



Performance of Uda Rams Fed Graded Levels of Two Forms of Kanwa

N. Muhammad¹, U. A. Umaru², A. I. Bukar³, K. M. Aljameel^{1*}, M. B. Bislava⁴,
I. M. Jaji¹ and M. A. Dilala¹

¹Department of Animal Science, Usmanu Danfodiyo University Sokoto, Nigeria.

²Department of Animal Health Production, College of Agricultural Gujiba, Nigeria.

³Department of Animal Science, Federal University, Dutse, Nigeria.

⁴Department of Animal Science, University of Maiduguri, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Authors UAM and AIB designed the study and conducted the research. Author KMA performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author NM supervised the study and managed the analyses of the study. Authors MBB, IMJ and MAD managed the literature searches. All authors read and approved the final manuscript.

Article Information

Editor(s):

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Reviewers:

(1) Anderson Fernando de Souza, University of São Paulo (USP), Brazil.

(2) Gebrekidan Tesfay Weldeslasse, Adigrat University, Ethiopia.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/60328>

Original Research Article

Received 06 July 2020

Accepted 11 September 2020

Published 10 October 2020

ABSTRACT

An experiment was conducted to evaluate the utilization of trona (*kanwa*) in the diet of yearling Uda rams. A complete experimental diet was formulated and graded levels of different forms of trona at 0.5, 1.0, 1.5 and 0kg of *maifatsi* and *yarzankuwa* per 100 kg inclusion levels. The experimental diet was fed to twenty eight (28) yearling Uda rams. Data was collected on different form of Kanwa and analyze of chemical composition of different forms of trona (*kanwa*), and: determination of feed intake and growth performance. The mineralogical composition of the trona indicates that *yarzankuwa* and *maifatsi* contained Na (18,000 and 20,400), K (5,000 and 5,000), P (6.30 and 8.25) in mg/kg respectively. Results on rams performance revealed significant difference ($P < 0.05$) between treatment 2 and other treatments in terms of average daily gain (ADG), final body weight as well as the feed conversion ratio. There was a significant difference ($P < 0.05$) in final body weight of rams fed 10 g / kg *maifatsi* (T2) compared to other treatments.

*Corresponding author: E-mail: Muhdkjameel@gmail.com;

Keywords: Sheep; performance; ADG; weight gain.

1. INTRODUCTION

1.1 Background of the Study

Minerals play important metabolic roles in animal nutrition, however, they are neither sources of energy nor protein, but are essential for biosynthesis of the essential nutrients [1]. The deficiency symptoms of one mineral may predominate and affect the performance of the ruminant animal. Low animal's productivity is attributed to many limitations, the most apparent being the inadequate and poor-quality feed (lacking in protein, energy, minerals) which consequently result in poor growth and low reproductive performance [1].

Hydrated carbonate of sodium (Trona), generally referred to as *Kanwa* in the northern part of Nigeria, is a product of the salt industry in many parts of northern Africa. It occurs as a mixture of different substances with sodium constituting about 30% and other minerals such as potassium, iron, zinc etc. in varying proportions. The composition of *kanwa*, a naturally occurring mixture of salts varies widely, but mostly contains Na_2SO_4 , in varying proportions [2, 3]. It has been shown that *kanwa* salts from Nigeria are rich in macro nutrients and calcium sulphate in various concentrations [4]. Some forms of *kanwa* contain virtually no sodium carbonate or sodium sulphate but consist primarily of sodium and potassium chloride, with smaller amounts of calcium carbonate, potassium sulphate and calcium sulphate [5]. [6] Analyzed eight samples of *kanwa* by the Raman spectroscopic analyses. Result of the analysis indicated that the *kanwa* specimens are of indefinite composition, comprising of sulphate. sodium sulphate (Na_2SO_4) and sodium carbonate (Na_2CO_3), with several containing sodium carbonate (Na_2CO_3) and gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). The different forms also vary with respect to their locations [7, 8].

Trona has several uses: it is used in cooking as a food tenderizer especially in pulses [9, 10], to curdle milk, in the tanning industry and in the preparation and enhancement of flavor of local beverages and snuff [11]. It is used extensively in ethno-veterinary practices for the treatment of skin diseases and digestive problems. This is addition to its use as a salt lick for mineral supplementation in ruminants [12]. This study, therefore investigate on the effects of supplementing the varying forms of trona on

performance of fattening Uda rams in Sokoto, Nigeria.

