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Asian Journal of Animal and Veterinary Advances

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www.academicjournals.com

OPEN ACCESS Asian Journal of Animal and Veterinary Advances

ISSN 1683-9919
DOI: 10.3923/ajava.2022.53.60

Research Article
Utilization of High and Low-Quality Roughages by Sudan Desert Sheep and Nubian Goats

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Abstract

Background and Objective: Goats and sheep breed native to dry regions have developed strategies to use the utmost of the regulatory systems to cope with the harsh environment. Straw can be useful, in specific conditions such as shortage of good quality feed, for low producing animals, for maintenance or as special feed for high producing animals. The objective of the present experiment was to evaluate the effects of two types of roughages alfalfa hay (*Medicago sativa*) and sorghum straw (*Sorghum vulgare*), fed to Sudan desert sheep and Nubian goats, on some nutritional and physiological parameters related to animal performance. **Materials and Methods:** A digestibility-nitrogen balance experiment was conducted with six animals from each species with an average weight of 19±1.87 and 15.8±0.66 kg for sheep and goats, respectively. The animals were randomly assigned to dietary treatments (alfalfa hay or sorghum straw) with three animals per treatment following the completely randomized design in a 2×2 factorial arrangement. **Results:** Animal species resulted in a significant effect ($p<0.01$) in dry matter intake, rectal temperature and respiration rate. Feed quality induced a significant ($p<0.01$) increase in dry matter intake, water intake: Dry matter intake ratio, weight gain, urine volume and respiration rate with alfalfa hay than sorghum straw. Sheep had higher ($p<0.01$) digestibility coefficients and total digestible nutrients compared to goats. The digestibility coefficients of crude fibre increased ($p<0.01$) with sorghum straw. Nitrogen intake was affected significantly ($p<0.01$) by species×treatment interactions in sheep more than in goats. Alfalfa hay recorded a significant ($p<0.01$) increase in nitrogen intake and faecal and urinary nitrogen. **Conclusion:** It was concluded that the response of digestion of feed differs between sheep and goats, sheep are better utilized for both low and high-quality roughage. Alfalfa hay had a higher feed intake value than sorghum straw and sorghum straw had higher fibre digestion.

Key words: Alfalfa hay, sorghum straw, sheep, goats, nitrogen balance

Citation: Hassouna, S.M.H., A.A. Mohammed, A.A.R.A. Lutfi and A.B. Habib, 2022. Utilization of high and low-quality roughages by Sudan desert sheep and Nubian goats. Asian J. Anim. Vet. Adv., 17: 53-60.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Nutrient requirements for Maintenance (as a percentage of body weight) tend to increase as animal size decrease[1]. Unlike small size animals, large size animals require lower energy for maintenance[2]. Ruminant species has different response to roughage utilization, which might present different feeding strategies. Alfalfa is characterized by its high intake and digestibility potential, high energy and protein contents and low fibre contents[3]. It also contains considerable amounts of major minerals and certain trace elements[4].

Agricultural crop straw is widely used as roughages as ruminants feed in arid and semi-arid areas[3]. Agricultural by-product feed sources with high fibre content are used to replace forages for their potential to stimulate chewing and ruminal function[5]. Straw as a low-cost roughage is characterized by its poor nutritive value mainly due to the low crude protein and available mineral contents, low digestibility and low intake[6]. The nutritive value of straws is mostly affected by the botanical fraction, therefore, it has been reported that the leaf and leaf sheath is more digestible than stem[7]. Moreover, the nutritive value of straw could be improved by chopping, however, its utilization as a roughage source is not recommended if there is an alternative feeds available[8]. The best way to feed agricultural crop straw is to offer a sufficient amount to ensure a small amount to be refused by the animals[9].

