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Research Article

Effect of Feeding Wheat and Paddy Straw on Blood Parameters and Serum Enzymes in Goats

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Abstract | Paddy and wheat generate multi-million tons of straw as residue. These two straws although similar in their nutrient content are quite different in microstructure and non-nutritive chemical composition. Present study scrutinized the effect of these straws when fed in combination as compared to fed as sole roughage on blood biochemical profile and serum enzymes. Eighteen non-descript local adult male goats were randomly divided into three equal groups as per randomized block design and were offered concentrate mixture @20g /kg metabolic body weight ($W^{0.75}$) along with either wheat straw (WS), paddy straw (PS) or wheat-paddy straw as 60:40 mix (WP) *ad libitum*. Feeding trial lasted for 30 days. The haemoglobin, total serum protein, albumin, blood urea nitrogen and serum enzymes (alanine transaminase and aspartate aminotransferase) were comparable among goats irrespective of the diets. It may be concluded that wheat and paddy straw can be used as sole roughage or in combination without effecting blood biochemical profile and serum enzymes of goats.

Keywords | Goats, Paddy straw, Straw combination, Wheat straw

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INTRODUCTION

A major portion of ration of ruminant livestock in South-east Asia including India is based on cereal crop residues. The scarcity of green fodder, pasture and quality hay has increased the onus over cereal crop residues, as their feeding to livestock offers no direct competition with human resources and requirements. Alternative mode of disposal of cereal straw by burning is a major source of land and air pollution (Andreae, 2001; Zeng et al., 2007). However, using it as a feedstuff for ruminant animals makes it an extremely important renewable resource (Severe and ZoBell, 2012).

Rice (*Oryza sativa* L.) - wheat (*Triticum aestivum* L.) (RW) cropping system has been developed through the introduction of rice in the traditional wheat-growing areas and *vice versa* in India (Paroda et al., 1994). Increased production of rice and wheat from last decade results enhanced residue production. There is a large variability in production of crop residues, and their use depends on the crops grown, cropping intensity, and productivity in different regions of India. There is mean residue production of about 6.7 and 5.0 metric tonne/h for paddy and wheat, respectively (Lal, 2005). Cereal crops (rice, wheat, maize, millets) contribute 70% of the total crop residues (352 Mt) including 34% by rice and 22% by wheat crops, out of which, the RW system accounts for approximately one-fourth of the total crop residues produced in India (Sarkar et al., 1999).

Paddy and wheat are both important cereal crops of Jammu and Kashmir (J&K) state. About 290.99 thousand hectares of land in J&K is under wheat cultivation, producing about 5819.5 thousand quintals of grain yield (GoJK, 2015), concurrently producing roughly 1.5 times the weight as wheat

straw and twice the weight as rice straw (Lal, 2005).

Paddy straws either burned, left on the field before the next ploughing, ploughed down as a soil improver or used as a feed for livestock (Kadam et al., 2000). It has poor nutritive value (Sarnklong et al., 2010) containing less lignin, but more silica and oxalic acid as compared to other cereal straws (Van Soest, 1981; Juliano, 1985). The slow and partial ruminal degradation of fibrous carbohydrates and the little content of nitrogen are the main limiting factors of rice straw, affecting its value as feed (Van Soest, 2006). Wheat straw is generally low in crude protein and phosphorous, limited in calcium, and high in fiber and lignin (Anderson, 1978). As such, it typically causes a decrease in voluntary intake, slowing of passage rate, and a decrease in digestibility.

In our previous study, we determined the chemical composition and *in vitro* dry matter degradability (IVDMD) of wheat and paddy straw in combination and concluded that straw combination of W60P40 was suitable for small ruminant feeding (Ganai et al., 2017).With this background, present study was envisaged to scrutinize the effect of this combination of straws on blood parameters and serum enzymes in goats when fed in combination as compared to their sole feeding.