2. MATERIALS AND METHODS

2.1 Description of the Experimental Sites

The study were carried out at the Livestock Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture, located at the main campus of the Usmanu Danfodiyo University, Sokoto. Sokoto state lies between longitudes $4^{\circ}8'E$ and latitudes $12^{\circ}0'N$. The state has an average maximum temperature of $41^{\circ}C$ and minimum of $13^{\circ}C$ in April and January respectively. Sokoto State is characterized by alternating rainy and dry seasons. The annual rainfall is about 700 mm per annum, and an altitude of 350m above sea level, [13]. The dry season starts from October and lasts up to April, in some parts and may extended to May or June in other parts. The wet season on the other hand begins in most part of the state in June and last up to September or October. Sokoto state has abundant livestock resources, because the climate is suitable for livestock production, abundant vegetation due to the absence of Tsetse fly on open grass land.

2.2 Methodology

2.2.1 Treatments and experimental design

A completely randomized design (CRD) was used in this experiment with number of animals representing replicates. Four animals were allocated to each treatment, the mean weight between the treatments were balanced. Each animal was housed in a pen which was disinfected before and during experiment. Each group was assigned to one of the experimental diet and fed *ad libitum* for 12 weeks. The treatments for this experiment comprised of three levels of 0.5, 1.0, and 1.5 kg/100 kg feed each for *maifatsi* and *yarzankuwa*. While 0g /100 kg feed which served as the control.

2.2.2 Sources of experimental feedstuff

Experimental feed ingredients such as cereal grain products (maize stover), plant protein (cotton seed cake), and cereal/legume offal (groundnut hubs and rice offal) were purchased from local Rice and groundnut processing mills in Sokoto metropolis while molasses and vitamin

premix were purchased from Potiskum cattle market in Yobe state and trona (*kanwa*) were purchased from the Gashua main market, in Yobe state. The *kanwa* was crushed to powder form before mixing it with the other feed ingredients.

2.2.3 Experimental diet formulation

A complete experimental diet was formulated with graded levels of *Maifatsi* and *yarzankuwa* forms of trona (*kanwa*) at 0.5 kg, 1.0 kg, 1.5 kg for each form respectively and 0 kg inclusion levels in 100 kg. Experimental diets was offered to the twenty eight (28) Uda Rams. The diets were designated as treatments 1, 2, 3 at 0.5, 1.0 and 1.5 kg respectively for *Maifatsi* 4, 5, 6 at 0.5, 1.0 and 1.5 kg respectively for *yarzankuwa* while 7 served as control in the experiment (Table 1).

2.2.4 Experimental animals and their management

Twenty eight (28) healthy male yearling Uda rams were used for the experiment. The rams were purchased from the local markets around Sokoto state. The rams were put on adaptation for two weeks. The animals were subjected to prophylactic treatment before the commencement of the experiment. Routine management was also carried out regularly. Feaces and urine were removed frequently from the feeding pens to ensure adequate ventilation, less ammonia accumulation, adequate cleanliness of the experimental pens and to ensure minimum discomfort of the experimental animals. The rams were orally dewormed with albendazole (2.5% solution) 5 ml start against gastrointestinal parasites and oxytetracycline (long acting broad-spectrum antibiotic) at 2.5 ml bd for 2 days.

2.2.5 Proximate analysis of the experimental diets

The crude protein (CP), Crude fibre (CF), Ether extract (EE), nitrogen free extract (NFE), ash components of the diets and mineral profile of trona were determined according to the procedures of [14].

2.3 Data Collection

2.3.1 Analyses of chemical composition of different forms of *Kanwa*

Analyses of the six (6) different forms of trona namely: *Ungurno* (Unk 1), *Jan kanwa* (Unk 2), *Maifatsi* (Unk 3), *Kyallara* (Unk 4), *yarzankuwa* (Unk 5) and *Farar kanwa* (Unk 6) were carried out to determine the chemical (mineralogical) compositions of Na, Fe, Cu, Mn, Zn, K, Ni, Cd, Mg, Cr, Pb, Ca, P and S, Using AOAC (2007) procedure.

2.3.2 Feed intake

Daily records of feed intake were taken throughout the 84 days of the experiment. This was determined by subtracting feed leftover (kg) from the feed offered (kg) to the animals to obtain feed intake (kg). Adequate measures were taken to safeguard against feed wastage.

