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Effects of Different Dietary Levels of Pigeon Pea Hay (Cajanus cajan) on Growth Performance and Blood Biochemical Characteristics of Sudanese Desert Lambs (Hamari and Shuguor)

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ABSTRACT

Sheep production plays an important role in Sudan because of the large sheep population, availability of rangelands and crop residues, socioeconomic importance, and high consumer demand for sheep meat. This study was conducted to evaluate the effects of different dietary levels of pigeon pea hay (PPH) on feedlot performance and blood biochemical and mineral characteristics of Hamari and Shuguor Sudanese desert sheep breeds. Three iso-caloric and iso-nitrogenous diets containing 0%, 20%, and 30% PPH were formulated to provide approximately 10.50 MJ/kg metabolizable energy and 14.6% crude protein. Twenty-seven male lambs from each breed, aged 4–5 months, with an average initial body weight of 25.45 kg, were randomly assigned to one of the three dietary treatments. The experiment was conducted using a 2 × 3 factorial arrangement in a Completely Randomized Design (CRD). Data were analyzed using analysis of variance (ANOVA), and significant differences among treatment means were compared using Duncan's multiple range test at $P \leq 0.05$. Dietary PPH level significantly ($P \leq 0.05$) affected final body weight, total body weight gain, average daily gain, feed intake expressed as a percentage of live body weight, relative growth rate, and feed conversion ratio. However, breed had no significant ($P > 0.05$) effect on these feedlot performance parameters. Dietary PPH level had no significant ($P > 0.05$) effect on daily feed intake or total body weight gain expressed as a percentage of live body weight. Among the blood characteristics, albumin, potassium (K), and magnesium (Mg) concentrations were significantly ($P \leq 0.05$) affected by dietary PPH level, whereas breed had no significant ($P > 0.05$) effect on the measured blood biochemical and mineral characteristics. These findings indicate that pigeon pea hay can be effectively utilized as a dietary feed ingredient for fattening sheep. Based on the findings of this study, the 20% PPH inclusion level appeared to be the most suitable level for improving feedlot performance while maintaining normal blood biochemical and mineral characteristics.

KEYWORDS: **Hammari and Shuguor Breeds, Pigeon Pea Hay Daily Feed Intake, Daily Weight Gain and Blood Characteristics**

Introduction:

Sudan ranks first among the Arab countries and second in Africa with respect to animal population. According to recent estimates of livestock, there are about 41.7 million heads of cattle, 52.1 million heads of sheep, 43.4 million heads of goat and 4.6 million heads of camel (M.A R., 2011). In the Sudan, sheep plays an important integral component in most traditional production systems. Sudanese sheep have been classified on the basis of morphology and distribution into four main groups: Sudan Desert, Sudan Nilotic, Sudan Arid Upland and Sudan Equatorial Upland (McLeory, 1961). Fused ecotypes from non-systematic crossbreeding at the boundaries of the eco-zones have also been recognized. Sudan Desert sheep are further classified into tribal subtypes, e.g. Hamari, Kabashi, Shenbali in North and West Kordofan States (Mukhtar, 1985), Shuguor, Dubasi and Watish in the Central States (Sulieman et al., 1990) and Bourug in the Butana area of eastern Sudan. However, crop residues have been shown to contain low amounts of digestible nitrogen and energy (Tagel-Din et al., 1989), and dry matter intake is usually low (Dolberg et al., 1981). Animals fed on agricultural by- products alone usually result in negative nitrogen balance (Tagel-Din et al., 1989).

