Grass (GG), Cassava Peels (CP)} and non-conventional feeds {Banana Leaf (BL), Banana Stem (BS), and Wood Saw-dust (WS)} on the levels of cholesterol and some other biochemical parameters in fully-confined cattle breeds in Ibadan. Male (9) and female (14) cattle of different age groups were used. Feeds is a major limitation for rearing cattle in full-confinement in the area, hence the aim of this investigation is to assess important nutritive values and safety parameters of the alternative feeds to the cattle and consumers.Proximate analysis for each of the feeds was determined for %crude protein, % crude fibre, % crude fat, % ash, % dry matter and % moisture content. The serum biochemical parameters analyzed were cholesterol, triglycerides and glucose (mg/dl); total protein, albumin, globulin and creatinine (g/ml). All analysis were determined by standard methods. Results of proximate analysis showed the following feeds with highest values, crude-protein (EG 15.13±0.11%), crude-fibre (EG 29.8±1.56%), crude fat (EG 4.40±0.57%), ash (BB 12.15±0.21%), dry matter (BA 94.90±0.14%) and moisture (WM 7.83±0.25%). The following cattle breeds showed the highest serum biochemistry values, cholesterol (Bororo-female [1], 253 mg/dl), triglycerides (Bororo-female [2], 5.4mg/dl), glucose (Gudali-male[3], 224 mg/dl), total protein (Gudali-female[7], 34.92 g/ml), albumin (Gudali-male[2] and Bororo-female[1],10.17 g/ml each), globulin (Gudali-male[7], 32.38g/ml), albumin/globulin ratio (Gudali-male[2] and Bororo-female [1], 0.84 each) and creatinine (Gudali-female[6] and Cross Kugu-male[1], 3.20g/ml each). The study concluded that the non-conventional feeds had high levels of crude proteins, crude fibre, dry matter, moisture and the serum biochemistry values were within normal reference intervals. However, lower triglycerides and higher creatinine values were recorded, which indicated further tests on liver and kidney functions. No clinical signs of organs abnormality were manifested.
Keywords: Conventional, alternative feedstuffs, Nigerian cattle, serum biochemistry

Introduction

Animal feed has always been a major limiting factor in the growth of the livestock industry in Nigeria and other developing countries (Oguntimein, 2017). Most of the feed ingredients are imported and a large proportion of foreign exchange is spent for this purpose.

As improved breeds of livestock become more available, provision of better nutritive management will be more important. Pasture and fodder remain the cheapest form of animal feed available (Oguntimein, 2017). Concentrates are only required at very high level of management. Pasture grasses and legumes however, vary in their nutritive value and productivity. In order to reduce the cost of livestock and thus make animal protein more affordable, there is the need to increase livestock production with affordable feed ingredients (Idoko *et al.,* 2016). Good animal production requires pasture and fodder species with a high yield of palatable and digestive herbage, containing adequate and balanced nutrients. Fodder crops are planted specifically to provide feed for cutting. They are cultivated and managed in the same way as arable crops. Elephant grass is an example of a useful fodder crop.

Non-conventional feeds are those feeds that are not traditionally used in livestock feeding or not normally used as conventional livestock diets (Ogbuewu *et al.,* 2015). In view of the dwindling supply of the conventional feed resources and the shortage of foreign exchange for importation, non-conventional feed sources produced locally within the country are being investigated (Oguntimein, 2017).

Increasing rise in costs of feeds and drought have been two of the most important factors responsible for reducing of livestock inventories (Agrilife, 2017). Availability of adequate animal feeds is one of the greatest limitations to the expansion of the livestock industry in Nigeria and other developing countries (Oguntimein, 2017). Apart from the high and fluctuating costs of feeds, some of the ingredients used in mixed feeds, notably cereal grains, are also in high demand for human consumption. Literature review shows that the haematological parameters have been reported for some cattle breeds found in Nigeria like Keteku breed of cattle (Awolaja *et*

al., 1997), White Fulani cattle (Olusanya, 1979 ; Oyedipe *et al.,* 1984; Olayemi *et al.,* 2001; Olayemi and Oyewale, 2002 and Olayemi, 2004) and the N'Dama cattle breed (Oduye and Okunaiya, 1971 Olayemi and Oyewale, 2002). However, none of these studies investigated the additive effects of non-conventional feeds on important blood parameters like cholesterol (mg/dl), triglycerides (mg/dl), glucose (mg/dl), total protein (g/ml), albumin (g/ml), globulin (g/ml) and creatinine (g/ml). Afolabi *et al.,* (2010) and Addass *et al.,* (2012) reported that age, breed, sex and nutritional status are some of the factors affecting the haematological values of farm animals. Etim *et al.,* (2014) stated that as a result of the effects of age, breed, sex, nutritional and other factors affecting farm animals, there is the need to establish a physiological baseline values for livestock in Nigeria, as this could assist in evaluating the nutrition, management practice, physiological status and health diagnosis of farm animals.

