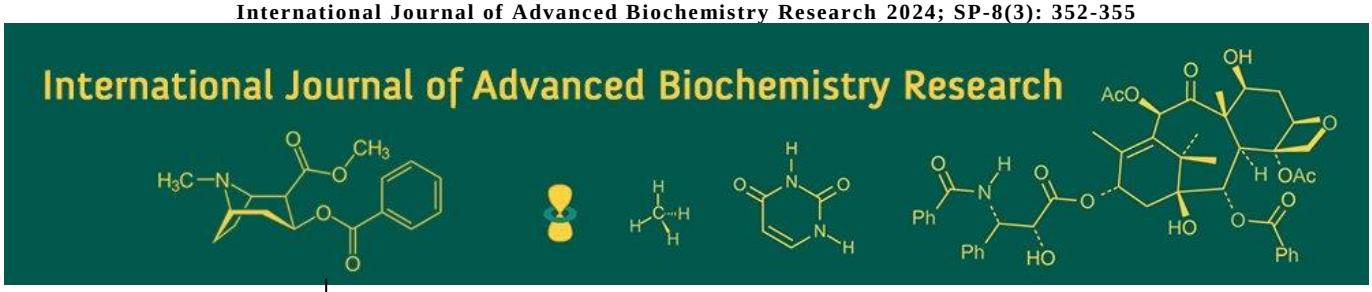

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Effect of feeding high concentrate ration on blood-biochemistry and rumen fermentation pattern of sheep

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Abstract
The current study was aimed to evaluate the effect of feeding sheep with high concentrate ration on blood biochemistry and rumen fermentation parameters. A total of 10 crossbred male lambs (12±02 months old) were selected and divided equally into two groups *viz*. control (CTL) and treatment (FL), with 05 animals in each group. The duration of study was 74 days (involving 14 days acclimatization period). The CON group animals were fed by thumb rule method (60% roughage and 40% concentrate) and FL group was fed high concentrate ration (80% concentrate and 20% roughage). The outcomes of blood biochemical parameters indicated non-significant difference ($p \geq 0.05$) between treatment groups. Results of rumen fermentation parameters also showed non-significant difference ($p \geq 0.05$) among treatments, except rumen pH and total nitrogen at 60th day which showed significant difference ($p < 0.05$). Thus, from the findings of present experiment it could be concluded that feeding high concentrate ration had no negative effect on haemato-biochemistry and rumen fermentation pattern of sheep reared intensively.

Keywords: Blood biochemistry, high concentrate diet, rumen fermentation, sheep

1. Introduction
Rearing sheep for mutton production is an age-old practice in Kashmir valley and findings of the famous Neolithic site of Kashmir-Gufkkral testify to the large-scale domestication of sheep around second millennium B.C. Jammu and Kashmir rank's 6th in sheep population among Indian states possessing 3.4 million sheep. Being leading mutton consuming region, the total mutton production of Jammu and Kashmir is about 21.37 thousand tonns annually contributing 3.15% of the total mutton produced in India (APEDA, 2019) [3]. The demand for mutton is increasing day by day as total annual requirement of mutton is around 488 lac kg out of which at present availability of mutton from local resources is about 278 lac kg (57%) and around 210 lac kg is imported from other states. So 43% of the mutton is imported from other states of country mainly from Rajasthan (Shah *et al*., 2020) [20]. When the locally available feed resources are in plenty, various feeding strategies could be opted to escalate the live weight and improve the carcass value (Sahib *et al*., 2023) [19]. Finish lambs on high concentrate ration is currently used by farmers, however, these animals are very demanding in nutrients. In order to encounter the energy asks of the lambs for growth, feed ingredients with high starch and relatively low fibre, are included in the diets (Kleen *et al*., 2003) [14]. In this system of rearing, the normal ADG is above 250g, however, 400 g/day or above can also be achieved by animals that have a higher weight gain potential which comes from genetic traits (Gallo *et al*., 2014) [9]. Finishing animals on high concentrate ration is used to add value to the carcass of a lamb although with a poor conformation through intensive feeding to promote muscle tissue growth and fat deposition so as to obtain a more desirable meat product (Van Der Merwe *et al*., 2020) [22].