Non - traditional by-products of the agricultural industry are a potentially valuable alternative source of animal feed which may decrease dependence on traditional feed products and decrease overall feeding costs (Gomes et al., 2012).In most tropical and sub-tropical countries, ruminant feeds are primarily native pasture and/or crop residues. The genus Cajanus (Family: Fabaceae) consists of approximately 37 species, and Cajanus cajan (C. cajan) is a significant member of the genus. It is a commercial legume crop widely grown in sub-tropical and semi-arid tropical areas of the world. C. cajan have many properties have been linked to the presence of several value-added nutritional and bioactive components. Different solvent extracts from C. cajan (leaves, root, stem and seeds) have been evaluated for their phytochemical and biological activities, namely antioxidant, antimicrobial, antidiabetic, neuroprotective, and anti-inflammatory effects. Taken together, and considering the prominent nutraceutical and therapeutic properties of C. cajan (Gargi et al., 2022). Pigeon pea is a multipurpose leguminous plant that could be used as livestock feed. Pigeon pea is widely adapted and drought-tolerant (Bekele-Tesema, 2007) The biomass yield of pigeon pea ranged between 13.92 and 21.84 t/ha DM (Hidosa et al., 2020), and Pigeon pea leaves are rich in protein (Nurfeta et al., 2013). The existence of a small amount of tannin (0.4–4.3%) in pigeon pea leaves (Alexander et al., 2007) could have beneficial effects by increasing rumen undegradable protein (Mezzomo et al., 2011), potentially improving feed intake and digestibility yield in cattle (Ali et al., 2009). Pigeon pea is typically used as a protein source, due to its high concentration of protein in both seeds (23.0 percent, DM basis) and leaves (19.0 percent, DM basis). However, a high proportion of protein is bound to fiber (20–26) percent N fixed in ADF;(Pires et al., 2006). On the other hand, lamb fattening has widely used to

improve meat characteristics. Many studies were conducted (Darran, 2007; Beshir et al., 2009 Hassan, et al.(2012),(AbdElgadeem,2019), (Mohana,2018), Ibrahim, (2020) and Hassan, (2010) on fattening and finishing lambs. The results of these studies indicated the high potentiality of pigeon pea in fattening animals and improving meat characteristics.

Although pigeon pea has considerable potential as a locally available feed resource, information on the response of Sudanese Desert sheep, particularly Hamari and Shuguor lambs, to graded dietary levels of pigeon pea hay remains limited. Evaluating the effects of different inclusion levels on growth performance and blood biochemical characteristics may therefore provide useful information for developing practical feeding strategies for lamb production under Sudanese conditions

Accordingly, the general objective of this research was to study the effect of using different levels of Pigeon pea hay on sheep performance and blood characteristics of Sudan desert lamb (Hamari and Shugor ecotypes).

MATERIALS AND METHODS:

Site of study:

This study was conducted at the Rural Development and Extension Center (R.D.E.C), Faculty of Animal Production – Almanagil- University of Gezira, Gezira State, Sudan. The experimental duration was extended from June to August, 2018.

Housing:

The experimental animals were housed in semi open pens enclosed by corrugated steel, bamboo poles and steel bars of about three meters high, and covered with corrugated steel sheets. Each pen was provided with water and feed troughs.

Experimental rations:

Pigeon pea hay preparation:

Pigeon pea hay was collected after harvesting operation during end of season from Almanagil area. A sample of Pigeon pea hay was chemically analyzed according to AOAC (1984) in Suba central laboratory in Khartoum as the following.

Table (1). Chemical composition (dry matter basis) of Pigeon pea hay

Parameters	Percentage
Dry matter	91.50
Crude protein "C.P"	7.10
Crude fiber "C.F"	10.00
Ether extract "E.E"	2.05
Ash	10.55

Ration formulation:

Three experimental rations A, B and C with different levels of Pigeon pea hay (0%,20% and 30%) was experimental group, group A (control group), group B feed with ration content 20% Pigeon pea hay and group C feed with ration content 30% Pigeon pea hay. The three rations were formulated to be iso-caloric/ iso-nitrogenous (10.50MJ/kg energy and 14.6 CP) respectively.