Nutritive value, selectivity, particle size and the amount of feed offered to animals and species of animal could affect feed intake and digestibility. Therefore, the objective of the present study was to evaluate the effect of feeding high and low-quality roughages in *ad libitum* intake to compare DMI, the digestibility of nutrients, N balance, rumen fermentation products, blood metabolites and some other physiological parameters related to animal performance in Sudan desert sheep and Sudan Nubian goats.

MATERIALS AND METHODS

Study area: The experiment was conducted during the period from September to October, 2021, at the Experimental Unit of the Animal Production Research Department, National Centre for Research located in Soba, Southeast Khartoum. The average daily maximum and minimum temperatures were 29.1±0.89 and 20.1±0.89°C, respectively.

Experimental animals: Six yearling un-castrated males of Sudan desert sheep averaging 19±1.87 kg and six yearling un-castrated males of Sudan Nubian goats averaging 15.8±0.66 kg were used in this study. The animals were purchased from the local market. On arrival at the experimental farm animals were ear-tagged, dewormed with Ivomec against endo-parasite, sprayed with Gamatox to control the ectoparasite and given a prophylactic dose of Oxytetracycline. The animals were left to acclimatize for 14 days, during which the animals were allocated at random to each of the experimental feeds under investigation. Four treatments with three animals to each one: Sheep for (T1, T2) and goats for (T1, T2) were employed in a digestibility trial test.

Feeds: Alfalfa hay (*Medicago sativa*) and sorghum straw (*Sorghum vulgare*) were utilized to investigate the digestibility coefficients of the various nutrients, nitrogen balance, rumen fermentation products and blood urea nitrogen and some other physiological parameters related to animal performance. Alfalfa hay was used as T1 for both sheep and goats, whereas, sorghum straw was used as T2 for both sheep and goats. The chemical composition of the experimental feeds is shown in Table 1. Water was served in metal buckets tied to the crates. Animals had free access to water. Water consumed by each sheep and goat was determined by measurement of depletion in the bucket and correcting for evaporation.

Digestibility trial: The animals were harnessed and kept in metabolism cages to allow the collection of faeces and urine separately. After 14 days adjustment period, DMI was recorded for 5 days and dry matter digestibility and nitrogen retention were measured during a 5 days collection period. Faecal and urine collection for nitrogen balance determination were done by using the procedure described by Abubakr *et al.*[10]. Samples of feeds offered were taken daily and bulked at the end of the collection period. The collected composites were divided into two portions: One dried at 60°C and the other at 105°C for chemical analysis and DM determinations, respectively. Digestion coefficients were calculated according to the procedures described by Akinmoladun *et al.*[11]. Samples of feed

Table 1: Chemical composition of the experimental feeds on a dry matter basis

Parameters	Alfalfa hay	Sorghum straw
Ash	10.03	9.82
Organic matter (OM)	89.97	90.18
Crude protein (CP)	14.00	2.28
Ether extract (EE)	1.92	1.00
Crude fibre (CF)	29.03	39.42
Nitrogen free extract 24	45.02	47.48
Metabolizable energy (ME) (MJ/kg DM)*[1]	10.03	9.20

*[1]Calculated after MAFF (1975) using the following equation (nutrients are expressed in terms of g/kg DM): ME (MJ/kg DM): 0.012 CP+0.031, EE+0.005 and CF+0.014 NFE

and faeces were analyzed for their proximate chemical components as described by Abubakr *et al.*[12]. Urine nitrogen was determined as described by Abubakr *et al.*[10]. Rectal temperature was recorded with a telethermometer and respiration rate by counting the flank movement. All the observations were recorded when the animals were resting under shade at 8:00 am.

Rumen liquor and blood samples: At the end of the digestibility trials, the animals fasted for 24 hrs then samples of rumen liquor were obtained using a stomach tube immediately before feeding, 3 and 6 hrs after feeding. The samples of rumen liquor were strained by a mesh cloth and used for the determination of pH and ammonia nitrogen. Rumen pH was determined with a pH meter (ICM model 41600). Ruminal ammonia nitrogen was determined as described by Abubakr *et al.*[13]. Blood samples were withdrawn from the jugular vein immediately before feeding, 3 and 6 hrs post-feeding. The blood samples were allowed to clot and the serum was separated by centrifugation and stored at -20°C until assayed for blood urea as described by Niyigena *et al.*[14].