MATERIAL AND METHODS

Present study was conducted in the Division of Animal Nutrition, F.V.Sc. & A.H., SKUAST-J, R.S. Pura, Jammu. Eighteen non-descript local adult male goats were taken as the experimental animals. Goats were randomly divided into three equal groups of six animals each as per randomised block design and were subjected to three dietary treatments namely WS, PS and WP.The groups were subjected to dietary treatments viz., WS (Wheat straw *ad libitum* + concentrate mixture @20g /kg metabolic body weight ($W^{0.75}$); PS (Paddy straw *ad libitum* + concentrate mixture @ 20g/kg $W^{0.75}$) and WP (wheat (60%) and paddy straw (40%) combination *ad libitum* + concentrate mixture @20g/kg $W^{0.75}$). The composition of concentrate mixture (mustard de oiled cake-40%; wheat bran-32%; barley-25%, mineral mixture-2%, salt-1%) was formulated to meet the nutrient requirements of the animals as per ICAR (2013). All the goats were reared under uniform management conditions with the provision of individual housing in well-ventilated cement floored sheds up to end of trial (30 d). The goats were treated for ecto- and endo-parasites with Butox(R) spray (Intervet) and Panacur(R) bolus (Intervet), respectively before the start of study. Clean, wholesome drinking water was provided twice daily on *ad libitum* basis. Each group of the goats were fed with respective straw twice daily *viz.* in morning at 8:30 am and in evening at 4:00 pm along with daily allowance of concentrate mixture divided into two equal parts.

To collaborate the effect of straw feeding on blood parameters, periodic monitoring of blood parameters was carried out. Blood from experimental goats was collected early in the morning before feeding and watering, by jugular vein puncture at day 0, 15 and 30 of experimental trial. About 10 ml of whole blood was collected from every animal, from that 2 ml was mixed with EDTA for haematological parameters and the remaining was taken in well cleaned, dry, sterilized and labelled test tubes and allowed to clot. After clotting, the tubes were centrifuged to collect serum. The serum samples were collected in labelled containers separately and then stored in deep freeze (-20°C) for further analysis. Haemoglobin was quantified in whole blood samples by Drabkin method (Crook JD, 1985). The estimation of total serum protein, albumin, blood urea nitrogen (BUN), alanine transaminase (ALT) and aspartate aminotransferase (AST) were carried out using "ERBA Diagnostic Kits" manufactured by Transasia Bio-Medicals Limited in technical collaboration with ERBA diagnostics Mannheim GmbH.

STATISTICAL ANALYSIS

The data generated was then subjected to multivariate analysis (Snedecor and Cochran, 1994). The means bearing significant difference (at $P < 0.05$) were ranked by Duncan's multiple range test as per Duncan (1955).

RESULTS

The blood biochemical profile and levels of serum enzymes of experimental goats are presented in Table 1 and Table 2 respectively.

Haemoglobin

The mean haemoglobin level in WS group, PS group and WP group was 10.36±0.263 g/dl, 10.83±0.198 g/dl, and 10.92±0.159 g/dl, respectively. There was no significant ($P>0.05$) difference in haemoglobin level between the periods as well as between the groups (Table 1).

Total Serum Protein

The mean level of total serum protein was 5.75±0.137 g/dl for the experimental goats, with 5.97±0.070 g/dl in the WS group, 5.78±0.280 g/dl in the PS group and 5.55±0.274 g/dl in the WP group. There was no significant ($P>0.05$) difference between the groups as well as among periods (Table 1).

Serum Albumin and Globulin

The mean serum albumin content of the goats was compa-

Table 1: Effect of combined feeding of wheat and paddy strawon levels of blood bio-chemicals of experimental goat

