ACCEPTABILITY RATINGS AND NUTRITIVE VALUE OF FOUR SELECTED FODDER SPECIES BY YANKASA SHEEP IN SUB-HUMID NIGERIA

Shu'aibu, A.S., Hassan, A.H., Dahiru, M.G. and Bature, M.S.
College of Agriculture and Animal Science, Division of Agricultural Colleges, Ahmadu Bello University, Mando-Road, Kaduna.
Corresponding Author's email address: shubsadeeq@gmail.com +2348025864185

ABSTRACT
A study was conducted to estimate the dry matter intake of four selected forage species by Yankasa sheep so as to assess their nutritive value and preference by the animals. Four fodder tree species, viz; Gliricidia sepium, Gmelina arborea, Leucaena leucocephala, and Spondis purpurea were offered to 12 Yankasa sheep in a free choice cafeteria feeding method that lasted for 14 days to determine their intake and coefficient of preference (CoP). Data obtained from the experiment were subjected to a two-way analysis of variance (ANOVA). Preference data were analysed as a complete randomized design using collection days as replicates and shrub species and animals as treatments. The fodder samples were chemically analysed. Results revealed that their chemical composition varied significantly (P<0.05). The DM, CP, CF, Ash, EE, and NFE ranged between 33.80-40.50%, 12.80-26.41%, 12.80-14.20%, 9.10-11.11%, 11.03-15.21% and 29.90-55.31%, respectively. Significantly (P<0.05) higher mean daily fodder intake (2015.7 and 1820.4 gDM) were observed in L. Leucocephala and G. arborea respectively, while the least (697.2 gDM) was observed in S. purpurea. The CoP of the fodder was best in L. leucocephala (1.53) and G. arborea which were the preferred species by the animals. The preference ranking in descending order was L. leucocephala > G. arborea > G. sepium > S. purpurea. It was concluded that L. leucocephala and G. arborea were the preferred amongst the selected fodder species, suggesting their potentials as feed supplements for sheep.
Keywords: Fodder, acceptability, preference, Yankasa sheep.

INTRODUCTION

The two major determinants of forage quality are intake and digestibility (Ziblim *et al*., 2019). Animal performance is the product of nutrient concentration, intake, digestibility and metabolic efficiency of absorbed nutrients (David, 2007). The use of browse plants in ruminant nutrition has become an essential practice, especially in the dry season when herbaceous forages are scarce and of low quality (Onyeonagu and Asiegbu, 2006). Browse plants are available all year round, contributing their succulent leaves and twigs to small ruminant feeding and production (Onyeonagu and Asiegbu, 2006). The potentials of trees and shrubs as alternative fodder resources in ruminant nutrition have attracted the attention of researchers worldwide (Fadiyimu *et al*., 2011). Browse species are useful sources of animal feeds, as these plants remain green during the dry season and provide vegetation with better nutritive value than other annual grass and herbaceous species that become withered (Ademosun, 1988).

Palatability is affected by many animal factors such as general of the animal health, hunger and differential preference for forage species (Kochare *et al*., 2018) as well as environmental influences (Adimasu, 2008). Palatability is also affected by different plant factors such as degree of maturity, growth stage, chemical composition, morphological and seasonal availability of plants (Amjad *et al*., 2014). Voluntary intake is the overall acceptance and relish with which an animal consumes any given feedstuff or diet depending on appearance, odour, taste, texture, temperature and auditory properties of the food (Olufayo, 2019). Coefficient of Preference (CoP) is a direct measure of acceptability and nutritional capability of feedstuff or forage. In recent time, cafeteria technique had been used to assess the acceptability of some forage species (Babayemi *et al*., 2006; Olufayo, 2019).

