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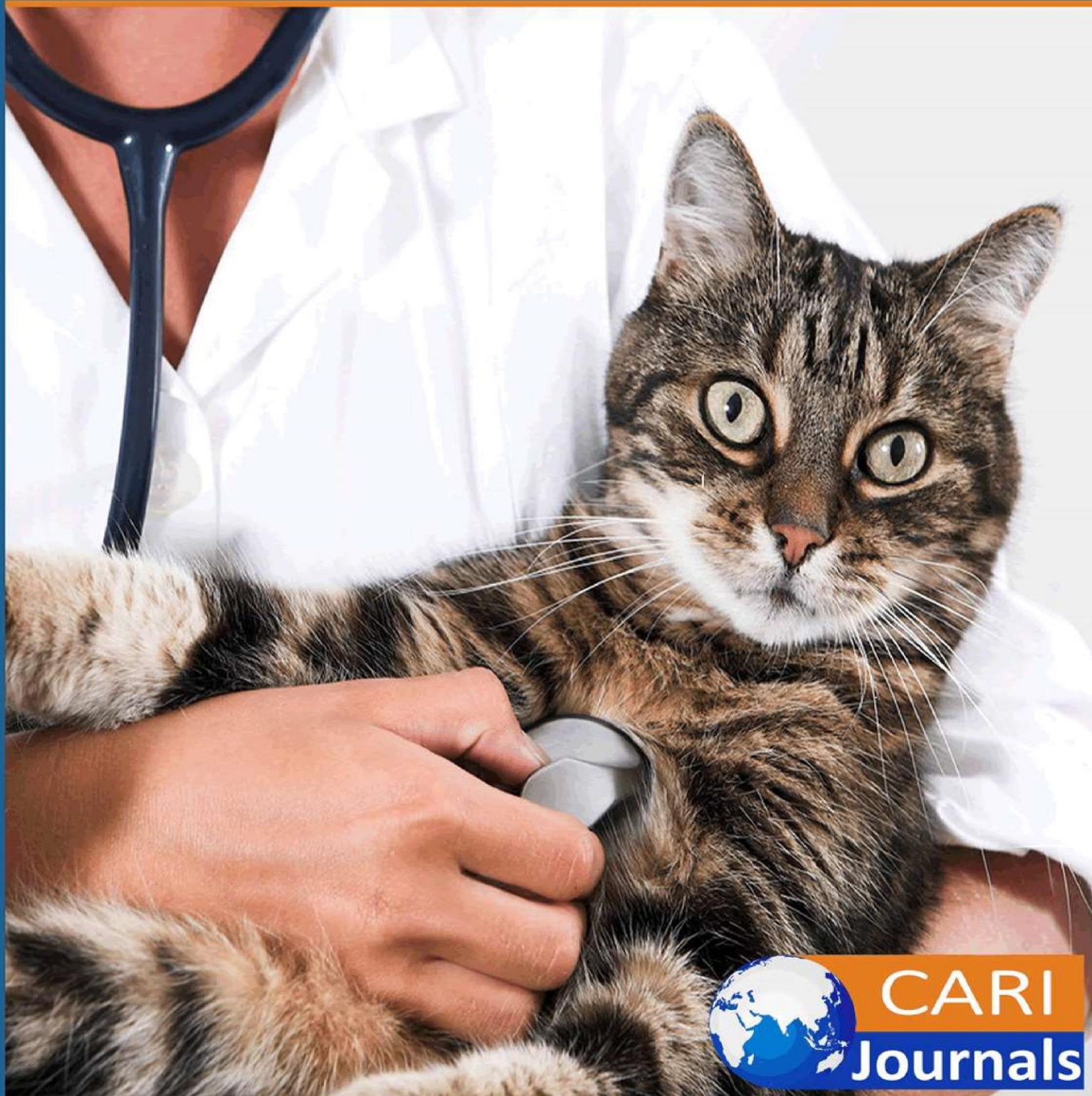

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Nutritional Value of Dried Rumen Digesta from Cattle, Sheep and Goat: A case of Bolgatanga Abattoir, Ghana

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Abstract

Purpose: The work evaluated the nutritive value of dried rumen digesta (DRD) from cattle (CRD), sheep (SRD) and goat (GRD) in Bolgatanga Abattoir, Ghana.

Methodology*:* Rumen digesta (RD) was collected from twenty-seven (27)) animals, nine each from cattle, sheep and goat at the Bolgatanga Municipal Abattoir and sundried for 4 days. Proximate analysis, cell wall component and metabolizable energy were estimated after which the data was subjected to analysis of variance for statistical difference at 0.05% level.

