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Received: 6/8/2022

Revised: 4/9/2022

Accepted: 22/9/2022

DOI: <https://doi.org/10.31559/VMPH2022.3.3.2>



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How to cite this article: Ocheja, J.O. et al. (2022). Water Intake and Organ Weights of Red Sokoto Goats Fed Different Forms of Neem Leaves, Supplemented with a Concentrate Diet. *Veterinary Medicine and Public Health Journal*, 3(3), 43-47.

DOI: <https://doi.org/10.31559/vmph2022.3.3.2> **Received Date:** 6/8/2022 **Revised Date:** 4/9/2022 **Accepted Date:** 22/9/2022

Abstract

The study evaluated the water intake and organ weights of red sokoto goats fed different forms of neem (*Azadirachta indica*) leaves and concentrate diet. The experiment was carried out at the small ruminant unit Teaching and Research Farm, Federal University of Kashere. Sixteen red sokoto goats (bucks) aged between 7 to 9 months with a weight range of 6.8 kg to 7.3 kg were allotted into four (4) treatments of four goats each. The goats were housed individually in pens. The goats were fed fresh neem leaves, neem leaves hay, neem leaves meal and neem leaves silage at 300g/goat/day for treatments 1, 2, 3 and 4 respectively; and concentrate diet at 125g/goat/day for a duration of sixty-three (63) days. Known volume of water was served and daily water intake was determined. The experimental design was a completely randomized design; data were analyzed using a one-way analysis of variance. The significant means were separated using Least Significant Difference contained in SAS 9.4 statistical packages, 2018 edition. The concentrate and the neem leaves were analyzed for their proximate composition using the method of AOAC (2000). The daily water intake values ranged from 286.87 – 392.95 ml and were significantly ($P < 0.05$) different across the treatment means (significant between which Treatment 1 on one hand and Treatments 2, 3 and 4 on the other hand and both values increased with dry matter intake. All the organ weights values evaluated were not significantly ($P > 0.05$) different across the treatment means. and which value, water intake/dry matter intake (2.70 – 3.87ml/g) values also showed significant ($P < 0.05$ difference between The values for kidney ranged from 0.50 – 0.53 % while those for liver were 2.10 – 2.17 % It was concluded that the various forms of the neem leaves had no influence on the water intake of the goats, the different forms of neem leaves were not toxic to the goats as the goats. Neem leaves can be used to feed goats during the long dry season. Further research should be carried out using other species of ruminants such as sheep and cattle.

Keywords: Water Intake; Organ Weight; Red Sokoto Goats; Neem Leaves; Supplement.

1. Introduction

Inadequate grasses during the long dry season necessitates the use of browse plant species to feed goats and also supplementation with concentrate (Mafindi *et al.*, 2018)

Good nutrition is a prerequisite for good health, good reproduction, high milk yield, fast growth rate and a successful goat production system (Peacock, 1996).

The main problem confronting ruminant livestock producers in Nigeria today is the seasonal fluctuation in the availability of forages for ruminant. The use of leaves from trees that retain their leaves during the long dry season, to feed ruminants during the difficult period is very important. One of such leaves that can be used is leaves from Neem (*Azadirachta indica*) tree.

It is important to use leaves from trees to feed goats during the long dry season, due to unavailability of grasses. Neem leaves as supplement to basal diets of crop residues have been shown to improve feed utilization and animal performance in ruminants (Raghuvansi *et al.*, 2017). Neem leaves are high in crude protein. There are, however, wide variations in the reported values. Crude protein concentrations between 17.5% and 18.7% have been reported (Bhowmik *et al.*, 2010).

The success of animal nutrition depends largely on supplying adequate water to animals (NRC, 2007). Water is very important in goat nutrition, but requirements vary with season, dry matter intake, size of animals, physiological state of animals, climatic conditions, etc. (Ocheja *et al.*, 2020). Phenomena such as climate change, global warming, droughts etc. especially in most recent times makes research on water intake and requirements of livestock expedient.

Ngi. (2012) reported that toxic substances consumed in feeds would reflect in organs such as liver and kidney by enlargement and atrophy of these organs, this makes organ weights evaluation necessary since many unconventional feed stuffs are now being used to feed animals due to scarcity and high cost of conventional feed stuffs.

This study was therefore designed to determine the water intake and organ weights of red Sokoto goats fed different forms of neem leaves and a concentrate diet.

2. Materials and Methods

2.1. Experimental Site

The study was conducted at the Teaching and Research Farm, Faculty of Agriculture, Federal University of Kashere in Gombe State, Nigeria. The

state is situated within latitude 9°54'46N and longitude 9° 46'27E and 10°57' E and altitude of 349m above sea level. The annual rainfall of Kashere ranges between 800mm-900mm per annum and is characterized by distinct dry season (October-May) and rainy season (June-September) seasons. The annual mean temperature ranges from 30-32° C and it experiences a relative humidity of 17-90% (National Geospatial Intelligence Agency, 2012).