Unfortunately, the adoption of most of these forages by farmers has been faced with several challenges such as disease and pest attacks, presence of anti-nutritional factors and insufficient knowledge about their potential feeding value (Olufayo, 2019). There is therefore the need for continuous screening of browse plants to identify those with good potentials as livestock fodder and which could serve as supplements or substitutes to the poor quality and available grasses (Oji *et al*., 2007). Thus, this study aimed at evaluating the acceptability and nutritional composition of fodder

from four tree species (*Gmelina arborea, Gliricidia sepium, Leucaena leucocephala,* and *Spondis purpurea*) by Yankasa sheep.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the Small Ruminants Unit of the Teaching and Research Farm, College of Agriculture and Animal Science, Ahmadu Bello University, Mando-Road, Kaduna. The area is situated at Latitude 10.58ºN and Longitude 7.42ºE, southern guinea savannah zone of Nigeria. It is characterized with tropical dry-and-wet climate. The wet season lasts for about 6 to 7 months (April to October) with an average annual rainfall of about 1323 mm, with the month of August being the peak of the wet season. Higher rainfall intensity occurs within the months of July and August (60 mm to 99 mm hour^{-1}) (Abaje and Oladipo, 2019; Shu'aibu *et al*., 2023). The highest average air temperature of about 28.9ºC normally occurs in April while the lowest (22.9 to 23.1ºC) occurs in December through January (NiMet, 2017). The mean atmospheric relative humidity ranges between 70 - 90% and 25 - 30% for the rainy and dry seasons respectively (Abdulkarim and Sarki, 2013).

Source of experimental sheep and their management

Twelve matured (12-15 months old) mixed sexes Yankasa sheep (8 rams and 4 ewes) with average weight of 21.49 ±0.54 kg were obtained from the Small Ruminants Unit of the College. Each day during the experimental period, animals were kept in their pen measuring 10m x 15m within the period of data collection.

Fodder collection and feeding management

Four different fodder species namely; *Gmelina arborea, Gliricidia sepium, Leucaena leucocephala,* and *Spondias purpurea* were used for the study. They were harvested fresh from the Range Unit of the College. Fodder collection was done in the morning (8:00 am) every day and allowed to wilt for 30 minutes. The feeding of sheep to determine dry matter intake and acceptability of the fodder was carried out using cafeteria method (Larbi *et al.,* 1993; Ziblim *et al*., 2019; Shu'aibu *et al*., 2023). Measured quantities of the fodder were tied and secured with rope, and suspended from the roof of the animal pen to the chest-height of the experimental animals. This is to allow for clear visibility of all the forages by the animals. The fodders were randomly placed in three locations within the animal pen (Shu'aibu *et al*., 2023). The order of fodder placement in the animal pen was randomized every day to avoid bias by the animals taking a particular part of the pen as the position for a particular type of fodder "habit reflex" (Kaitho *et al.,* 1996). Water was provided *ad libitum.*

Fodder intake and acceptability

Twelve (12) Yankasa sheep were used in the cafeteria fodder intake and acceptability trial that lasted for 14 days with 4 - day adjustment and 10 - day data collection period. The animals were exposed to each of the experimental fodder for 4 h each day between 08:30- 12:30 noon. Fodder refused after 4 h was weighed each day. The difference between the fodder offered and fodder refused was used to determine intake of each experimental fodder in g/day. Fodder preference was determined from the coefficient of preference (CoP). The CoP value of each experimental fodder was determined the procedure described by Bamikole *et al*. (2004); Shu'aibu *et al.* (2023) as the ratio between the intake of each experimental feed divided by the total intake.

CoP = Intake of individual fodder offered / mean intake of all the fodder offered

On this basis, a particular fodder was said to be preferred by animals to the others when a calculated CoP is greater than unit. The CoP values were used to rank the various fodders.

Chemical analysis

Samples of each fodder used for the trial were collected in sample bags and kept in moisture extraction oven for 48 h at 60ºC for dry matter determination. The samples were milled in a hammer mill to pass through 1mm mesh sieve and stored in air-tight containers at room temperature for laboratory analysis. Proximate analysis - CP, CF, Ash, EE and NFE - were analyzed in triplicate using standard procedures of AOAC (2012).