Table (2) Composition (by weight) of experimental rations

Feed Ingredients (% of DM)	Control (0% PPH)	20% PPH	30% PPH
Pigeon pea hay	0.00	20.00	30.00
Sorghum grain	25.00	9.00	9.00
Groundnut cake	10.00	9.00	9.00
Wheat bran	25.00	10.00	10.00
Groundnut hulls	10.00	34.75	19.90
Molasses	25.00	10.00	15.00
Urea	1.00	1.25	1.10
Oyster shell	2.00	3.00	3.00
Sodium chloride (NaCl)	2.00	3.00	3.00
Total	100.00	100.00	100.00

Experimental ration chemical composition:

100g of each experimental treatments were taken after each ration mixing, mixed together and then prepared for analysis. The ration formulated to attain (14.10% CP and 11.10 MJ/Kg) Table (3). The experimental diets were formulated as to be isoenergetic and isonitrogenous to meet the sheep requirement according to (NRC,2007). Crude protein and metabolic energy values in the tables were calculated by the modified equation of Ellis, (1981).

Table (3): Chemical composition (dry matter basis) of experimental rations

Chemical composition	Control (0% PPH)	20% PPH	30% PPH
Dry matter (DM, %)	93.10	92.10	94.50
Crude protein (CP, %)	16.50	16.00	15.75
Crude fiber (CF, %)	8.70	9.30	9.50
Ether extract (EE, %)	4.55	4.15	4.35
Ash (%)	9.15	8.75	9.15
Metabolizable energy (ME, MJ/kg DM)	10.60	10.60	10.60

Experimental animal grouping and design:

A total of 54 male Sudanese Desert lambs, comprising 27 Hamari and 27 Shuguor lambs, were used in the experiment. The lambs were approximately 4–5 months of age and were obtained from local livestock markets. Animals were selected for relative uniformity in age and body weight. The experiment was arranged as a 2 × 3 factorial experiment in a completely randomized design (CRD). Factor A was sheep ecotype (Hamari and Shuguor), and Factor B was dietary pigeon pea hay level (0%, 20%, and

30%). Each ecotype was represented by 27 lambs, with nine lambs assigned to each dietary treatment. The nine lambs within each treatment were distributed among three replicates, with three lambs per replicate. Before the beginning of the feeding trial, the animals were individually identified, weighed, vaccinated, and treated against internal and external parasites according to the experimental health-management protocol. The lambs were then randomly allocated to the experimental treatments while maintaining comparable initial body weights among groups.

Data collection

Feed intake

The experimental diets were offered daily at 08:00 h. Feed refusals were collected and weighed the following morning at 07:00 h. Daily feed intake was calculated as the quantity of feed offered minus the quantity refused.

Body weight and growth performance

Individual body weights were recorded weekly after overnight fasting with free access to water. Body-weight measurements were used to calculate total body-weight gain, average daily body-weight gain, relative growth rate, and feed conversion ratio.

Feed conversion ratio was calculated as the amount of feed consumed per unit of body-weight gain. Therefore, a lower FCR represents better feed conversion efficiency.

Blood tests

Blood samples were drawn from each animal through the jugular vein using a 12ml gauge (6cm) needle to draw 5ml of blood on the first and last day of the study. Urea was determined by the urease–Berthelot method (Coles,1986). Blood glucose was determined by Folin and Wu method (Allen, 1990; Ullman et al., 1992). Total protein was analyzed by the method described by Kind and King (1954). Serum blood glucose was measured by the method described by Trindler, 1969. Serum cholesterol was determined by the spectrophotometer using enzymatic calorimetric test (CHOD-PAP) (Richmond, 1972). Serum Ca was analyzed according to the method described by (Trindler, 1960). Serum inorganic phosphorous *was determined by the method described by Varley, 1967).*

Statistical Analysis

Data were analyzed using analysis of variance appropriate for a 2 × 3 factorial arrangement in a completely randomized design (Steel and Torrie, 1980). The statistical model included the effects of sheep ecotype, dietary pigeon pea hay level, and their interaction. When significant differences were detected, treatment means were separated using Duncan's multiple range test. Statistical significance was declared at $P \leq 0.05$.according to (Snedecor and Cochran, 1980).