Statistical analysis: Data for the experiment from the digestibility trials as affected by animal species and roughage quality was arranged as a 2×2 factorial. Whereas, ruminal metabolites and blood urea-nitrogen as affected by animal species, roughage quality and sampling time was arranged as a 2×2×3 factorial. Analysis of Variance (ANOVA) was applied to analyze the main effects of animal species, roughage quality, sampling time and interactions at ($p \leq 0.05$) and ($p \leq 0.01$) using the GLM procedure of SAS (https://support.sas.com/documentation/onlinedoc/stat/indexchapter.html#stat93). The least significant differences (LSD) test was used for mean separation at $p \leq 0.05$.

RESULTS AND DISCUSSION

Effect of roughage quality on DMI, WI, DMI ratio, total weight gain, average daily gain, urine volume, RT and RR: Table 2 showed that dry matter intake DMI (kg/day) was higher ($p<0.01$) in sheep compared to goats (0.54 vs. 0.75 kg/day). Nevertheless, weight gain WG (kg) and average daily gain ADG (kg/day) water intake WI (kg/day) and WI: DMI were not different between sheep and goats. This was following the results obtained by Leon-Tinoco *et al.*[15] and Li *et al.*[16], who reported that with little possibility to choose dietary components, goats compared with sheep, showed lower feed intake.

Rectal temperature and respiratory rate were affected significantly ($p \leq 0.01$) by animal species. In the present study, the values of rectal temperature RT and respiration rate RR were higher in sheep compared to goats being 38.28 and 36.66°C in sheep and goats, respectively. a similar trend was noticed for respiration rates RR (min^{-1}) values which were higher in sheep (27.20 min^{-1}) than in goats (23.77 min^{-1}). Lins *et al.*[17] stated that under thermo-neutral conditions, RT varies between 38.3 and 39.9°C for sheep and the baseline for goats is between 38.8 and 39.8°C. In this study, the RT in sheep lies within the normal range. Goats showed a significant decrease in DMI and RT compared to sheep. With a low level of intake, the metabolic heat was decreased and resulted in lower RT. Respiration was higher in sheep than in goats which were in line with the data reported by Majeed *et al.*[18]. There was a numerical increase in water intake in sheep compared with goats. It has been reported that the water intake of sheep and goats is influenced by diet types, the composition of rations and the processing of the feeds[19].

In the present study, DMI was higher in animals fed alfalfa hay (0.68 kg) compared to that fed sorghum straw (0.61 kg). This could be explained by the low level of protein contents in sorghum straw (2.28%). Contradicting result was reported earlier by Malik *et al.*[20], who found that forage type did not affect DMI in goats fed either wheat straw or corn stover. The increased DMI seen with alfalfa hay compared with sorghum straw could be explained by the animal's preference for forage that has greater nonstructural carbohydrate contents[21,22], which results in faster degradation and passage rate. Similar results were obtained by Wang *et al.*[3] who found that Increasing alfalfa supplementation levels increased roughage intake.

In the present study, roughage type had affected significantly ($p<0.05$) WG (kg) and ADG (kg) feeding alfalfa hay resulted in slightly higher body weight, whereas loss in weight was observed when sorghum straw was fed. One can expect that feeding good quality roughages with high content of protein will result in superior WG and ADG. Recently, Askar *et al.*[23] reported that sheep had greater feed intake and utilization over goats when a high level of concentrate was offered. Earlier research indicated that both species of small ruminants showed significantly higher weight gain when fed various summer fodders[24]. Water intake was affected significantly ($p \leq 0.01$) by roughage quality. The use of alfalfa hay and sorghum straw increased ($p \leq 0.01$) water consumption (1.55 vs. 0.95 kg/day). The results indicated that there is a strong relationship between WI and digestible energy intake as suggested by Mpendulo *et al.*[25]. The WI: DMI

