DOI: https://dx.doi.org/10.4314/gjpas.v31i3.11

GLOBAL JOURNAL OF PURE AND APPLIED SCIENCES VOL. 31, 2025: 549-557
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PERFORMANCE OF SHEEP FED NAPIER GRASS HAY SUPPLEMENTED WITH *NYMPHAEA LOTUS* LEAF MEAL FOR SUSTAINABLE PRODUCTION

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(Received 20March 2025; Revision Accepted 7April 2025)

ABSTRACT

The effect of feeding Napier grass hay supplemented with *Nymphaea lotus* leaf meal (NLLM) on the performance of Yankassa rams was investigated. A total of thirty rams were randomly divided into five treatments with six animals each using a completely randomized design (CRD), with the rams weighing an average of 15.05±1.39 kg. The basal diet consisted of Napier grass hay, while NLLM was supplemented at 0, 10, 20, 30 and 40%. Daily feeding rate for the diets was 3% body weight per animal. The feeding experiment lasted for 120 days following a 28-day period of adaption. Digestibility was investigated using three (3) animals per treatment. Results showed that nutrient composition of NLLM was richer than Napier grass hay, except fibre fractions. The feeding trial indicated that feed consumption and body weight measurement of rams on supplemented diets increased proportionally to the supplementation level of NLLM from 10 - 40% (421.00 – 561.40 g/day) as compared to the sole Napier grass hay diet (350.30 g/day).Yankasa rams fed NLLM supplemented diets (40.30 - 52.10 g/day) gained significantly ($p<0.05$) more weight than rams fed only Napier grass hay (31.20 g/day). The daily water consumption varied between 3.10 and 3.35 litres and was comparable ($p>0.05$) for all treatments. Diets comprising 30 and 40 % NLLM yielded feed conversion ratios of 9.08 and 9.43, respectively which were significantly ($p<0.05$) lower than diets with 0, 10 and 20 % NLLM. Feeding cost per kilogram of weight gain showed no significant impact ($p>0.05$) with inclusion of NLLM. The study concluded that feed consumption, nutrient digestibility and growth performance of Yankasa rams can all be positively impacted by 40% NLLM in their diets.

KEYWORDS: Digestibility, Napier grass hay, performance, ram, water lily

INTRODUCTION

Natural pasture often utilized as conventional feed resources for ruminants in Nigeria (Amole *et al*., 2021) cannot meet the nutritional needs of sheep for sustainable production. Atsbha*et al*. (2021) reported that the performance of sheep on such feed material without the provision of adequate supplements leads to reduced production.

Protein supplementation is an established feeding technique for enhancing the utilization of natural pasture species in order to improve feed digestibility and growth performance (Gabr *et al*., 2023). Thus, the use of leguminous grains to supplement ruminant diets is hindered by availability, costs and competition from humans, monogastrics and industry (Stagnari*et al.,* 2017).

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The incorporation of aquatic weed into forage-based diets is one of the low-cost protein supplementation programs designed to overcome deficiencies in basal nutritional feed resources to meet the requirements of small ruminants.

Nymphaea lotus (*N. lotus*) commonly called water lily is a perennial aquatic flowering weed that belongs to the family *Nymphaeaceae* (Afolayan *et al.*, 2013). In Nigeria, the plant is abundant in rivers, streams, ocean and canals during the dry season, but during the raining season, they are found in small quantities except in fish ponds where their leaves are not wash away by heavy rains (Wasugu *et al.* (2015). Every part of the plant is reportedly consumed within and outside Nigeria.Reports have indicated that *N. lotus* has 6.40% moisture, 14.88% ash, 4.88% crude fat, 19.54% crude protein, 15.53% crude fibre and 44.78% nitrogen free extract (Mohammed *et al*., 2013). According to previous studies (Idowu *et al*., 2019; Kraidy,2019) on *N. lotus*, fish performance was enhanced with the inclusion of *Nymphaea lotus* leaf meal. Hence, this study was conducted to determine the performance, apparent nutrient digestibility and economic viability of Yankasa rams fed Napier grass hay-based diets supplemented with different inclusion levels of *Nymphaea lotus* leaf meal (NLLM).

MATERIALS AND METHODS

Location of the study

The study was conducted at the Small Ruminant Unit of the Teaching and Research Farm, University of Calabar, Calabar, Cross River State, Nigeria.Calabar lies on 4° 19/N of the equator and longitude 8° 20 /E on the Greenwich meridian. The average daily temperature ranges from 25° to 30°C, with a relative humidity between 70 and 90 %. It also has an average annual rainfall of 1260 to 1280 millimeters (NiMet, 2023).