Slaughter procedure and data

Three animals of each treatment were selected for slaughter according to the average body weight of treatment. Slaughter weight was taken after an overnight fasting with access only to water. The animal slaughtering procedure followed known Muslim practice.

RESULTS

Feedlot performance:

Initial live body weight

Table (4) shows the initial body weight of the experimental animals. effect of different levels of Pigeon pea hay and breed ecotype for initial body weight. According to the Pigeon pea hay level, initial live body weight showed no significant differences ($P \geq 0.05$) between different treatments values were (25.57, 25.45 and 25.46 kg), for 0%, 20%and 30% Pigeon pea hay. Due to breed ecotype factor the study showed that initial live body weight for experimental lambs of the desert breed ecotypes Hamari, and Shuguor fed different level of Pigeon pea hay reported no significant differences ($P \geq 0.05$) for the two breed ecotype groups, values were (25.46 and 25.46 kg), for Hamari and Shuguor respectively.

Final weight

Table (4) shows effect of dietary levels of Pigeon pea hay and breed ecotype on final weight gain, average final body weight gain according to level of Pigeon pea hay ration exhibit significant ($P \leq 0.05$) different between Pigeon pea hay levels, values were (34.24, 33.69 and 32.52) for 0%, 20% and 30% respectively. However, Pigeon pea hay level 0% (34.24 kg) was significantly ($P \leq 0.05$) higher than level 30% (32.52 kg) while no significant ($P \geq 0.05$) between former mentioned treatments and level 20% (33.69 kg). No significant ($P \geq 0.05$) different was found between the two ecotypes regarding final body weight gain. The values recorded for Hamari than Shuguor were 33.78 and 33.18 kg consecutively.

Total weight gain

Table (4) shows the effect of dietary incorporation of Pigeon pea hay and sheep ecotype on total weight gain for the Pigeon pea hay levels. Significant ($P \leq 0.05$) differences were observed between rations levels and the value 8.67, 8.49 and 7.06 kg for 0%, 20% and 30% respectively. However, the ration levels 0% and 20% where not significantly ($P \geq 0.05$) different while ration 30% was significantly ($P \leq 0.05$) lower than the rest. Total body weight gain for experimental lambs, was not significantly ($P \leq 0.05$) different among two breed ecotypes, values were 8.41 and 7.73 for Hamari and Shuguor respectively. Nonetheless, Hamari has higher value than Shuguor.

Daily weight gain

Table (4) demonstrates the effect of dietary content of Pigeon pea hay and sheep ecotype on daily body weight gain. The Pigeon pea hay level had significant (P≤0.05) influence on daily weight gain. The three rations were scored 0.197, 0.187 and 0.157 g per day for 0%, 20% and 30% respectively. There were no significant (P ≥ 0.05), difference between Hamari and Shuguor in daily body weight gain. However, Hamari lambs gained more than Shuguor ones.

Daily feed intake

Table (4) shows effect of dietary incorporation of Pigeon pea hay and breed ecotype on daily feed intake, Average daily feed intake According to Pigeon pea hay level were had no significant (P ≥0.05) different between Pigeon pea hay level were (1.28, 1.28 and 1.34 kg) for 0%, 20% and 30% Pigeon pea hay respectively. Average daily feed intake of lambs fed different Pigeon pea hay levels, were no significantly (P ≥ 0.05) different, between treatments groups, values were, 1.31, and 1.29 kg, for Hamari and Shuguor respectively. There were no significant (P ≥ 0.01), difference between Hamari and Shuguor in daily feed intake.

Feed conversion ratio

Feed conversion ratio is an important factor reflecting the nutritive value of the feed offered and the efficiency of feed utilization by the animal. Table (4) shows the effect of dietary incorporation of Pigeon pea hay and sheep ecotype on feed conversion ratio. The influence of Pigeon pea hay level on feed conversion ratio was significant (P≤0.05) and the extents 6.79, 6.87 and 8.76 was recorded for ration 0%, 20% and 30% respectively. Feed conversion ratio of ecotypes Hamari and Shuguor, fed different levels of Pigeon pea hay, was no significantly (P≤0.05) different between these desert breed ecotypes, nonetheless, the values observed were 7.09 and 7.81 for Hamari and Shuguor.