Table 2: Effect of roughage quality on dry matter intake (DMI), water intake (WI), total weight gain (WG), average daily gain (ADG), urine volume (UV), rectal temperature (RT) and respiration rate (RR) in Sudan desert sheep and Nubian goats

	Parameters							
Source of effects	DMI (kg/day)	WI (kg/day)	WI DMI	WG (kg)	ADG (kg)	UV (mL)	RT (°C)	RR (min^{-1})
Goat	0.54^{B}	1.17	2.18	-0.33	-0.02	263.30	36.66^{B}	23.77^{B}
Sheep	0.75^{A}	1.33	1.86	-1.29	-0.07	264.90	38.28^{A}	27.20^{A}
SEM	0.11	0.01	0.16	0.48	0.00	0.80	0.81	1.72
AF	0.68^{a}	1.55^{A}	2.41^{A}	0.25^{a}	0.02^{a}	395.97^{A}	37.68	26.30^{a}
SS	0.61^{b}	0.95^{B}	1.62^{B}	-1.88^{b}	-0.10^{b}	132.23^{B}	37.26	24.67^{b}
SEM	0.00	0.30	0.40	1.07	0.01	131.87	0.21	0.82
Goat×AH	0.57	1.44	2.54	0.75	0.04	410.27	37.07	25.07
Goat×SS	0.50	0.89	1.82	-1.42	-0.07	116.33	36.25	22.47
Sheep×AH	0.79	1.65	2.29	-0.25	-0.01	381.67	38.29	27.53
Sheep×SS	0.71	1.01	1.42	-2.33	-0.12	148.13	38.27	26.87
SEM	0.01	0.18	0.25	0.67	0.00	76.63	0.50	1.13

^{A,B}Within the same column, means with different superscripts differ significantly at $p\leq0.01$, ^{a,b}Within the same column, means with different superscripts differ significantly at $p\leq0.05$, SEM: Standard error of means, AF: Alfalfa hay and SS: Sorghum straw

Table 3: Apparent digestibility coefficients of nutrients in Sudan desert sheep and Nubian goats as affected by roughage quality

	Parameters						
Source of effects	DM	OM	CP	EE	CF	NFE	TDN
Goat	64.82^{B}	65.68^{B}	70.66^{b}	36.59^{B}	68.17^{B}	63.97^{B}	59.86^{B}
Sheep	76.85^{A}	77.36^{A}	77.11^{a}	60.58^{A}	79.90^{A}	75.35^{A}	70.71^{A}
SEM	6.02	5.84	3.23	12.00	5.87	5.69	5.43
AF	72.75	73.19	73.64	50.20	70.37^{b}	75.77^{A}	67.02
SS	68.93	69.87	74.13	46.96	77.69^{a}	63.55^{B}	63.55
SEM	1.91	1.66	0.25	1.62	3.66	6.11	1.74
Goat×AH	67.29	67.86	67.99	38.18	63.80	71.96	62.08
Goat×SS	62.35	63.49	73.33	35.00	72.54	55.98	57.63
Sheep×AH	78.20	78.47	79.28	62.22	76.94	79.58	71.95
Sheep×SS	75.51	76.25	74.93	58.93	82.86	71.12	69.46
SEM	3.66	3.52	2.33	6.99	4.01	4.94	3.30

DM: Dry matter, OM: Organic matter, CP: Crude protein, EE: Ether extract, CF: Crude fibre, NFE: Nitrogen-free extract, TDN: Total digestible nutrients, ^{A,B} Within the same column, means with different superscripts differ significantly at $p\leq0.01$, ^{a,b}Within the same column, means with different superscripts differ significantly at $p\leq0.05$, SEM: Standard error of means, AF: Alfalfa hay and SS: Sorghum straw

ratio was higher in alfalfa hay compared with sorghum straw (2.42 vs. 1.62). In this study, the water requirements varied with types of feed, indicating that the amount of water that was adequate at one time for a particular diet could be insufficient for another. In the present study, animal species×roughage type interaction did not affect all parameters measured in this study.