Experimental design, animals and management

In a completely randomized design (CRD) experiment, thirty Yankasa rams aged between 7 and 8 months (mean body weight of 15.05± 1.39kg/ram) were randomly assigned into five dietary groups after weight equalization, each dietary group consisted of six rams. The animals were sourced from Shinge cattle outlet in Lafia Local Government Area of Nasarawa State, Nigeria. Albendazole and ivermectin were administered to the animals upon arrival in order to eradicate internal and external parasites, respectively.

Prior to the arrival of the animals, the pens were washed thoroughly and disinfected with saponated cresol (Izal solution). Each of the rams was kept in a single open sided pen of 1m × 1m made up of wood. The animals were allowed 4 weeks to adjust to the pen environment and settings of the study.

Experimental diets

Five experimental diets were formulated.The experimental diets consisted of T_1 (100 % Napier grass hay), T_2 (90% Napier grass hay + 10 % *Nymphaea lotus* leaf meal), T_3 (80% Napier grass hay + 20% *Nymphaea lotus* leaf meal), T_4 (70% Napier grass hay + 30% *Nymphaea lotus* leaf meal) and T_5 (60% Napier grass hay + 40% *Nymphaea lotus* leaf meal). The composition of experiment diets is presented in Table 1.

Table 1: Gross composition of dietary treatments

Ingredient	0% NLLM	10% NLLM	20% NLLM	30% NLLM	40% NLLM
Napier grass hay	100.00	90.00	80.00	70.00	60.00
NLLM	0.00	10.00	20.00	30.00	40.00
Total	100.00	100.00	100.00	100.00	100.00

Growth performance

Experimental animals were offered dietary treatment daily at the rate of 3% body weight at 9.00am and 3.00pm in equal proportions. A preliminary 28-day adaptation period preceded the 120 days feeding trial. The amount of feed served and leftover was deducted to obtain feed intake on a daily basis. Animals were taken for exercise every day between the hours of 7.30 and 8.30 am in a confined hall where mineral block was served free choice. Their body weights were measured on a weekly basis using a spring balance of 50 kg maximum capacity prior to feeding. The following formulae were used to determine growth performance parameters:

Growth performance parameters were calculated as follows:

$$\text{Dry matter consumption (g/day)} = \frac{\text{Dry matter content of feed}}{100} \times \text{daily feed consumption(g/day)}$$

$$\text{Daily body weight gain (g/day)} = \frac{\text{Final body weight (g) – initial body weight (g)}}{\text{Duration of the feeding trial (days)}}$$

$$\text{Average daily water intake (L/day)} = \frac{\text{Total water intake}}{\text{Duration of the feeding trial (days)}}$$

$$\text{\% Mortality per treatment} = \frac{\text{No. of dead animals}}{\text{Total no. of animals}} \times 100$$

Body weight gain (kg) = Final body weight (kg) – initial body weight (kg)

$$\text{Feed conversion ratio} = \frac{\text{Dry matter intake (g/day)}}{\text{Body weight gain (g/day)}}$$

Digestibility trial

A total of fifteen rams, three rams per treatment were randomly allocated to individual metabolism crates for an adjustment period of 14 days. The digestibility study lasted for seven days after the adjustment period. Daily feed consumption was calculated as feed given minus leftover. Daily faecal output was weighed in the morning before feeding commenced and sub - samples of the faeces were obtained and preserved in a refrigerator at -4°C for nutrient digestibility analysis.

Thus, nutrient digestibility was calculated as follows:

$$\text{Nutrient digestibility (\%)} = \frac{\text{Nutrient intake - Nutrient in faeces}}{\text{Nutrient intake}} \times 100$$

Economics of production

The parameters of economic of production were cost of feed per kilogramme, total feed cost per animal per day and cost of feeding/kg weight gain (₦/kg). It was computed as follows:

$$\text{Cost per kg (₦)} = \sum \left(\frac{\text{proportion of feed ingredient}}{100} \times \text{cost per kg of feed ingredient}\right)$$

Total feed cost/animal/day = Total daily feed consumption (kg) × feed cost per (₦/kg)

$$\text{Cost of feeding/kg weight gain (₦/kg)} = \frac{\text{Total feed cost/animal/day}}{\text{Body weight gain}}$$

Laboratory analyses

The hammer mill was used in milling the experimental diets and faecal samples, respectively through a 2.5mm sieve after being oven-dried for 48 hours at 70°C. Organic matter was determined after 48 hours of drying at 60°C. The Kjeldahl technique was used to determine the feed samples' nitrogen concentration (AOAC, 2010). In a muffle furnace, the samples were ashed by charring for approximately three hours at 500°C. The AOAC (2010) technique was used to analyze the samples' crude fibre and ether extract, while a Van Soest *et al.* (1991) method was used to determine the fibre fractions of diet and faecal samples, respectively.