Table (4) Effect of Dietary Inclusion Levels of Pigeon Pea Hay and Breed Ecotype on the Feedlot Performance of Experimental Lambs

Factor	PPH%	IBW (kg)	FBW (kg)	TBWG (kg)	TBWG (% LBW)	DBWG (kg/day)	DFI (kg/day)	DFI (% LBW)	RGR (%)	FCR
Pigeon pea hay level	0%	25.57	34.24^{a}	8.67^{a}	25.28	0.19^{a}	1.28	3.79^{b}	33.89^{a}	6.79^{b}
	20%	25.45	33.69^{ab}	8.69^{a}	24.59	0.18^{ab}	1.28	3.87^{b}	32.80^{a}	6.87^{b}
	30%	25.46	32.52^{b}	7.06^{b}	22.50	0.16^{b}	1.34	4.20^{a}	26.01^{b}	8.76^{a}
S.E.		0.80	0.50	0.46	1.15	0.01	0.02	0.08	2.05	0.41
Sig.		NS	*	*	NS	*	NS	*	*	*
Breed (ecotype)	Hamari	25.46	33.78	8.41	24.53	0.19^{a}	1.31	3.91	32.36	7.09
	Shuguor	25.45	33.18	7.73	23.71	0.17^{b}	1.29	3.99	29.44	7.81
S.E.		0.37	0.41	0.37	0.94	0.01	0.02	0.06	1.68	0.34
Sig.		NS	NS	NS	NS	*	NS	NS	NS	NS

PHL = Pigeon hay levels, IBW = Initial Body weight, FBW= Final body weight, TBWG= Total live body weight gain, DBWG =Daily body weight gain, DFI= Daily feed intake, RGR= Relative growth Rate, FCR Feed conversion rate, Sig = Level of significance, S.E = Standard error of the treatment means, N.S. = Not significantly different,* = Significant different at 0.05and Mean in columns followed by the same letter subscript are not significantly different (P>0.05).

Blood biochemical parameters

Final Blood Characteristics

Table (5) effect of dietary incorporation of Pigeon pea hay and sheep breed on Final Blood Characteristics of experimental lambs according to Pigeon pea hay level were significantly (P≤0.05) different in Albumin, K+ and Mg+, There was no significant (P ≤ 0.05) differences in Urea, Glucose Cholesterol, Tri Gleseride, Total protein, Na+, Ca+ and $PH+^4$. Final Blood Characteristics of experimental lambs according to Pigeon pea hay level were no significant (P≤ 0.05) different among the breeds ecotype in all parameters.

Table (5) effect of dietary incorporation of Pigeon pea hay and sheep ecotype on Blood biochemical parameters of experimental lambs

(PPHL %)	Urea	Chole	Glucose	Triglycerides	T. protein	Albumin	Na^+	Ca^+	K^+	Mg^+	PH^{+4}
0%	51.03	55.66	63.53	50.50	6.32	2.45b	137.16	8.01	3.72b	3.39b	6.92
20%	49.43	42.28	56.65	52.55	7.23	2.69a	136.54	7.52	4.02a	3.29b	6.70
30%	51.00	46.78	59.50	61.65	6.80	2.52b	136.66	7.31	3.86ab	3.93a	6.42
S.E	4.06	4.73	4.79	4.19	0.31	0.04	1.37	0.49	0.05	0.17	0.49
Sig	N.S	N.S	N.S	N.S	N.S	*	N.S	N.S	*	*	N.S
(Breed ecotype)											
Hamari	50.76	44.78	60.46	53.71	7.02	2.51	136.98	7.79	3.87	3.55	6.97
Shuguor	50.21	51.70	59.33	56.09	6.54	2.60	136.60	7.43	3.87	3.52	6.38
S.E	3.32	3.86	3.91	3.42	0.28	0.03	1.12	0.40	0.04	0.13	0.40
Sig	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

PHL= Pigeon hay levels, Chole = Cholesterol, Gluco = Glucose, Gleser = Tri Gleseride, T.Protein = Total Protein =Albumin, Sig = Level of significance, S.E = Standard error of the treatment means, N.S. = Not significantly different,* = Significant different at 0.05and Mean in columns followed by the same letter subscript are not significantly different (P>0.05).