Effect of roughage quality on nutrient digestibility coefficient: The effect of roughage quality on nutrient digestibility in sheep and goats is presented in Table 3. In the present study, sheep had superior values over goats for digestibility coefficient of dry matter (DM, 76.b5 vs. 64.82) organic matter (OM, 77.36 vs. 65.68) crude protein (CP, 77.11 vs. 70.66) ether extract (EE, 60.59 vs. 36.59) crude fiber (CF, 79.90 vs. 68.17) nitrogen-free extract (NFE, 75.35 vs. 63.97) and total digestible nutrient (TDN, 70.71 vs. 59.86). This is in line with data reported by Li *et al.*[16], who compared the digestibility of the pellet diets (grass hay, corn stalk and wheat straw) when fed to sheep and cashmere goats. Similar results were reported when sheep and goat fed maize, millet and sorghum fodders[25]. They found that the digestibility of various nutrients such as CP, NDF and ADF was significantly higher ($p<0.05$) in sheep compared to goats. In contrast, Moyo and Nsahlai[26] found that goats digested fibre fractions more efficiently than sheep, especially for diets high in cell wall content. Goats are selective feeders and have the advantage over other domestic ruminants of being able to select a relatively high-quality diet when a variety of feeds are available. Therefore, it is expected that the feed consumed by goats may contain high nitrogen and low cell wall contents. It has been documented that goats showed a faster rumen outflow rate when compared to sheep and hens, lower fibre digestion is expected due to insufficient time for rumen microbes to act on plant tissue[16].

Feeding alfalfa hay resulted in higher CF and NFE digestibility when compared to sorghum straw, however, the digestibility of DM, OM, CP and EE, were similar in both

Table 4: Nitrogen (N) balance in Sudan desert sheep and Nubian goats as affected by roughage quality

	Parameters					
Source of effects	N intake (g/day)	Faecal N (g/day)	Urinary N (g/day)	N balance (g/day)	N-balance as a percentage of N intake	N-balance as a percentage of digested N
Goat	7.27^{B}	2.31	4.53	0.43	5.91	8.67
Sheep	10.18^{A}	2.15	6.14	1.89	18.56	23.54
SEM	1.46	0.01	0.81	0.73	6.33	7.44
AF	15.24^{A}	3.89^{A}	9.25^{A}	2.10	13.78	18.50
SS	2.21^{B}	0.56^{B}	1.42^{B}	0.23	10.41	13.94
SEM	6.52	1.67	3.92	0.94	1.69	2.28
Goat×AH	12.72^{B}	4.13	8.27	0.32	2.52	3.73
Goat×SS	1.82^{C}	0.48	0.79	0.55	30.22	41.04
Sheep×AH	17.75^{A}	3.65	10.22	3.88	21.86	27.52
Sheep×SS	2.60^{A}	0.64	2.06	-0.10	-3.85	-5.10
SEM	3.90	0.97	2.31	0.92	8.00	10.62

^{A,B}Within the same column, means with different superscripts differ significantly at $p \leq 0.01$, SEM: Standard error of means, AF: Alfalfa hay and SS: Sorghum straw

alfalfa hay and sorghum straw. Contrary to this result, Bhatti *et al.*[27] found that forage source did not affect the apparent digestibility of all nutrients except CP, while Wang *et al.*[3] recorded that the nutrient digestibility was significantly decreased with an increase in the level of alfalfa substitution for concentrate in dry ewes' diet. In this regard, the contradictory data could be explained by the differences in the environment where the experiments took place, different types of diets tested and different breeds of small ruminants used. Nevers less, animal species×roughage type affected nutrient digestibility.