2.2. Experimental Animals, Management, Feed preparation and Experimental procedure

Sixteen (16) red Sokoto goats aged between 7-9 months with a weight range of 6.8 to 7.2 kg were sourced from within Kashere and its environs and randomly allocated into four (4) Treatments of four (4) goats each. The goats were housed individually in pens. The animals were treated with Ivomec for endo and ecto parasites control at 0.3ml each and oxytetracycline, hydrochloride and procaine penicillin at 2.0ml each to take care of scouring and nasal discharge and to provide a common health status. The Neem (*Azadirachta indica*) leaves used for this experiment were collected from within the Federal University of Kashere Campus. The components of the concentrate diet consisted of Bambara nut offal (BNO), Beans offal meal (BOM), Cassava peel meal (CPM), Yam peel meal (YPM), Maize offal (MO), Full fat soya bean (FFSB), Egg shell meal (ESM) and Wood ash (Ash). These components were thoroughly mixed after pounding and grinding. Each treatment had (4) goats, each goat was fed 125g of the concentrate diet per day, and the Neem leaves at 300g per Goat per day of which the Neem leaves was fed first, then the concentrate one hour later, the Goats were served known volume of water and the water intake of the goats were determined by subtracting volume of water consumed by the goats from the volume served also taking cognizance of evaporation. Loss

Treatment one (T₁) was fresh neem leaves; treatment two (T₂) was neem leaves hay; treatment three (T₃) was neem leaf meal and Treatment four (T₄) was neem leaves silage.

The concentrate offered the goats were weighed daily and the left over was also weighed and subtracted from the quantity of feed that was served to determine the feed intake of the animal. The experiment lasted for sixty- three (63) days. On the last day of the experiment, 4 goats were slaughtered, bled and the heart, liver, kidney, lungs and spleen were cut off weighed and their weights recorded and later converted to percentage of slaughter weights.

Table (1): Composition of Experimental Diet

Feed ingredients	Value (%)
Bambara nut offal	15.00
Beans offal meal	1.50
Cassava offal meal	4.50
Sweet potato peel meal	3.00
Maize offal	56.00
Yam peel meal	10.25
Full fat soya bean meal	5.00
Egg shell meal	1.00
Wood Ash	0.75
Table salt	2.00
Total	100.00
Calculated nutrient content:	
Crude protein	16.15
Crude fibre	11.30
Metabolizable energy (Kcal/kg diet)	2.700

2.3. Chemical Analysis

Samples of the Neem leaves and the concentrate diet were analyzed for their proximate composition using the method outlined by AOAC (2000).

2.4. Experimental Design and Statistical Analysis

The experimental Design was Completely Randomized Design (CRD). Data obtained was analyzed using a one-way Analysis of variance (ANOVA), means with significant differences were separated using Least Significant Differences (LSD) with the aids of Statistical Package identified as SAS, 9.04, 2018 edition.

3. Results

3.1. Proximate Composition of Neem (*Azadirachta indica*) Leaves and Concentrate Diet

The proximate composition of neem leaves and concentrate diet is summarized in Table 2. The crude protein content of the neem leaves ranged from 6.44 - 9.19% deficiency while the protein content of the concentrate diet was 16.80%. The crude fibre content of the concentrate was 9.5% and 18.00% to 23.80% for the neem leaves. The ether extract values ranged from 3.00% -4.80 % The ash value ranged from 8.00 % - 14.0 %. These values did not follow ant definite pattern.

Table (2): Proximate Composition of Experimental Diets

Nutrient	Treatments				
	T1	T2	T3	T4	Conc
Crude protein	9.19	8.55	6.44	7.88	16.80
Crude fiber	18.50	19.30	18.00	23.80	9.50
Ash	11.50	11.80	8.00	14.50	3.15
Ether extract	3.60	3.70	3.00	4.80	5.85
Moisture	34.00	15.00	40.50	10.00	5.05
Dry matter	64.00	85.00	59.50	90.00	94.95
NFE	23.20	41.65	22.76	41.02	60.65
Neutral Detergent Fibre	54.00	55.00	54.55	52.35	60.00
Acid Detergent Fibre	37.40	36.30	37.00	40.15	34.50
Acid Detergent Lignin	8.60	8.70	8.45	7.50	5.50
Ceellulose	28.80	27.60	28.55	32.65	29.00
Hemicellulose	16.60	18.70	16.45	12.20	25.50

Conc.=Concentrate, NFE=Nitrogen Free Extract

3.2. Water intake of Red Sokoto Goats Fed Different Forms of Neem Leaves and a Concentrate Diet

The total water intake, daily water intake, water intake/dry matter intake and water intake /liveweight gain were all significantly ($P<0.05$)

different. All the array of values did not follow any definite trend increased. The water intake /dry matter intake ranged from 286.87 – 392.95 ml/g.