Currently, there is increasing small and medium cattle rearing operations around major cities including Ibadan in the humid southwest Nigeria. This new development is due majorly to the fact that beef serves as major source of protein in human diet in this area. Beef is of high demand due to rapid urbanization and with no religious bias. Also, establishment of food industries (Grain, wood, tubers, fruit mills, beverages and Breweries) are on the increase with massive industrial agricultural wastes build-ups. These food industries by-products can serve as supplementary feeding of livestock especially ruminants in urban cities. Rapid food industries growth is also an important factor for the increasing number of small and medium cattle rearing enterprises (SME)which is creating chains of value for employment among youths. Consequential upon urbanization prohibition of open-grazing of cattle and other ruminants in many Nigeria cities, due to destruction of farmland crops, flower gardens and to prevent road traffic accidents or injuries to humans, make this work a necessity.

Therefore, this investigation was conducted to evaluate safety of inclusion of high biomass agricultural wasted plants materials such as banana and wood processing mill wastes as (alternative feedstuffs) based on blood biochemistry levels especially cholesterol of some confined Nigerian breeds of cattle in Ibadan, the largest Nigeria city with high herbage potential and many agricultural industries.

Materials and Methods

Proximate Analysis

The proximate composition of the non-conventional feeds samples of Banana Leaf (BA), Banana Stem (BB), Wood Material (WM), and conventional feeds samples of Cassava Peels (CP), Elephant Grass (EG) and Guinea Grass (GG) were determined by the method of Association of Official Analytical Chemists (AOAC, 2000). The proximate analysis included % crude protein, % crude fibre, % crude fat, % ash, % dry matter and % moisture content. The total nitrogen (N) was measured using macro Kjeldahl apparatus and crude protein content in the sample was calculated using the formular N x 6.25. Crude lipid (ether extract) content was determined by the use of soxhlet apparatus.

Collection of Blood Samples

Blood samples were collected aseptically from the jugular vein with sterile needles and syringes into sterile plain sample bottles which were immediately processed for separation of serum samples. The serum samples were obtained from the blood after clothing and centrifugation for the analysis of the serum biochemical parameters.

Determination of Serum Proteins, Cholesterol, Triglycerides, Glucose and Creatinine

Analytical procedures

All biochemical parameters were measured on spectrophotometer (Spectro Lab 23A). The serum total proteins and albumin were estimated by Biuret and BCG Dye Binding Method by using total proteins and albumin Kit manufactured by Fortress Diagnostics Limited, Unit 2C Antrim Technology Park, Antrim, BT41 1QS, United Kingdom. Serum globulin was calculated as the difference between total protein and albumin.

Triglycerides were analysed using commercial standard kits from Vital Diagnostics SPb" Ltd., Engelsa prospect 27, bld 12B, St. Petersburg, Russia. Serum cholesterol, creatinine and glucose were measured using standardized kits supplied by Fortress Diagnostics Limited, Unit 2C Antrim Technology Park, Antrim, BT41 1QS, United Kingdom.

Statistical Analysis

All the data were analysed by means of Student's t-test.

Results

Table 1: Proximate analysis of the conventional and non-conventional cattle feeds

Feed	% Crude Protein	% Crude Fibre	% Crude Fat	% Ash	% Dry Matter	%Moisture Content
EG+	15.13±0.11	29.80±1.56	4.40±0.57	3.30±0.28	93.59±0.83	6.41±0.83
GG+	13.33±0.46	27.25±0.07	3.80±0.28	11.20±0.28	94.36±0.06	5.64±0.06
CP+	7.18±0.25	7.80±0.28	4.25±0.21	5.05±0.36	92.63±0.81	7.38±0.81
BA++	5.64±0.792	19.00±0.14	3.75±0.35	12.15±0.07	94.90±0.14	5.10±0.14
BB++	11.53±0.035	19.74±0.51	2.90±0.00	12.15±0.21	93.48±0.53	6.53±0.53
WM++	4.60±0.57	5.25±0.07	3.75±0.07	2.60±0.57	92.18±0.25	7.83±0.25

Key: BA= Banana Leaf, BB= Banana Stem, WM= Wood Material, CP= Cassava Peels, EG= Elephant Grass and GG= Guinea Grass, += Conventional feed, ++= Non-conventional feed.