Statistical analysis

Data obtained in this study were subjected to one-way analysis of variance using GenStat statistical package (GenStat, 2012). Significant means were separated using Duncan's Multiple Range Test (Duncan, 1955).

The statistical model used in this study was as follows:

$Y_{ik} = \mu + T_i + E_{ik}$

Where:

Y_{ik} = Total observation
μ = Population mean
T_i = Treatment effect
E_{ik} = Random error

RESULTS AND DISCUSSION

Table 2 shows the chemical composition of Napier grass hay and supplemented diet, *Nymphaea lotus* leaf meal (NLLM). The crude protein of NLLM (22.09 %) was relatively higher ($p<0.05$) than 5.82 and 18.46 % as documented by Wasugu *et al.* (2015) and Idowu *et al.* (2019) respectively for *N. lotus* leaf harvested from different water reservoirs across Nigeria, but within the crude protein range (10 – 26 %) documented for aquatic weeds (Ekunseitan *et al.,* 2015). Similarly, it was comparable to the crude protein content (22.99-29.36 %) of *Moringa oleifera* leaves reported by Salma (2020). The high protein values of the NLLM suggest that it might be a good protein supplement for animals. The value of crude fibre content (10.23 %) of NLLM was low compared to 25.45 % in Napier grass hay. The crude fibre content of NLLM compares with 10-15 % range in some waterweeds studied by Wasugu *et al.* (2015). This corroborates previous findings suggesting that aquatic plants have lower crude fibre content than many tropical forages (Idowu *et al.,* 2019). *Nymphaea lotus* leaf meal had very low neutral detergent fibre (NDF) and acid detergent fibre (ADF) concentrations (23.42 % and 20.79 %, respectively) in comparison to Napier grass hay (43.16 % and 33.05 %), suggesting higher nutritional digestibility. On the other hand, Napier grass hay might be a better feedstuff of soluble carbohydrates to the animals, because its nitrogen free extract (NFE) concentration was higher ($p<0.05$) than that of NLLM. The metabolizable energy (ME) (2561.99 Kcal/kg) of NLLM was comparable to 2573.80 Kcal/kg of *Leucaena leucocephala* leaves (Ayssiwede *et al.,* 2010); but higher than some ruminant feedstuffs such as Gmelina leaves with 1699.62 Kcal/kgME (Uchele*et al.,* 2022) and Gamba grass hay 1299.32 kcal/kgME, respectively (Ajiji*et al.,* 2013).

Table 2: Chemical composition of Napier grass hay and *Nymphaea lotus* leaf meal

Parameter (%)	Napier grass hay (Basal diet)	*Nymphaea lotus* (Supplement diet)
Dry matter	95.21	92.90
Crude protein	13.50	22.09
Crude fibre	25.45	10.23
Ether extract	2.54	3.42
Ash	7.25	17.74
NFE	45.72	44.50
NDF	43.16	23.42
ADF	33.05	20.79
ADL	30.35	12.51
Cellulose	2.70	10.91
Hemicellulose	25.67	2.63
ME (Kcal/kg)	2389.56	2561.99