Table (3): Water intake of Red Sokoto Goats Fed Different Forms of Neem Leaves and a Concentrate Diet

Parameters	Treatments				
	T1	T2	T3	T4	SEM
Total Water Intake(ml)	23495.00 ^a	19797.50 ^b	21457.67 ^a	19963.00 ^b	105.33
Daily Water Intake(ml)	392.95 ^a	314.24 ^b	340.92 ^b	286.87 ^c	35.72
Water Intake/DM Intake(ml/g)	3.87 ^a	2.86 ^b	2.70 ^b	2.97 ^b	0.55
Water Intake/Live Weight Gain (ml/kg)	0.059 ^a	0.034 ^b	0.037 ^b	0.034 ^b	0.07

a, b, c: Means on the same row with different super scripts differ significantly (P<0.05).

SEM: Standard Error of the Means

3.3. Organ Weights of Red Sokoto Goats Fed Different Forms of Neem Leaves and a Concentrate Diet

The Organ Weights of red Sokoto goats fed different forms of neem leaves and a concentrate diet is presented in Table 4.

The weight of the liver, lungs, spleen, kidneys and heart were not significantly (P>0.05) different. The values did not follow any definite trend for all the organs. The values did not follow any definite trend.

Table (4): Organ Weights of Red Sokoto Goats Fed Different Forms of Neem Leaves and a Concentrate Diet (Percentage of Live Weight)

Organs	Treatments				
	T1	T2	T3	T4	SEM
Liver	2.10	2.15	2.17	2.13	0.05
Spleen	0.17	0.20	0.16	0.15	0.03
Heart	0.59	0.57	0.53	0.55	0.03
Lungs	1.55	1.46	1.49	1.52	0.04
Kidney	0.50	0.51	0.50	0.53	0.03

SEM: Standard Error of the Means

4. Discussion

The protein content of 6.44-9.19% for the neem leaves were lower than 18.76 % reported by Fasae *et al.* (2018) the values were also lower than 12-18% recommended for growing ruminants in the tropics (NRC 1996). However, the supplement may take care of this deficiency while the protein content of the concentrate diet (16.80%) was within the values of 12.18% recommended by NRC (1996). The crude fibre content of 9.5% for the supplement diet and 18.00% to 23.80% for the neem leaves were adequate for the goats (Lakpini *et al.*, 2002). The ether extract values of 3.00% -4.80 % for the Neem leaves were within recommended values for ruminants while that of the concentrate diet fell within the range of 5-6% which if exceeded may reduce appetite and fibre digestion (Maithison *et al.*, 1997). The ash value range of 8.00 % - 14.0 % was higher than 11.67 % reported by Fasae *et al.* (2018)

The increase in water intake with different and increased in dry matter intake, this tallies with the report of Okagbare *et al.* (2004) and further supported by Taiwo *et al.* (2005) who reported consumption of more water when dry matter intake increased. The water intake /dry matter intake ranged from 286.87 – 392.95 ml/g and showed significant (P<0.05) differences. This result showed that the different forms of neem leaves did not

influence the water intake of the goats, this tallies with the report of a study by Ocheja *et al.* (2020) in which the water intake of West African dwarf goats fed graded levels of cashew nutshell was influenced by the dry matter intake of the goats.

The non-significance of the values for the weights of all the organs shows that all the different forms of neem leaves evaluated did not significantly influence the weights of all the organs considered. Internal organs such as the liver and heart would vary by enlargement if the diets contained poisonous substances. Since there was no significant differences, it implies that the four forms of neem leaves were safe for the goats. The kidney on the other hand is an excretory organ. Similarities or non-significance in the values of the heart indicates that the kidney performed its normal functions, thus the excretory functions of the goats were not impaired (Ngi, 2012). This result ranks with the result obtained by that of Okpanachi *et al.* (2016) who recorded no significant differences in yearling West African Dwarf goats fed graded levels of cashew pulp meal-based diets. However, Ozung and Anya (2018) however recorded significant differences in the weights of the organs when they fed cassava peel meal-based diets supplemented with African yam bean concentrate. The observed

discrepancies could be attributed to differences in the diets fed to the goats as well as breed and ages of the goats used in the experiments.

5. Conclusion and Recommendations

5.1. Conclusion

The different forms of the neem leaves had no influence on the water intake of Red Sokoto goats. The different forms of neem leaves were not toxic to the goats and therefore safe for feeding red Sokoto goats since they had no significant effects on organ weights of the goats.

5.2. Recommendations

The fresh Neem leaves (T1) evaluated is recommended for feeding goats especially during the long dry season. Further research should be carried out using other species of ruminants such as sheep and cattle.

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