Findings: Result obtained showed significant differences (P< 0.05) in proximate compositions. Goat Rumen Digesta (GRD) had highest organic matter (90.81%), Crude protein (12.17%) and metabolizable energy (ME) (374.24 Kca/100g) compared to the other experimental digesta from cattle. The Neutral detergent fibre (NDF), acid detergent fibre (ADF) and cellulose were not significantly different across the rumen digesta obtained from the species of animals.

Unique contribution to theory, practice and policy: The values for organic matter and crude compositions obtained from the Sun-dried rumen digesta from cattle, sheep and goat indicated the ability of rumen digesta to provide the nutrients particularly protein required by animals for normal physiological activities. Farmers can process the digesta and include it in livestock feeds.

Keywords: *Sun Dried rumen digesta, Cattle, Goat, Sheep, Proximate analysis*

1.0 INTRODUCTION

Nutrition of ruminant livestock in most developing countries is often derived entirely from natural pasture with very little supplementation (Ansah and Issaka, 2018). The main challenge nowadays in livestock production is to reduce feeding cost globally. Animal feeds are not readily available and where they are, affordability for an average farmer is a challenge (Ruzic-Muslic et al., 2014). The cost of protein concentrate for livestock production has increased due to competition between humans and animals, production instability, distribution of protein feedstuffs, etc. Increasing reliance on imported proteins has also exposed farmers to unstable prices, currency movements

and supply shortages. All these factors limit farmers access to protein for livestock production (Merry et al., 2001).

The livestock sector plays a crucial role in meeting the nutritional needs of Ghanaians (meat, eggs and milk), The demand for these livestock products is still at a greater rate than production especially in the cities due to increasing incomes of consumers (Osei, 2012). The attempt to meet this demand has been met with unavailability of feed resources, most especially, when the dry season period sets in (Awuma, 2012). The low ruminant livestock production in Ghana is attributed to the lack of adequate nutrition during the dry season period.

In the Northern parts of Ghana, the weather becomes very dry and hot from November to April. This period comes with its challenges such as very poor feed quality low in nitrogen, scarce grazing material and shortage of drinking water for ruminant livestock on natural pasture. The lack of quality feed resources during the dry season is a prime concern of livestock farmers in Northern Ghana. This result in loss of weight of animals which affects their market value and other production indices. Considering these challenges, alternative source of non-conventional feeds needs to be evaluated and produced to augment feed supply. Rumen digesta is one of such protein sources which could enhance livestock production to ensure efficient and sustainable animal production.

Rumen digesta is waste generated from ruminant animals in slaughterhouses (cattle, sheep and goats). It is a partially digested forage mainly found in the rumen of ruminant animals that contains gas, fluid, bacteria, protozoa and fungi and is fairly rich in crude protein (Agbabiaka et al., 2011; Okere, 2016). This waste, is usually discarded on the environment to become pollutants and breeding sites of both parasites and vectors of human and animal diseases.

Meanwhile, scarcity of feed is a limiting factor to the production of animals for food (meat and milk) industrial raw materials (hides, fur, hooves, etc.) and labour. However, if properly evaluated, rumen digesta could be processed into animal feed to enhance animal production and eliminate the hazards of its disposal on the environment as well as the concomitant the public health risks. Hence the need to evaluate the nutritional value of rumen digesta from cattle, sheep and goat in the Bolgatanga Abattoir, Ghana.

Various reports on the chemical composition of rumen contents suggests a high degree of variability. This variation is attributed to the type of forage consumed by the animal, environment in which the experiment took place, health condition of the animal, season, the number of microbes present in the rumen and the duration of the forage in rumen of the animal before slaughter (Togun et al., 2010; Togun et al., 2010; Sakaba et al., 2017).

The nutritional composition of dried rumen digesta has actually revealed its relevance in the livestock feed industry by nutritionists as inexpensive feedstuff (Togun et al., 2010; Elfaki et al., 2014 and Osman and Elimam, 2015). It is fairly rich in crude protein (CP) (18.52%) and micro-flora such as fungi, protozoa and bacteria (Dairo et al., 2005; Esonu et al., 2006; Agbabiaka et al., 2011). Dried rumen digesta contains 13.36 to 98.4% of dry matter (DM), 11.38 to 19.6% CP and 15.3 to 41.84% crude fibre (CF) (Togun et al., 2010). According to Agbabiaka et al. (2011), dried rumen digesta has 5.41% moisture, 18.58% CP, 3.77% crude fat, 34.44% CF, 24.81% nitrogen free extract (NFE) and 18.4% ash. Al-Wazeer (2016) reported a CP composition of 14.22% for

dried rumen digesta, Rios-Rincon et al. (2010); Nasser et al. (2012); Olafadehan et al. (2014) and Talib et al. (2016) reported the range of 13.3-16.4% for cattle rumen digesta while Mondal et al. (2013) reported CP of 12.57%. These reports show variation in the chemical composition of the dried rumen digesta and they were all limited to rumen digesta from cattle neglecting sheep and goat rumen digesta which could also contain high levels of nutrient composition.