Proximate composition of experimental diets

Table 3 shows the proximate composition of dietary treatments. All the proximate fractions recorded significance ($p<0.05$) differences except NDF. The dry matter values (92.80 - 93.45%) were comparable to 673.0 – 963.0 gkg^{-1} (67.30 - 96.30 %) reported by Wada *et al.* (2014) for *Ziziphus mucronata*and *Parkia biglobosa* leaves. The experimental diets had relatively high DM content indicating longer shelf life. Binuomote *et al.* (2022) reported crude protein range (9.75 - 18.33 %) for experimental diets which was similar to the range (12.06 - 13.67 %) reported in this study. These values were also comparable to the range (12.11 - 13.04 %) reported by Fasae and Alokan (2006), who fed varying levels of *Leucaena leucocephala* to Yankasa rams. The crude protein content in experimental diets was beyond 7 % recommended for optimum performance of small ruminants (Minson, 1990). The study revealed that as the incorporation of NLLM increased in the diets, the crude protein increased significantly ($p<0.05$). Furthermore, Njidda and Titus (2023) observed a similar pattern with the inclusion of *Gmelina arborea* leaf meal. This result implies that NLLM is moderate in crude protein content. This supports the assertions documented by Mohammed *et al.* (2013), Wasugu *et al.* (2015) and Idowu *et al.* (2019) that crude protein is abundant in NLLM. The experimental diets' crude protein value suggests the diets would improve growth performance of animals.

Table 3: proximate composition of experimental diets

Parameters (%)	0% NLLM	10% NLLM	20% NLLM	30% NLLM	40%NLLM	SEM
Dry matter	93.45^{a}	93.12^{a}	93.08^{a}	92.80^{b}	91.45^{b}	0.58
Organic matter	85.30^{a}	84.60^{a}	83.53^{b}	82.31^{c}	81.50^{d}	0.72
Crude protein	12.06^{c}	12.36^{bc}	12.56^{bc}	13.23^{b}	13.67^{a}	0.03
Crude fibre	29.85^{a}	28.81^{b}	27.56^{c}	26.45^{d}	25.56^{e}	0.95
Ether extract	1.74^{c}	1.91^{c}	2.08^{b}	2.24^{a}	2.44^{a}	0.21
Ash	7.50^{d}	8.52^{c}	9.55^{b}	11.00^{a}	11.95^{a}	1.35
NFE	42.54^{a}	41.97^{ab}	41.36^{b}	41.22^{bc}	41.11^{c}	0.03
NDF	42.91	42.65	42.38	42.12	41.85	0.76
ADF	34.24^{a}	33.16^{ab}	32.08^{b}	30.99^{c}	29.91^{c}	0.05
ADL	30.50^{a}	28.70^{ab}	26.90^{b}	25.10^{c}	23.30^{d}	0.27
*Cellulose	3.24^{d}	4.01^{cd}	4.77^{b}	5.54^{ab}	6.31^{a}	0.12
*Hemicellulose	26.84^{a}	24.16^{b}	21.47^{c}	18.78^{d}	16.10^{e}	1.45
*ME (Kcal/kg)	2075.23^{b}	2106.56^{ab}	2147.58^{ab}	2182.04^{ab}	2233.03^{a}	48.23

^{a,ab,b}Mean on the same row with different superscripts differ significantly ($p<0.05$)
SEM = Standard Error of Mean, NFE=100 - (Moisture+ CP+CF+ Crude fat +Ash)
*ME (Kcal/kg) = 37 x % CP + 81.8 x % EE +35 x % NFE (Pauzenga, 1985)
*Cellulose = ADF – ADL, *Hemicellulose = NDF- ADF (Agric-Facts, 2006),
ADL = Acid Detergent Lignin, ADF = Acid Detergent Fibre,
NDF = Neutral Detergent Fibre,

Growth characteristics

Table 4 shows the effect of different levels of inclusion of NLLM on feed intake and weight gain of Yankasa rams fed Napier grass hay. The average final body weight, which ranged from 18.75 – 22.30 kg was significantly ($p<0.05$) influenced by the supplementation of NLLM in the diets. Rams fed 40 % NLLM showed significant ($p<0.05$) heavier body weight (22.30 kg) than rams fed other treatments with the least being rams fed control diet (18.75 kg). Furthermore, the rams fed 10, 20 and 30 % NLLM diets were significantly similar ($p >0.05$) in final body weight. The range of value (18- 22.30 kg) was lower than the (36.25 - 38.25 kg) reported by Ashiru *et al.* (2017) for the same breed of sheep fed complete rations containing inclusion levels of sugarcane waste ensiled with poultry litter.

The study further reveals total feed intake range (414.50 – 515.40g/day), which was lower than 1110.90 and 907.70 g/day reported by Yerima *et al.* (2022) who fed complete diet with untreated groundnut shell with high level of cotton seed cake to Yankasa sheep and Ashiru *et al*. (2017) who fed ensiled sugarcane waste with poultry manure, respectively. This result implies that supplementation of NLLM in Yankasa ram diets improved feed intake. However, NLLM has high protein content (22.09 %), which might enhance rumen digestion efficiently resulting in improved growth performance in this study.