2. Materials and Methods
2.1. Animal source and experimental feeding
The present study was conducted on 10 male crossbred lambs (12±02 months old) at Mountain Research Centre for Sheep and Goat, SKUAST-Kashmir.

The animals were equally divided into two groups (CON and FL) of 05 animals each. The design of experiment was completely randomized design (CRD). The diets were prepared as per the recommendations of ICAR (2013) [11]. The total mixed ration (TMR) prepared by mixing roughage and concentrate was offered to all experimental animals twice daily throughout the experimental duration of 74 days. In CON group, experimental animals were fed ration containing 60% roughage and 40% concentrate, while in the FL group, animals were fed high concentrate diets (80% concentrate and 20% roughage). The ingredient composition of concentrate mixture is presented in Table 1, and the roughage offered to the animals was oat hay.

Table 1: Ingredient composition of concentrate mixture used in experimental trial

Ingredients (%CP, %TDN)	Parts (%)	CP (kg)	TDN (kg)
Maize (11.67, 85)	54	6.30	45.90
Wheat Bran (16.04, 68)	12	1.93	8.16
Mustard oil cake (33.54, 74)	23	7.71	17.02
Cowpea (27.71, 70)	8	2.22	5.60
Mineral Mixture	2	0	0
Salt	1	0	0
Total	100	18.16	76.68

CP- Crude protein; TDN- Total digestible nutrients

2.2. Blood-biochemical parameters

Various haemato-biochemical parameters viz., hemoglobin (Hb), PCV (Packed cell volume), blood glucose, liver function tests (ALT, AST and ALP) and kidney function tests (BUN and serum creatinine) were analyzed before the feeding trial initiated and afterwards at regular monthly intervals till the end of experiment. The collected of blood was done from jugular vein using 20-gauge needles. The blood was collected in vials containing Na_2EDTA @ 1 mg/ml of blood. Haematological studies were performed soon after collection of blood. Blood glucose was estimated on spot using Accu-Chek instant Glucometer. For analysis of blood biochemical constituents, the serum was collected in small Pyrex tubes and kept for laboratory analysis. The estimation of haemoglobin (Hb) and packed cell volume (PCV) was done by using standard protocols, while blood glucose was analysed by using Accu-Chek instant Glucometer. The estimation of ALT, AST, ALP, BUN and creatinine was done by using commercial diagnostic kits (Table 2).

Table 2: Haemato-biochemical parameters and their diagnostic procedure

Parameters	Diagnostic Procedure
Haemoglobin (Hb)	Sahli's method
Packed cell volume (Hematocrit)	Microhematocrit method
Glucose (mg/ dl)	Using Accu-Chek instant Glucometer
ALT/SGPT (units/ L)	Method of IFCC (International Federation of Clinical Chemistry)
AST/SGOT (units/ L)	Method of IFCC (International Federation of Clinical Chemistry)
ALP (units/L)	Method of IFCC (International Federation of Clinical Chemistry)
BUN (mg/ dl)	Urease-GLDH enzymatic method
Creatinine (mg/ dl)	Jaffe's method (Modified)

2.3. Rumen fermentation parameters

The rumen liquor samples were collected from the experimental animals at initial and final day of trial with the help of perforated stomach tube (50 mm) introduced through the wooden mouth gag in the rumen. Rumen fluid pH was determined by using portable digital pH meter (pen type) immediately after collection of rumen liquor. Rumen liquor samples were then strained using muslin cloth and brought to laboratory in a thermos flask pre-warmed at 39°C for further analysis of total volatile fatty acids (TVFA), ammonia nitrogen, tricarboxylic acid (TCA) precipitable nitrogen and total nitrogen.

2.4. Statistical analysis

The statistical analysis of data generated throughout the experiment was done by applying one-way ANOVA as per the protocols proposed by Snedecor and Cochran (1994), using SPSS Software, Base 23.0 for macOS. Data was presented as mean, SEM and *p*-value.