Table 2: Cholesterol, triglycerides, glucose, serum proteins and creatinine levels in confined Nigerian cattle breeds fed with grass and feed suppliments

SN	Breed	Sex	Age in Months	Months on feeds	Cholesterol mg/dl	Triglycerides mg/dl	Glucose mg/dl	Albumin g/ml	Globulin g/ml	Albumin/Globulin (A:G) Ratio	Total Protein g/ml	Creatinine g/ml
1	Kuri	Male[1]	68	50	237	2.57	197	9.39	21.37	0.44	29.78	2.60
2	Kuri	Male[2]	36	3	134	2.57	120	9.19	17.59	0.52	26.78	2.30
3	Kuri	Male[3]	20	08	127	4.37	093	6.65	16.06	0.41	22.71	2.10
4	Kuri	Female[1]	32	32	188	2.68	131	4.09	25.31	0.16	30.21	2.30
5	Gudali	Male[1]	64	61	173	1.30	108	8.60	19.04	0.45	27.64	2.20
6	Gudali	Male[2]	38	32	247	2.85	220	10.17	12.11	0.84	22.28	2.90
[3]	Gudali	Male[3]	38	32	195	3.99	224	4.50	27.85	0.16	32.35	2.60
8	Gudali	Male[3]	49	43	164	2.84	108	2.54	32.38	0.08	34.92	2.90
9	Gudali	Female[1]	69	50	206	4.76	093	9.19	24.23	0.38	33.42	2.10
10	Gudali	Female[2]	69	50	207	2.85	097	9.39	18.89	0.50	28.28	2.70
11	Gudali	Female[3]	50	46	171	[3].53	135	9.58	16.99	0.56	26.57	3.10
12	Gudali	Female[4]	37	31	182	5.36	133	8.80	21.20	0.42	30.00	2.20
13	Gudali	Female[5]	42	46	204	1.76	113	9.20	13.08	0.70	23.85	2.80
14	Gudali	Female[3]	40	36	154	1.86	073	8.41	14.73	0.57	23.40	3.20
15	Gudali	Female[8]	40	36	133	4.02	080	9.00	19.50	0.46	28.50	1.70
16	White Fulani	Male[1]	64	61	208	5.07	066	6.65	19.70	0.34	26.35	2.90
17	White Fulani	Female[1]	59	53	157	2.68	111	8.02	17.90	0.45	25.92	1.80
18	Bororo	Female[1]	62	59	247	2.85	220	10.17	12.11	0.84	22.28	2.90
19	Bororo	Female[2]	58	52	152	5.40	106	9.00	13.08	0.69	22.28	2.40
20	Cross Kugu	Male[1]	47	35	150	4.31	082	7.04	14.96	0.47	25.50	3.20
21	Cross Guku	Female[1]	16	10	105	3.13	131	9.39	21.25	0.44	30.64	2.30
22	Cross Kugu	Female[2]	12	10	197	2.86	160	5.28	21.07	0.25	26.35	2.40
23	Ambala	Female	61	55	143	5.36	151	7.82	19.18	0.41	27.00	1.60

Normal triglycerides Bovine dairy (9-38), Bovine beef (14-46). Normal cholesterol Bovine dairy (43-331), Creatinine (0.5-1.4) Bovine dairy Veterinary Diagnostic Laboratory, Oregon State University, USA.

Discussion

The result of the proximate analysis in Table 1 showed that elephant grass had the highest crude protein 15.13±0.11% while wood material recorded the least value 4.60±0.57%. For crude fibre, elephant grass recorded the highest value 29.80±1.56% while wood material recorded the least value 5.25±0.07%. Elephant grass again recorded the highest value for crude fat 4.40±0.57% while banana stem recorded the least value 2.90±0.00%. Banana stem and banana leaf both had the highest ash contents 12.15±0.21% and 12.15±0.07% respectively while wood material had the least value 2.60+0.57%. The dry matter and moisture contents of all the cattle feeds were within the same ranges. Banana leaf had the highest dry matter value 94.90±0.14% while wood material had the lowest 92.18±0.25%. For moisture content, wood material had the highest value 7.83±0.25% while banana leaf had the least value 5.10±0.14%.