Table 4: Effect of Napier grass hay supplemented with NLLM on the growth performance of Yankasa rams

Parameter	0% NLLM	10% NLLM	20% NLLM	30% NLLM	40% NLLM	SEM
Initial weight (kg)	15.00	15.17	15.00	15.00	15.06	1.39
Final weight (kg)	18.75^{b}	20.00^{ab}	20.50^{ab}	21.25^{ab}	22.20^{a}	0.85
ADWG (g/day)	31.20^{c}	40.30^{b}	45.80^{ab}	52.10^{ab}	59.50^{a}	9.96
Body weight gain (kg)	3.75^{c}	4.83^{b}	5.50^{ab}	6.23^{ab}	7.14^{a}	1.20
Total feed intake (g/day)	414.50	470.60	495.20	515.40	593.00	62.00
Dry matter intake (g/day)	350.30^{b}	421.00^{ab}	466.60^{ab}	473.40^{ab}	561.40^{a}	55.30
Feed conversion ratio	11.27^{a}	10.45^{ab}	10.19^{ab}	9.08^{b}	9.43^{b}	1.56
Av. daily water intake (l)	3.10	3.13	3.25	3.28	3.35	1.08
Mortality (%)	1.11	1.11	1.11	1.11	1.11	0.10

^{a,ab,c} Means on the same row with different superscripts differ significantly ($p< 0.05$)
ADWG = Average daily weight gain,
SEM= Standard error of mean, NLLM= *Nymphaea lotus* leaf meal, Av. = Average

This result shows that the supplementation of Napier grass hay with *Nymphaea lotus* leaf meal promoted weight gain of Yankasa rams (40.30 - 52.10 g/day) over Napier grass hay alone (31.20 g/day). A similar result was reported by Ibrahim (2007) who obtained weight gain of 80-93 g/day with Gamba grass supplemented with cowpea vines and 51.40 g/day with Gamba grass alone fed to Yankasa rams. The inclusion of NLLM in the diets of Yankasa rams fed Napier grass hay did not have any significant impact on the daily water consumption among dietary groups. Miller *et al*. (2006) reported a range (2 – 3l/d) which was comparable 3.10 – 3.35 l/d obtained in the study, but lower than 1.75 – 2.65 l/d reported by Osuhor *et al.* (2004). Diets with 30 and 40 % NLLM revealed the best feed conversion ratio (FCR) (9.08 and 9.43) respectively. This implies that NLLM could enhance feed efficiency. Fasae *et al.* (2016) reported improved FCR for sheep fed supplemented diets. The range FCR (9.08 - 11.27) was lower than 8.38 - 8.69, but similar to the range (9.96 - 11.00) reported by Yusuf *et al.* (2016) and Fasae *et al*. (2016), respectively.

Apparent nutrient digestibility Result of apparent nutrient digestibility of Yankasa rams is presented in Table 5. Digestibility parameters such as DM, CP, EE, Ash, OM, NDF and fibre fractions improved with the supplementation of NLLM in the diets except NFE. This result suggests that the lower crude fibre content of NLLM relative to Napier grass hay might have resulted in higher nutrient digestibility. This result supports the findings of Sánchez *et al.* (2006), who reported improved digestibility for ruminants fed supplemented leaf meal diets. However, Sarwatt*et al.* (2002) report with inclusion of *M. oleifera* leaf meal in goat diets was not is not in consonance with this study. This result suggests that the NDF content of the diets was within a tolerable level, hence, digestibility was not impaired.

Table 5: Effect of Napier grass supplemented with NLLM on nutrient digestibility of Yankasa rams