Effect of roughage quality on N-balance: The results showed that there were differences ($p \leq 0.01$) between sheep and goats in N intake in Table 4. Nitrogen intake was higher in sheep than in goats (10.18 vs. 7.27 g/day). Faecal and urinary nitrogen was not affected by animal species, however, nitrogen excreted in urine was higher than that excreted in faeces in both sheep and goat. Similar results were obtained by Moyo *et al.*[28], who reported higher levels of urine nitrogen excretion in sheep. Nitrogen balance values were numerically higher with sheep compared to the goats (0.43 g/day vs. 1.89 g/day). Antwi *et al.*[29] reported that there were no significant differences in N balance between sheep and goats fed on different roughages. Species did not induce a significant ($p \geq 0.05$) effect on N balance whether it is expressed as a percentage of N intake or as a percentage of digested N. Goats recorded lower values in both cases. The positive N balance observed with both species indicated that N was sufficient to meet the requirements of the animal. Species also failed to induce a significant effect on total N excreted either in faeces or urine.

N intake, was higher with alfalfa hay (15.24 g/day) when compared to sorghum straw (2.21 g/day). Similarly, faecal N and urinary N values were higher in alfalfa hay (3.89 and 9.25 g/day) than in sorghum straw (0.56 and 1.42 g/day). In this study, N balance was higher with alfalfa hay compared with sorghum straw (Table 4). This may be attributed to the significant increase in N intake with alfalfa hay as compared with sorghum straw. In this study, positive N balance was observed with animals fed on sorghum straw. Also, the higher N excretion in faeces and urine with alfalfa hay would reflect the higher CP content and higher N intake. Current results confirmed the finding of Foster *et al.*[22], who found that N intake, faecal N and urinary N increased as CP increased in animals fed on different forage legume hays. The decrease in nitrogen intake will result in lower excretion of urea in urine for maintenance of the pool of urea in the plasma, while the increase in nitrogen intake is accompanied by the increase in the urea production in the liver and subsequently, its excretion in urine[28].

The results of the present study showed that there are animal species×roughage type interaction on nitrogen intake. Both goat and sheep fed alfalfa hay had higher values of nitrogen intake when compared to sorghum straw. This could be attributed mainly to the different CP contents of alfalfa hay (14%) and sorghum straw (2.28%).

Effect of roughage quality on rumen fermentation products and blood urea nitrogen: The data for both rumen parameters and BUN as affected by roughage quality are presented in Table 5. Both animal species (sheep vs. goats) and roughage type (alfalfa hay vs. sorghum straw) had affected rumen NH_3-N and BUN but not on ruminal pH. Rumen NH_3-N values were higher in sheep (17.47 mg/100 mL) when compared to goats (14.20 mg/100 mL), similarly, higher values of rumen BUN were recorded in sheep (42.50 mg/100 mL) when compared to goats (33.5 mg/100 mL). Moreover, NH_3-N

Table 5: Effect of roughage quality and sampling time on rumen pH, ruminal ammonia nitrogen (NH_3-N) and blood urea nitrogen (BUN) of Nubian goats and Sudan desert sheep