Rumen Digesta is used as Feed Ingredient for both ruminants and non-ruminant animals in many parts of the world (Okere, 2016). It can be used as a feed substitute for forage basal feed (Yitbarek et al., 2016). Currently, researchers are making great efforts to properly processed rumen digesta from slaughterhouses as alternate source of nutrient to support the shortage of feed resource (Adedipe et al., 2005; Amata, 2014). This is of economic value for the livestock industry (Amata, 2014). According to Ra and Iliyasu (2017) several studies have shown that dry rumen digesta had been fed to various animals as feedstuff at different levels. A mixture of blood and dried rumen digesta has shown no adverse effect on diet of poultry, catfish, quail, lamb and cattle (Osman and Elimam 2015; Mishra et al., 2015).

The use of rumen digesta in livestock feed can improve the flexibility of feed formulation and reduce the environmental hazards associated with abattoir waste. However, differences in species and forages ingested by slaughtered ruminants in different agro-ecological zones may significantly affect the quality of rumen digesta. Furthermore, evaluating the nutritional value of rumen digesta from cattle, sheep and goat will add to the current literature on the potential value of rumen digesta.

2.0 METHODOLOGY

2.1 Research Design

The design used for the studies was a complete randomized one with three treatments {Cattle Rumen Digesta (CRD), Sheep Rumen Digesta (SRD) and Goat Rumen Digest (GRD)}, each sample replicated thrice for the proximate composition and cell wall component.

2.2 Study area and sample collections

This research was conducted at Ecological Agriculture Department, School of Applied Science and Arts, Bolgatanga Technical University. Samples of Cattle Rumen Digesta (CRD), Sheep Rumen Digesta (SRD) and Goat Rumen Digesta (GRD) were collected from 9 each of slaughtered cattle, sheep and goat from the Bolgatanga Abattoir in the Upper East Region of Ghana. The digesta was collected from animals examined by veterinary staff to ensure that they were healthy before being slaughtered and sundried for 4 days. The Sun-dried rumen digesta (SRD) was then milled through 2 mm and then 1 mm sieves respectively, screened sequentially using a Hammer mill (Brabender, Germany) for chemical analysis.

2.3 Proximate analysis

Dry matter (DM), crude protein (CP), fat content, crude fibre and ash were determined according to AOAC (1990). The Nitrogen Free Extract (NFE) and carbohydrates were calculated as follow: NFE (%) = 100 - (% moisture + % fat + % crude fibre% + % Protein + % ash) and Carbohydrates

(%) = 100 – (% moisture + % fat + % protein + % ash). The metabolizable energy (Kcal/100g) was determined by using Atwater method at the Kwame Nkrumah University of Science and Technology.

2.4 Neutral detergent fibre (NDF) and acid detergent fibre (ADF)

NDF and ADF were determined exclusive of residual ash by sodium sulphite and α- amylase following the procedure of Van Soest *et al.* (1991) and was run on the Ankom200 fibre analyser.

2.5 Statistical Analysis

All data were subjected to statistical analysis of variance using Genstat 18.2 edition. With the following model: Yij=μ+Ti+eij, where Yij: observed variation, μ: population means, Ti: nutritional values i the digesta and eij: error term. Significant difference among treatment means were tested by using Turkey at 5% ($p<0.05$) using the same software.

3.0 FINDINGS AND PRESENTATION

3.1 Chemical Composition

The results in table 1 show that dried Cattle Rumen Digesta (CRD) had the highest dry matter content (96.34%), Carbohydrate (70.64%), ash (14.40%) and nitrogen free extract (NFE) (40.79%) while Goat Rumen Digesta (GRD) had highest organic matter (90.81%), Crude protein (12.17%) and metabolizable energy (ME) (374.24 Kca/100g). Least dry matter, Carbohydrate and nitrogen free extract were observed in Sheep Rumen Digesta (SRD) with figures of 94.68%, 66.39% and 33.90% respectively while CRD had lowest organic matter (85.60%), Crude protein (8.49%), Fat (2.81%) and ME (341.78 Kca/100g) and GRD had the lowest ash (9.19%). The results imply that goat rumen digesta GRD organic matter and crude protein can support livestock production.