2.3.3 Live weight changes

The animals were weighed prior to the commencements of the experiments and on weekly basis thereafter on the same day of the week, using a hanging balance (100 kg capacity).

Table 1. Gross composition of the experimental diets (%)

Ingredients (%)	Composition (%)
Groundnut pods	20.00
Maize Stover	15.00
Cotton Seed Cake	17.10
Rice offal	25.60
Cowpea hay	18.30
Molasses (liquid)	4.0
	100
Inclusion level of trona 0.5, 1.0, 1.5 kg / 100 kg of <i>maifatsi</i> and <i>yarzankuwa</i> as treatment 1,2,3 and 4, 5 and 6 respectively while treatment 7 as control	
Calculated Energy (kcal ME/kg)	2509
Calculated CP (%)	12.14
Calculated CF (%)	23.46

2.4 Statistical Analysis

The data obtained from the laboratory analysis on the chemical composition of trona (*kanwa*) in phase 2 of the experiment were presented as it were. The data generated from feed intake and live weight changes of the experiment were subjected to analysis of variance (ANOVA) in a Completely Randomized Design (CRD). Statview Statistical Package (2002), where significant differences exists, Duncan’s multiple range was used to separate the means at 5% level of significance. The normality of the Data was tested using Shapiro-Wilk W Test.

3. RESULTS

3.1 Interactive Effect of Forms and Level of Inclusion of *Kanwa* on Performance of Uda Rams

The performance of Uda rams fed graded levels of *Kanwa* are presented in Table 3. The results indicated significant (P<0.05) differences in all the parameters measured. Rams fed treatment 2 (*maifatsi*) performed better compared to animals in other treatments in terms of average daily weight gain (ADG) and final body weight. The result showed significant interaction between the levels and forms of *kanwa* in all the performance

parameters (P<0.05) except the initial body weight (P>0.05).

4. DISCUSSION

4.1 Mineralogical Composition of Different Forms of Trona (*Kanwa*)

The result of the analysis of different forms of trona (*kanwa*) shows unk3 and unk4 had higher content of calcium, with 188910 mg/kg and 194567 mg/kg respectively. Lower value of calcium (13044 mg/kg) was found in unk 2. Unk1 has a higher value of sodium, potassium, magnesium, iron, zinc and manganese and unk 3 has a lowest values of sodium, potassium, and magnesium as compared to other forms. Since the composition of *kanwa* varies widely since it is a naturally occurring mixture of salts, but mostly contains Na₂SO₄, in varying proportions [3, 2].Result showed that all the varieties have no cadmium, nickel, lead and chromium. Copper and iron are higher in unk1 and lower in unk2 as compared with manganese which is higher in unk3, unk4 and lower in unk2 and unk6 which clearly agreed with the finding of [9; 10] which observed trona in different forms and varies in mineralogical (chemical) composition differs according to locations.

Table 2. Mineralogical composition of different forms of trona (*Kanwa*) in mg/kg

Code	Macro elements					Micro elements							
	Na	K	P	Mg	Ca	Cd	Cu	Fe	Ni	Pb	Zn	Cr	Mn
Unk1	35000	15000	5.52	3198	172537	ND	1.33	106	ND	ND	2.46	ND	69
Unk2	30500	8000	5.81	3049	13044	ND	0.64	24	ND	ND	0.23	ND	47
Unk3	18000	5000	6.30	2505	188910	ND	0.73	103	ND	ND	1.83	ND	76
Unk4	25000	11500	6.25	2993	194567	ND	1.30	100	ND	ND	1.64	ND	72
Unk5	20400	5000	8.25	2742	163044	ND	2.56	91	ND	ND	4.72	ND	67
Unk6	25000	3500	6.03	3190	107268	ND	2.45	66	ND	ND	1.67	ND	32

UNK1 = Ungurno (blackish grey), UNK2 = Jankanwa (light Pink with white patches), UNK3 = Maifatsi (Greyish white aggregates), UNK4 = Kyallara (dirty-white grey), UNK5 = Yarzankuwa (white grey), UNK6 = Fararkanwa (white grey with blackish grey stain) ND = Not detected

Table 3. Main effect of Forms and inclusion levels of *Kanwa* on performance of yearling Uda rams