DISCUSSION

Lambs feed lot performance

Daily feed intake

The plane of nutrition and the nutritive value of ingredients are the major factors affect the daily feed intake. In this study daily feed intake showed no significant different among the treatment groups, animals fed on 30% Pigeon pea hay in their ration had the high value 1.34 kg/d of daily feed intake while the other treatments (0% and 20%) had the less value 1.28kg/d, On the other hand, average daily feed intake of different ecotype lambs fed different Pigeon pea hay levels, were no significantly (P>0.05) different observed between breed groups and the values were 1.31, 1.29 kg/d for Hamari and Shuguor respectively. This finding is in line with those stated by Ibrahim (2020) who studied the effect of feeding different levels of groundnut hay on desert sheep lambs performance and reported that 1.25, 1.23 and 1.22 kg/d and higher than him, the results

agree with (Hassan, 2005) who studied the effect of feeding different levels of crushed Roselle seed for finishing desert sheep lambs and reported no significant (P>0.05) differences among treatments in daily feed intake. This study results were not agreed with those results found by Awad et al, (2012), found that the average daily feed intake of 1350, 1305 and 1465 gm/d. This different may be due to breeds and Pigeon pea hay levels differences. The differences in daily feed intake; in different studies maybe attributed to the system of fattening or breed, age and season. The results were des agree with Solomon et a l ., (2016) who found that There was significant difference (P < 0.05) in total intake, the proportion of pigeon pea leave increases there was an increment in feed intake.

Final body weight

The performance of the animal as reflected in the body weight gain is usually affected by many factors, such as age, sex of animal, breed, seasons of the year and type of nutrition. The final body weight in this study showed significant differences (P>0.05) between the treatment groups. Treatment 0% having the highest rate of daily weight gain and treatment 30% have the less value while treatment 20% have the medium, Similarly, Hassan, (2010) reported that the average final weight gain was (35.83, 35.18 and 33.97 kg) among desert lambs fed Roselle seed. .This result lower than that reported by Bashir, (1996) he reported that, the average final weight gain were no significantly(P≤0.05), different among the treatment ecotype groups, their values were (37.71, 36.69 and 36.04 kg), in treatments Hamari, Shuguor and Dubasi respectively This finding is higher than Abd Elgadeem (2018) who studied the effect of feeding different levels of groundnut hay levels on desert sheep lambs performance reported that (29.92, 29.63 and 29.06) for 0%, 20% and 30% respectively. Hassan (2005) found 200g daily weight gain in Hamari lambs. EL-Hassan (1994) reported that the daily weight gain of Shuguor and crosses of Shuguor with Watish ranged between 204 and 241g. The body weight gain of sheep in the current study was higher than reported by (Solomon et a l ., (2016): Karachi1998) which shows that increased body weight gain by increasing the amount of pigeon pea leaves.

These values were higher to that reported in this study. These differences in daily live weight gain may be due to the differences in age, type of diet and ecotype of animals used here. This is due to several anti-nutritional factors, namely, protein inhibitors, amylase inhibitors, and flab causing sugar and phytic acid which cause digestion fail. Pigeon pea contains some amount of polyphenolic compounds (tannins) that inhibit the digestive enzymes—trypsin, chymotrypsin, and amylase. These compounds create problems when pigeon pea is consumed in large quantities.