Statistical analysis

Data collected were analyzed using the analysis of variance (ANOVA) of general linear model (GLM) procedures (SAS, 2012) for Complete Randomized Design (CRD). Significantly different means were separated using Duncan Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The values in Table 1 revealed that mean daily fodder intake ranged from 697.2 gDM in *S. purpurea* to 2015.7 gDM in *L. leucocephala*. Significantly higher fodder intake (2015.7 and 1820.4 gDM) was recorded in *L. leucocephala* and *G. arborea* respectively. Kalio *et al.* (2006) stated that intake of green fodders is affected by plant species, stage of maturity and level of phytochemicals present in the forage. Intake during grazing does not depend only on diet quality but also directly correlated to forage distribution and availability, which can partly explain the lower level of intake observed.

It was observed that the highly preferred fodder species had higher CoP as observed in similar studies for other forages (Olufayo, 2019; Shu'aibu *et. al.,* 2023). According to Steel (2006), goats with free access to feed will vary their intake depending on the energy available. The study revealed that Yankasa sheep exhibited least acceptance for *S. purpurea.* This may be attributed to the low nutritive value of the browse plant as a result of its low CP (Oyenuga, 1978). Earlier studies had also reported that animals preferred certain feeds over others, which resulted in higher preference ranking as observed in the present study; *L. leucocephala* and *G. arborea* were the preferred fodder species, while *G. sepium* and *S. purpurea* with CoP < 1 were not accepted by the animals. Ranking of fodder species based on their CoP was; *L. leucocephala* > *G. arborea* > *G. sepium* > *S. purpurea*.

Table 1: Intake and coefficients of preference of selected fodder species by Yankasa sheep

Fodder species	Mean daily intake (gDM)	Coefficient of preference (CoP)	Ranking of forage Preference
Gliricidia sepium	743.7[b]	0.56	3
Gmelina arborea	1820.4[a]	1.38	2
Leuceana leucocephala	2015.7[a]	1.53	1
Spondias purpurea	697.2[b]	0.53	4
SEM	761.4	-	-

Mean values in the same column with different superscripts are significantly (P<0.05) different. SEM = Standard error of mean.

The proximate composition of the four selected fodder species (Table 2) revealed that all the parameters analyzed varied significantly (P<0.05). The DM content ranged from to 33.80% in *Spondias purpurea* to 40.50% in *Gliricidia sepium.* The CP content ranged from 13.80% in *S. purpurea* to 26.38% in *L. leucocephala*. This is in agreement with the findings of Falola (2016) and Olufayo (2019), who reported CP range of 10 to 37% for most tropical forage and browse plants. However, the CP values exceed the minimum recommended range of 7.0 to 8.0% for efficient functioning of rumen micro-organisms (Van Soest, 1994). It also indicates fodder high in nutrient that can serve as supplement for both growth and development for young animals as well as pregnant and lactating animals (Mohammed *et al.,* 2022). NRC, (2001) recommended 12% and 16.5% as a C requirement for young and lactating animals, respectively. Browse plants have been reported to have high CP of high digestibility, vitamins and minerals (Asaolu *et al*., 2011). The least nitrogen free extract (NFE) value (29.50%) was observed in *G. sepium* which was significantly (P<0.05) lower than the values recorded for other treatments**.** This implies that, the soluble carbohydrates could support the production of volatile fatty acids in the rumen during fermentation (Blummel *et al*, 1997).

Table 2: Proximate composition (%) of selected fodder species

Fodder species	DM	CP	CF	Ash	EE	NFE
Gliricidia sepium	40.50[a]	25.80[a]	13.22[b]	11.11[b]	13.80[b]	29.90[d]
Gmelina arborea	36.56[b]	16.00[b]	12.31[c]	9.50[c]	12.02[c]	55.31[a]
Leuceana leucocephala	33.70[c]	26.38[a]	14.50[a]	9.90[c]	15.21[a]	37.70[c]
Spondias purpurea	33.80[c]	13.80[c]	12.90[bc]	10.92[b]	11.03[c]	48.61[b]
SEM	0.11	0.34	0.12	0.16	0.05	0.06

Mean values in the same column with different superscripts are significantly (P<0.05) different.SEM = Standard error of mean.

CONCLUSION

Leuceana leucocephala and *Gmelina arborea* were the preferred amongst the selected fodder species by Yankasa sheep, suggesting their potentials as feed supplements for sheep most especially during dry season.

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