Parameter	Treatment (combinations)							
	Forms of <i>Kanwa</i>		SEM	Level of inclusion				SEM
	<i>Maifatsi</i>	<i>Yarzankuwa</i>		0	0.5	1	1.5	
Feed intake	0.95 ^a	0.82 ^b	0.03	0.89 ^b	0.84 ^{bc}	1.07 ^a	0.75 ^c	0.03
Initial weight	20.47	20.41	0.42	20.63	20.19	20.50	20.45	0.56
Final weight	27.44 ^a	25.78 ^b	0.32	30.01 ^a	24.31 ^c	27.50 ^b	24.63 ^c	0.60
Weight gain	6.97 ^a	5.38 ^b	0.26	9.38 ^a	4.13 ^c	7.00 ^b	4.19 ^c	0.56
Average daily gain	82.98 ^a	64.00 ^b	2.61	111.67 ^a	49.11 ^c	83.33 ^b	49.85 ^c	6.61
FCR	13.43	15.92	1.81	8.01 ^b	18.90 ^a	15.09 ^a	16.68 ^a	1.96

a, b, c means within the same row with different subscripts are significantly different (P<0.05); SEM= Standard error of means

Table 4. Performance characteristics of Uda rams fed graded levels of different forms of trona

Parameter	Treatments combination							SEM	INT
	(M*0.5)	(M*1)	(M*1.5)	(Y*0.5)	(Y*1)	(Y*1.5)	7(control)		
Average daily Intake (kg)	0.94 ^b	1.17 ^a	0.80 ^c	0.73 ^c	0.96 ^b	0.70 ^c	0.89 ^b	0.04	*
Initial body weight (kg)	20.25	20.75	20.75	20.13	20.75	20.13	20.63	0.69	NS
Final body weight (kg)	30.00 ^b	31.38 ^a	30.38 ^b	28.63 ^b	30.63 ^b	28.88 ^b	30.01 ^b	0.31	*
Weight gain (kg)	9.75 ^b	10.63 ^a	8.63 ^b	8.50 ^b	9.88 ^b	8.75 ^b	9.38 ^b	0.72	*
Average daily weight gain (g/day)	116.07 ^b	126.26 ^a	102.74 ^b	101.19 ^b	117.61 ^b	104.17 ^b	111.65 ^b	7.85	*
Feed conversion ratio	8.10	7.21	7.79	7.21	8.16	6.72	7.97	1.4	*

a, b, c means within the same row with different subscripts are significantly different (P<0.05)

*SEM= Standard error of means. M= maifatsi Y= Yarzankuwa, (0.5, 1 and 1.5) = level of inclusion. INT = interaction between forms and level of inclusion of Kanwa, NS= no significant, * = (P<0.05), ** = (P<0.01)*

4.2 Performance Characteristics of Uda Rams Fed Graded Levels of Different Forms of Trona

The significant difference in average daily gain, final body weight and feed conversion ratio in treatment 2 (*maifatsi*) might be a good indication of better utilization of trona (*kanwa*) by the experimental animals as compared with treatment *yarzankuwa*. The average daily gain was also significant (P<0.05) at treatment 2 (which is 1 kg inclusion), while other treatment at various levels. This is in line with the finding of [15] which observed that minerals (salt) is added to sheep diet at a recommended rate of 0.5% in a complete diet or 1% to concentrate portion. The average daily weight gain of treatment 2 (126.26g/day) which is 1kg inclusion shows significant (P<0.05) difference as compared with others treatment and is in line with findings that indicated that sheep weighing 20kg and gaining 100g/day need a dietary supply of 0.3g/day of sodium chloride [16, 17]. However, the non-significant difference in final live weights, live weight gain and ADG between all the treatments shows the efficiency of the animals in utilizing the feeds even with increased levels of the trona (*kanwa*). This is further indicated by the non-significant difference in feed conversion ratio. Performance was better in animals fed *maifatsi* trona (*kanwa*) which might be as a result of

higher mineralogical contain especially calcium which is a vital element for structural and skeletal functions. Also the animals fed 1 kg inclusion levels performed better than 0.5 and 1.5 kg which indicates that trona (*kanwa*) should not be supplemented above 1 kg irrespective of the forms of trona (*kanwa*) used.

5. CONCLUSION

It was concluded that supplementing *maifatsi* form of trona resulted in significantly higher body weight gain in Uda sheep compared to *yarzankuwa* at 10 g / kg (1 kg / 100 kg).

ETHICAL APPROVAL

Animal ethic Committee approval has been collected and preserved by the author.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:

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