Total weight gain

In this study Total body weight gain was higher in ration 0% followed by 20% and 30%. Total body weight gain for experimental lambs, significantly ($P \leq 0.05$) different among the treatment, were no significant ($P \leq 0.05$) different among the ecotype, values were 8.41 and 7.73kg for Hamari and Shuguor respectively. Hamari has higher value followed by Shuguor. This finding higher than Ibrahim, (2020) who studied the effect of feeding different levels of groundnut hay on desert sheep lambs performance reported that 7.90,8.20 and 7.88 kg for 0%, 20% and 30% respectively. These results lower than that reported by Hassan (2010) he reported that, the average Total body weight gain 10.77.10.25 and 9.16kg. The differences in total body weight gain; in different studies maybe attributed to the system of fattening or breed, age and season.

Feed Conversion Efficiency (F.C.E)

Feed conversion efficiency of ration is an important factor reflecting the nutritive value of the feed and the efficiency of utilization of the animals. The feed conversion efficiency in this study showed significant different ($P>0.05$) among the treatments. The treatment 30% had the high value of feed conversion efficiency while treatment 0% had the lowest value and the 20% had the medium value. This is results in agreement with Hassan, (2010) . Abd Elgadeem (2019) who used groundnut hay for feeding rumens reported a similar trend of Feed conversion ratio. Hagam (2020) reported 6.40, 7.09 in Hamari, Shuguor sheep ecotype respectively. The feed conversion ratio of sheep in the current study was higher than reported by (Solomon et a l ., (2016): who found that feed conversion ratio of sheep fed teff straw and supplemented with commercial concentrate, pigeon pea leaf and their mixtures at different proportions was 0.047, 0.059, 0.060 , 0.061 and 0.035.

These variations in feed conversion ratio may be due basically to variations in the voluntary feed intake and feed utilization efficiency.

Blood Characteristics for experimental lambs

As table (5) showed the effects of dietary incorporation of Pigeon pea hay and sheep ecotype on Final Blood Characteristics of experimental lambs according to Pigeon pea hay level were significantly ($P\leq0.05$) different in Albumin, K+ and Mg+, There was no significant ($P \leq 0.05$) differences in Urea, Glucose Cholesterol, Tri Gleseride, Total protein, Na+, Ca+ and PH+4. Final Blood Characteristics of experimental lambs according to Pigeon pea hay level were no significant ($P\leq 0.05$) different among the breeds ecotype in all parameters.

The results were agreed with (Mekonen et al ., 2022) who reported that using Pigeon pea leaves in levels of (0–30% of PPL) resulted in similar serum concentrations of total protein, globulin, urea nitrogen, glucose, triglycerides, creatinine, and cholesterol. The serum total protein and urea nitrogen are related to protein intake (Mutsvangwa et al., 2016), However the results were dis agreed with same author who reported Pigeon

pea leaves in levels of (0–30% of PPL) resulted in similar serum concentration of albumin concentration.

Present study were agreed with (Osita et al., 2019) who found that there were significant ($p<0.05$) differences among diet type on the Albumin and K+ values of sheep fed the grass, mixture of grass and legume, or legume diets. However, the results were in contrast with same author who reported that there were significant ($p<0.05$) differences among diet type on the TPP, globulin, Ca + and P values of sheep fed the grass, mixture of grass and legume, or legume diets.

Serum glucose and Tri glyceride concentrations is good indicators of energy status (Qureshi et al., 2016), and similar concentrations across our treatments suggest that the inclusion of PP in the concentrate mixture did not affect the energy status of the experimental animals. serum total protein, globulin, glucose, urea N, creatinine, and cholesterol were similar ($P > 0.05$) among treatments.

Conclusion:

According to the results of this study dried pigeon pea hay can be used as a substitute for concentrate mixture in the diets of growing local lambs. There was no any palatability problem observed on pigeon pea hay used in this experiment. Thus, pigeon pea hay can be used as an alternative home-grown supplement feed (protein source) in sheep feeding. Supplementing of pigeon pea hay up to 20 % for growing rams can improve body weight gain, body condition score, feed conversion efficiency and blood Characteristics without any adverse effect on the performance of local lambs.

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