Parameter (%)	0% NLLM	10% NLLM	20% NLLM	30% NLLM	40% NLLM	SEM
Digestible dry matter	69.00^{a}	57.14^{ab}	61.70^{ab}	63.10^{ab}	53.90^{b}	5.87
Digestible organic matter	50.30^{c}	52.70^{c}	55.00^{b}	58.00^{b}	62.40 ^{a}	5.94
Digestible crude protein	62.20^{c}	76.90^{bc}	77.00^{bc}	82.80^{b}	88.60 ^{a}	3.13
Digestible crude fibre	93.78^{ab}	93.92^{ab}	93.78^{ab}	94.01^{a}	94.70 ^{a}	0.85
Digestible ether extract	65.10^{d}	67.90^{c}	72.80^{b}	77.50^{a}	77.60^{a}	3.83
Digestible ash	61.30^{c}	63.40^{bc}	64.20^{bc}	73.10^{a}	67.20 ^{b}	5.28
Digestible NFE	63.70	64.45	66.97	68.30	69.40	4.78
Digestible NDF	71.12^{b}	71.83^{b}	73.60^{ab}	74.25^{ab}	76.43 ^{a}	5.23
Digestible ADF	68.8	71.60	73.30	76.10	77.70	3.94
Digestible ADL	57.20^{d}	59.00^{bc}	63.30^{b}	72.60^{a}	65.40 ^{b}	4.52
Digestible cellulose	62.10^{b}	62.90^{b}	68.15^{ab}	68..70^{ab}	72.70 ^{a}	4.91
Digestible hemicelluloses	60.70^{c}	68.15^{bc}	68.70^{bc}	72.70^{b}	76.90 ^{a}	6.83

$^{a, ab, b,bc, c}$ Means on the same row with different superscripts differ significantly ($p< 0.05$)

SEM = Standard error of mean, ND F = Neutral Detergent Fibre, ADF = Acid Detergent Fibre, ADL = Acid Detergent Lignin.

Economic analysis

Table 6 shows the economic analysis of feeding Yankasa rams with Napier grass hay supplemented with NLLM. Result shows that the supplementation of NLLM had no significant ($p>0.05$) effect on the cost of feed and cost of feeding/kg. This result differs from the report of Adegun and Aye (2013), who documented a substantial deduction in the cost of feeding per kg gain with supplementary diets. In this study, the feed cost per animal per day (₦50.00 – 90.00 ₦) was more than ₦40 reported by Abubakar *et al*. (2015), but comparable to ₦70.42 – 71.32 obtained by Yerima *et al*. (2022) who fed varying proportions *of Ficus polita* and *Pennisetum pedicella* supplemented with wheat offal and sorghum stover-based diets containing graded levels of urea and cotton seed cake. The total feed cost per animal per day was significantly ($p<0.05$) affected with varying levels of NLLM supplementation. The lowest feed cost/animal/day was obtained for rams fed Napier grass hay (₦248.16), compared to those fed supplemented diets (₦233.55 - ₦286.16).

It was higher than the range (₦233.50 - ₦286.16) reported by Dan-Abba *et al*. (2022). This implies that supplementation of NLLM in Napier grass hay - based diets attracted higher production cost. This could be attributed to renting of canoes for harvesting, paying of labourers to harvest and cost of transporting the harvested materials to the research site.

Table 5. Economics of feeding Yankasa rams with Napier grass hay supplemented with NLLM

Parameter	0% NLLM	10% NLLM	20% NLLM	30 % NLLM	40% NLLM	SEM
Daily feed intake (g)	414.50	470.60	495.20	515.40	593.40	51.6
Total feed intake (kg)	4.97	5.65	5.94	6.18	7.12	0.74
Daily live weight gain (g/day)	31.20^{c}	40.30^{b}	45.80^{ab}	52.10^{ab}	59.50^{a}	9.96
Cost/kg of feed (₦/kg)	50.00	60.00	70.00	80.00	90.00	1.34
Total feed cost/Animal/Day (₦)	248.70^{c}	338.80^{bc}	432.90^{b}	495.70^{ab}	640.90^{a}	51.60
Cost of feeding /kg weight gain (₦/kg)	67.80	73.50	85.10	89.60	92.30	12.30

^{a,ab,b,}Means on the same row with different superscripts differ significantly ($p< 0.05$)

CONCLUSION AND RECOMMENDATION

The study concludes that *Nymphaea lotus* leaf meal (NLLM) contains substantial amount of crude protein. The supplementation of Napier grass hay with NLLM significantly improved growth parameters and nutrient digestibility compared to sole Napier grass hay diet alone. Diet with Napier grass hay supplemented with 40 % *Nymphaea lotus* leaf meal is therefore recommended for Yankasa rams in the tropics.

ACKNOWLEDGEMENT

The authors are sincerely indebted to Tertiary Education Trust Fund for the award of Institutional Based Research Grant [Tetfund 2017 (Merged) batch 6/02] in carrying out this research work in the University of Calabar, Calabar, Nigeria.

FUNDING

This research received funding assistance from Tertiary Education Trust Fund Grant [Tetfund 2017 (Merged) batch 6/02].

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