Source of effect	Rumen (pH)	NH_3-N (mg/100 mL rumen fluid)	BUN (mg/100 mL blood)
Sheep	7.07	17.73^{A}	41.50^{a}
Goat	7.11	14.20^{B}	33.58^{b}
SEM	0.002	1.77	3.96
AH	7.13	21.22^{A}	57.43^{A}
SS	7.05	10.71^{B}	17.64^{B}
SEM	0.004	5.26	19.90
Before feeding	7.26^{A}	12.74^{B}	36.23
3 hrs post-feeding	7.14^{A}	19.68^{A}	36.35
6 hrs post feeding	6.87^{B}	15.48^{B}	40.04
SEM	0.12	2.02	1.25
Goat×AH	7.06	25.36^{A}	62.24
Goat×SS	7.07	10.10^{C}	20.76
Sheep×AH	7.20	17.08^{B}	52.63
Sheep×SS	7.02	11.31^{C}	14.53
SEM	0.003	3.48	11.72
Goat×before feeding	7.28	14.29	40.47
Goat×3 hrs post-feeding	7.09	22.47	38.85
Goat×6 hrs post-feeding	6.82	16.43	45.18
Sheep×before feeding	7.24	11.19	31.99
Sheep×3 hrs post-feeding	7.18	16.88	33.85
Sheep×6 hrs post-feeding	6.92	14.52	34.89
SEM	0.007	1.54	2.00
AH×before feeding	7.41	18.27	52.55
AH×3 hrs post-feeding	7.10	26.29	57.51
AH×6 hrs post-feeding	6.88	19.11	62.24
SS×before feeding	7.11	7.21	19.91
SS×3 hrs post-feeding	7.18	13.06	15.18
SS×6 hrs post-feeding	6.86	11.85	17.84
SEM	0.008	2.73	9.00

^{A,B}Within the same column, means with different superscripts differ significantly at $p \leq 0.01$, ^{a,b}Within the same column, means with different superscripts differ significantly at $p \leq 0.05$, SEM: Standard error of means, AF: Alfalfa hay and SS: Sorghum straw

concentration was higher with alfalfa hay (21.22 mg/100 mL) than that with sorghum straw (10.71 mg/100 mL), while, BUN values were higher with alfalfa hay (57.43mg/100 mL) than those with sorghum straw (17.64 mg/100 mL). Current results were in line with the data published by Li *et al.*[16], who found no differences in rumen pH between sheep and goats offered three pelleted diets. Rumen pH was not affected significantly ($p \geq 0.05$) by the quality of feed. Similar results were reported earlier by Li *et al.*[16] and Foster *et al.*[22]. The higher rumen NH_3-N concentration in sheep could be attributed to the lower efficient utilization of NH_3-N mainly due to the high rate of rumen microbial synthesis in sheep[16]. Moreover, diet quality had a significant effect on rumen NH_3-N concentration as evidenced by higher rumen NH_3-N in animals fed alfalfa hay compared to those fed sorghum straws. The crude protein content is superior in alfalfa hay, therefore, higher nitrogen intake could be expected in animals fed alfalfa hay compared to that fed sorghum straw as suggested by Foster *et al.*[22]. Additionally, rumen NH_3-N concentration was higher in both sheep and goats three hrs post-feeding compared to 6 hrs post-feeding. The higher BUN concentration with alfalfa hay compared to sorghum straw confirms the results obtained by Kheir and Ahmed[30] who found that blood urea concentration increased significantly with feeding Lucerne hay compared to grass hay. Zanton and Heinrichs[31] found that urea-N excretion increases linearly with N intake. In this study, the alfalfa hay had a higher N intake than sorghum straw (15.24 vs. 2.21 g/day). Both animal species×sampling time and roughage type×sampling time had no effects on rumen pH, BUN and NH_3-N.

CONCLUSION

The results have shown that sheep and goats induced different responses when fed different quality roughages, sheep were better utilized for both low and high-quality roughage. Alfalfa hay had a higher feed intake value than sorghum straw and sorghum straw had higher fibre digestion.

SIGNIFICANCE STATEMENT

This study discovered that the sheep and goats responded differently to different quality feeds which were evidenced by higher nutrient digestibility in sheep compared to a goat. Moreover, high-quality feed had resulted in higher nitrogen intake. This study will help the small ruminant owners to pay attention to the species differences when providing rations containing different roughages.

ACKNOWLEDGMENT

The authors gratefully acknowledge the staff member of the animal production department researchers and technicians for sharing in the fieldwork and laboratory techniques.

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