3. Results and Discussion

3.1. Blood-biochemical parameters

To evaluate the health status of experimental animals, evaluation of their blood-biochemistry is considered to be the key guide. The results of various blood-biochemical parameters *viz.* blood glucose, Hb, PCV, ALT, AST, ALP, BUN and creatinine is presented in Table 3. The results revealed non-significant difference ($p \geq 0.05$) between the treatment groups, which shows no negative impact of feeding high concentrate ration in sheep.

The results of Hb and PCV resemble well with the earlier reports of Patnayak *et al.* (1972) [18], Bhargava *et al.* (1974) [5], Bhagoji (1978) [4], Pandya (1978) [17], Abdel-Hafeez *et al.* (1982) [1] and Mohd Azmi *et al.* (2021) [6] who found no significant difference ($p > 0.05$) between the treatment groups. Results of ALT and AST showed harmony with El-Marakby (2003) [7] who observed no alterations in their concentration in serum. The results of BUN concentration shows harmony with the findings of Galip (2006) [8], Masek *et al.* (2008) [15], Bruno *et al.* (2009) [6], Khaled and Baraka

(2011) [13], Hillal *et al*. (2011) [10] and Issakowicz *et al*. (2013) [12], who observed no significant alterations in the BUN values when animals were fed on high concentrate diets.

Table 3: Blood biochemistry of experimental animals

Attributes	Experimental groups		SEM	*p*-value
	CTL	FL		
Glucose (mg/dl)	58.00	63.15	2.03	.224
Haemoglobin (g/dl)	8.66	8.48	0.16	.620
PCV (%)	25.96	25.43	0.50	.620
ALT (IU/L)	14.89	16.05	0.96	.583
AST (IU/L)	93.59	98.89	2.60	.338
ALP (IU/L)	115.15	121.66	2.73	.256
BUN (mg/dl)	15.77	16.49	0.83	.690
Creatinine (mg/dl)	1.25	1.49	0.70	.092

CTL- Control group; FL- Treatment group.
PCV- Packed cell volume; ALT- Alanine transaminase; AST- Aspartate transferase; ALP- Alkaline phosphatase; BUN- Blood urea nitrogen.

3.2. Rumen fermentation parameters

The results of rumen pH, total nitrogen, ammonia nitrogen, TCA-precipitable nitrogen, NPN and TVFA showed non-significant effect ($p>0.05$) between the treatment groups, but significant difference ($p\leq0.05$) was found between treatment in case of rumen pH and total nitrogen concentration at 60th day (Table 4). The increase in total nitrogen concentration may be due to the higher crude protein (CP) content in the TMR of treatment group than control. The previous work on rumen fermentation parameters of sheep fed high concentrate ration is very scanty.

Table 4: Rumen fermentation pattern of experimental animals

Attributes	Days	Experimental groups		SEM	*p*-value
		CTL	FL		
Rumen pH	0	6.80	6.77	0.07	.842
	60	6.83^{b}	6.56^{a}	0.07	.047
Total Nitrogen (mg/dl)	0	105.00	112.00	5.75	.602
	60	112.00^{a}	144.67^{b}	8.01	.011
Ammonia Nitrogen (mg/dl)	0	19.23	17.92	1.27	.662
	60	19.60	16.24	1.33	.224
NPN (mg/dl)	0	39.67	41.07	9.78	.952
	60	42.00	51.33	8.97	.658
TCA Precipitable Nitrogen	0	65.33	70.93	5.44	.661
	60	70.00	93.33	9.84	.279
TVFA (meq/dl)	0	8.95	8.53	0.30	.550
	60	9.23	9.50	0.68	.869

CTL- Control group; FL- Treatment group.
NPN- Non-protein nitrogen; TCA- Tricarboxylic acid; TVFA- Total volatile fatty acids.

4. Conclusion

From the outcomes of the present experiment, it could be concluded that feeding high concentrate ration had no negative effect on the haemato-biochemistry and rumen fermentation pattern of sheep. Thus, it is recommended to finish lambs on high concentrate ration without affecting their health status. However, further studies on large sample size and for long duration are recommended.

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