Cóser *et al.,* (2000) reported the use of elephant grass (*Pennisetum purpureum*) as feed for dairy cattle in Brazil. The elephant grass was also used as capineira, conserved forage such as silage and pasture. Little work has been done on the use of banana leaf as a forage in cattle (Ffoulkes and Preston, 1977). Dried cassava leaves and stems have been used as feed sources in pigs, poultry, and dairy cattle. The meal produced from them has a nutritive value similar to that of alfalfa although deficient in methionine, isoleucine and threonine (Normanha, 1962; Peyrot, 1969; Rojanaridphiced, 1977). Cassava leaves are a good source of about 20% protein. The amount of protein depends on the stage of growth. (Oguntimein, 2017). The use of cassava root as animal feed is increasing in importance in the developing countries of Latin America and Asia where an export market for this commodity has developed.

Guinea grass (*Megathyrsus maximus* (Jacq.) is a major pantropical grass which is used throughout the tropics as pasture, hay and silage and cut-and-carry. It is a fast growing and leafy grass, which is palatable to

livestock and has a good nutritional value. However, it is generally recommended to supplement it with sources of protein so as to meet the nutritional requirements and improve the performance of the animals. Many guinea grass cultivars have been developed for different purposes and agronomic situations (FAO, 2009). As the guinea grass rest-period affects animal performance, a good rest-period is to wait for regrowth of 2.5 leaves/tiller (Candido *et al.,* 2005). Ensiled guinea grass has a good texture and it was mixed with grasses of different ages with no effect on silage quality (Babayemi *et al.,* 2009). Research dating back to the early 1900's, along with current Texas A&M AgriLife Wood to Feed (San Angelo) trials, have shown that ground woody products can be used as roughage ingredients in livestock diets (Agrilife, 2017). Their trials showed that these ingredients have nutritional and feeding values similar to some traditional roughages and it can reduce internal parasite infection, and do not adversely affect the fetus, end-product quality or sensory characteristics of the cooked meat. The use of ground juniper in lamb feedlot diets has actually enhanced tenderness and juiciness of cooked chops without negatively affecting off-flavor (Agrilife, 2017).

Serum Proteins

Serum proteins could be good indicators of the metabolism of ingested feeds and also give information on the state of body cells, tissues and organs (Kaneko et al 1997; Akinfola *et al.,* 2007). The result of the serum chemistry shown in Table 2 showed that apart from one cattle, Gudali breed which recorded a lower than normal level of serum albumin concentration (2.54 g/ml), all the other breeds of cattle recorded a higher than normal values for albumin and total protein. A low concentration of serum albumin could be caused by liver dysfunction, since albumin is synthesized in the liver, and dissolved in plasma (Whitby *et al.,* 1989). A higher value of serum proteins and albumin signify a better quality of protein contained in the feed stuff and the total serum protein concentration decreases in severe protein malnutrition (Pritchet and Corning, 2004). In this study, the high level of total protein could be correlated to the appreciable high value of crude protein of the combined feeds given to the cattle. This is similar to Akinfola *et al.,* (2007) who reported a positive correlation between total serum protein and the dietary protein intake.

Blood albumin is a measure of the amount and type of protein in blood and this is an index of nutrition and health (Kelly, 1979) and blood albumin is also an indicator of protein status of the animal (Agenas *et al.,* 2006). Albumin is important for the maintenance of osmotic pressure required for proper distribution of body fluids between intravascular compartments and body tissues (Farrugia 2010). Albumin also acts as a carrier by binding several hydrophobic steroid hormones non-specifically and it is also serves as a transport protein for fatty acids and haeme.

The ability of the liver to synthesize albumin and globulin is decreased if the liver's synthetic function is affected. Hypoalbuminaemia is caused by several conditions like malnutrition, malabsorption, liver disease and nephrotic syndrome (Pasantes-Morales *et al.,* 1984).