Table 1: Chemical Composition of Dried Rumen Digesta from Cattle, Sheep and Goat (%)

	Species of Animals				
Nutrients	**CRD**	**SRD**	**GRD**	**± SED**	**P. value**
Dry matter	96.34[a]	94.68[c]	95.88[b]	0.052	<.001
Organic matter	85.60[c]	89.78[b]	90.81[a]	0.180	<.001
Crude protein	8.49[b]	11.37[a]	12.17[a]	0.314	<.001
Carbohydrate	70.64[a]	66.39[c]	69.02[b]	0.411	<.001
Ash	14.40[a]	10.22[b]	9.19[c]	0.180	<.001
NFE	40.79[a]	33.90[c]	37.51[b]	0.370	<.001
Fat	2.81[c]	6.70[a]	5.50[b]	0.213	<.001
ME (Kca/100g)	341.78[b]	371.36[a]	374.24[a]	1.667	<.001

CRD= Cattle Rumen Digesta, SRD= Sheep Rumen Digesta, GRD= Goat Rumen Digesta, NFE = nitrogen free extract, ME = metabolizable energy. Means within the same row with different

superscripts are significantly different (P< 0.05). Those with same superscripts are not significantly different (P> 0.05)

3.2 Fiber composition

The result of table 2 illustrate that sheep rumen digesta had highest Crude fibre (32.49 %) while cattle rumen digesta had highest Neutral detergent fibre (66%) and Cellulose (20%) and Goat rumen digesta had highest Acid detergent fibre (46.96%). Lowest crude fibre (29.85%) was observed in cattle rumen while sheep rumen digesta had lowest Neutral detergent fibre (61.32 %) and Acid detergent fibre (42.45%) and goat rumen digesta had lowest cellulose (16.9%). The high content of cell wall fractions in the rumen digesta implies low feed intake, since a major factor regulating forage intake is NDF content due to its effects on rumen fill.

Table 2: Fiber Composition of Dried Rumen Digesta from Cattle, Sheep and Goat (%)

	Species of Animals				
Nutrients	**CRD**	**SRD**	**GRD**	**± SED**	**P. value**
Crude fibre	29.853[a]	32.49[c]	31.51[b]	0.045	<.001
Neutral detergent fibre	66.00	61.32	63.95	3.206	0.446
Acid detergent fibre	46.00	42.45	46.96	1.851	0.175
Cellulose	20.00	18.87	16.99	3.128	0.663

CRD= Cattle Rumen Digesta, SRD= Sheep Rumen Digesta, GRD= Goat Rumen Digesta. Means within the same row with different superscripts are significantly different (P< 0.05). Those with same superscripts are not significantly different (P> 0.05)

4.0 DISCUSSION, CONCLUSION AND RECOMMENDATIONS

4.1 Discussion

The chemical composition shows the highest dry matter was obtained in cattle rumen digesta. The dry matter content was significantly (P<.001) different among the species of animals. The DM of the dried rumen digesta was sufficient to support an appreciable amount of DM intake in ruminant animals. High dry matter content is good for the rumen function of ruminants as they act as substrate for fermentation by the microbes (Oni *et al*., 2008). This result is consistent with Mahmoud et al. (2015) and Al-Wazeer (2016) for dried rumen digesta obtained from cattle, sheep and goat.

The CP content of the dried rumen digesta obtained from species of animals fell within the 7-8% requirement for satisfactory rumen function to enhance feed intake in ruminant animals. The result however contradict findings of Rios-Rincon *et al*., (2010), Nasser *et al.*, (2012), Olafadehan *et al*., (2014), Mahmoud and Khadiga (2015), Talib *et al*., (2016) and Sakaba *et al.*, 2017) on crude protein obtained from rumen digesta. This contrast may be due to the nutritive quality of the pastures, season and the holding time between feeding and slaughter. The CP obtained from goat

rumen digesta is consistent with findings of Togun *et al*., (2010) and Mondal *et al.,* (2013) for rumen digesta. The CP content of all the rumen digesta are superior to the commonly used crop residues like rice straw. Ansah *et al.* (2017) reported crude protein content of 45.9, 47.3, 65.7, 53.4 and 45.1 g/kgDM for Hybrid, Exbaika, Jasmine 85, IR841 and Long grain ordinary 2 varieties of rice respectively. The nutritional composition (dry matter, organic matter, carbohydrate, fat and the ME values of dried rumen digesta has actually revealed its relevance in the livestock feed industry.

Cattle rumen digesta had highest NDF and cellulose while goat rumen digesta had highest value in ADF. The crude fibre values were comparable to the report of Mahmoud and Khadiga (2015) for similar speecies of animals.

4.2 Conclusion

The values for organic matter and crude compositions obtained from the Sun-dried rumen digesta from cattle, sheep and goat indicated the ability of rumen digesta to provide the nutrients particularly protein required by animals for normal physiological activities.

4.3 Recommendations

Farmers can process the rumen digesta and include it in livestock feeds.

4.4 Limitations

To obtain excellent result for the study, there had been some constraints which have to do with source of funding for the research, to conduct feeding trial.

4.5 Areas of further research

The study recommends further investigations on minerals and anti-nutritional compositions of the digesta from cattle, sheep and goats. Also, further investigations on feeding the digesta to poultry to assess its effect on growth performance.

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