Low globulin levels could result from conditions like autoimmune disease, kidney disease, multiple myeloma or cirrhosis (Healthline, 2017). The serum albumin and globulin ratio produced values similar within the ranges recorded by Kapale *et al.,* (2008) for Gaolao Cattle of Vidarbha region, Nagpur.

Blood glucose

Blood glucose is one of the common metabolites used in the assessment of the energy status of animals (Akinfola *et al.,* 2007). Blood glucose varies moderately in blood and it has a diagnostic value in assessing the nutritional status of animals (Reynolds *et al.,* 2003). All the different breeds of cattle recorded glucose values within the normal reference interval (VDL, 2015) except for the Gudali breeds which recorded values higher than the normal reference interval. The Gudali males gave glucose values ranging from 220-224 mg/dl, while the Gudali females recorded values ranging from 115-135 mg/dl. This shows that the alternative feeds sources was acceptable to the cattle as it did not reduce their serum glucose concentration. Kaneko *et al.,* (2008) reported that ruminants produce endogenous glucose synthesis from non-carbohydrate sources (gluconeogenesis), as a result, they are generally well adapted to a carbohydrate economy. In ruminants, little glucose is absorbed from the gut, so the overwhelming bulk of glucose is synthesized (Lindsay, 1959; Otchere *et al.,* 1974). Most (approximately 90%) of this synthesis occurs in the liver with the remainder occurring in the kidney (Bergman, 1982). The chief substrates are propionate and amino acids, with the former being most important in animals on a high-grain diet. Other precursors are branched chain volatile fatty acids (VFAs) and lactate absorbed from the rumen and glycerol released during lipolysis (Bergman, 1975).

Creatinine

The creatinine values recorded by all the cattle breeds in this study were just slightly above the normal reference interval. Serum creatinine is an important indicator of kidney functions. Kluwe, (1981) reported that an elevation of creatinine level in the blood is suggestive of impaired kidney function. However, high creatinine levels could also be caused by dehydration or inadequate intake of water, over-tiredness and lack of rest and intake of drugs

having renal toxicity. More clinical observations will need to be carried out before implicating an impaired kidney function as the cause of the high serum creatinine in this study. A lower creatinine value for a feedstuff is proportional to the quality of protein in the feedstuff according to (Okorie, 2006; Ramsbottom *et al.,* 2008).

Cholesterol

Dietary cholesterol has generated much interest by the public in relation to coronary heart disease (Agboola *et al*., 2016). The cholesterol values recorded for all the cattle were within the normal reference range for bovine (VDL, 2015). This shows that the alternative feeds given to the cattle will not predispose them to hypertension, hyperlipidaemia and other health conditions associated with high cholesterol level (hypercholesterolaemia) and also the human consumers. There exists a relationship between dietary components and serum cholesterol levels in farm animals, according to clinical data (Okeudo, 2000; Oforjindu, 2006 and Obikaonu *et al.,* 2011). Many studies have shown that chronically high levels of cholesterol are associated with an increased incidence of atherosclerosis (Mbenza *et al.,* 2007). High total cholesterol are correlated with increased risk of atherosclerosis (Martin *et al.,* 1986). Triglyceride-rich lipoproteins of both liver and intestinal origin were revealed as an atherogenic factor (Phillips *et al.,* 1993; Zilversmit, 1995). Hypercholesterolaemia is associated with elevated total cholesterol and triglycerides (Abdelhalim and Alhadlaq, 2008). The values for triglycerides in all the cattle were below the normal reference interval. Triglycerides are a major type of body fat, which move in the blood as very low density lipoproteins (VLDL), which are also stored in adipose tissues for energy requirements by the body (Khanse, 2018). The excess calories not immediately required by the body are converted into triglycerides. The low values obtained for the triglycerides in this study indicates the need for a further investigation, since triglycerides should always be at optimum levels in the body so as to perform their functions adequately.

Conclusion

It is concluded that the alternative sources of feeds given to the cattle has appreciable high level of crude proteins and crude fibre and the serum chemistry results were within normal reference ranges except for the triglycerides which were lower than the normal reference values and the creatinine levels which were slightly higher. More studies are suggested to closely observe the triglycerides and creatinine levels especially with kidney function tests before recommending these alternative feed sources for feeding cattle. Also, further studies are needed to evaluate the effects of each of the individual non-conventional feeds on the haematological and serum chemistry of the confined cattle.

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