Attributes/Treatments	Days from onset of trial			Treatment Mean ± SEM	Pvalue
	0th Day	15th Day	30th Day		
Haemoglobin (g dl-1)					
WS	10.3	10.48	10.29	10.36±0.263	
PS	10.82	10.77	10.91	10.83±0.198	
WP	10.97	10.84	10.96	10.92±0.159	
Period mean ± SEM	10.72±0.226	10.71±0.232	10.74±0.190	10.72±0.122	0.996
P value				0.177	
Total Protein (g dl-1)					
WS	5.85	6.03	6.03	5.97±0.070	
PS	5.63	5.88	5.83	5.78±0.280	
WP	5.78	5.42	5.44	5.55±0.274	
Period mean ± SEM	5.75±0.222	5.75±0.252	5.74±0.257	5.75±0.137	0.998
P value				0.512	
Albumin (g dl-1)					
WS	3.18	3.38	3.4	3.32±0.081	
PS	3.2	3.08	3.3	3.19±0.082	
WP	2.95	3.06	3.17	3.06±0.105	
Period mean ± SEM	3.10±0.123	3.16±0.078	3.28±0.078	3.18±0.055	0.429
P value				0.192	
Globulin (g dl-1)					
WS	2.68	2.65	2.63	2.65±0.090	
PS	2.43	2.8	2.53	2.58±0.271	
WP	2.83	2.36	2.27	2.48±0.304	
Period mean ± SEM	2.66±0.273	2.58±0.237	2.46±0.249	2.57±0.143	0.902
P value				0.907	
A:G Ratio					
WS	1.21	1.29	1.33	1.28±0.067	
PS	1.63	1.15	1.61	1.46±0.222	
WP	1.29	1.73	1.64	1.55±0.215	
Period mean ± SEM	1.37±0.199	1.42±0.201	1.53±0.174	1.44±0.108	0.847
P value				0.610	
BUN (mg dl-1)					
WS	26.72	26.94	26.88	26.84±0.537	
PS	25.27	25.08	24.77	25.04±0.393	
WP	26.25	26.51	25.88	26.21±0.642	
Period mean ± SEM	26.09±0.585	26.20±0.534	25.84±0.653	26.05±0.334	0.923
P value				0.139	

WS: wheat straw; PS: paddy straw; WP: wheat-paddy straw; A:G ratio: albumin: globulin ratio; BUN: blood urea nitrogen

rable (P>0.05) among the three groups with an overall mean albumin concentration of 3.18± 0.055 g/dl. There was no significant (P>0.05) difference among periods. The mean globulin content WS, PS group and that of WP group was 2.65±0.090 g/dl, 2.58±0.271 g/dl and 2.48±0.304 g/dl, respectively. There was no significant (P>0.05) difference periodically as well as between the groups in globulin levels (Table 1).

Albumin: Globulin (A:G) Ratio

Mean A:G ratio in WS, PS group and that of WP group was 1.28±0.067, 1.46±0.222 and 1.55±0.215, respectively. There was no significant (P>0.05) difference periodically as well as between the animals of dietary groups (Table 1).

Blood Urea Nitrogen

Mean BUN concentration (mg/dl) in WS, PS and WP

Table 2: Effect of combined feeding of wheat and paddy straw on levels of serum enzymesof experimental goat

Attributes/Treatments	Days from onset of trial			Treatment Mean ± SEM	Pvalue
	0th Day	15th Day	30th Day		
AST (IU L^{-1})					
WS	57.05	63.5	64.48	61.68±2.902	
PS	62.74	69.5	75.38	69.20±3.654	
WP	66.8	75.44	74.94	72.39±2.910	
Period mean ± SEM	62.55±2.902	69.94±3.183	71.85±3.505	68.11±1.916	0.111
P value				0.066	
ALT (IU L^{-1})					
WS	15	15.33	15.5	15.28±0.164	
PS	16.13	15.45	16.2	15.93±0.554	
WP	15.48	15.12	15.14	15.25±0.179	
Period mean ± SEM	15.53±0.366	15.28±0.342	15.58±0.308	15.46±0.192	0.809
P value				0.334	
AST:ALT ratio					
WS	3.80	4.17	4.17	4.05±0.207	
PS	3.92	4.6	4.73	4.42±0.302	
WP	4.34	5.00	4.95	4.76±0.209	
Period mean ± SEM	4.04±0.190	4.62±0.267	4.64±0.259	4.44±0.143	0.172
P value				0.133	

WS: wheat straw; PS: paddy straw; WP: wheat-paddy straw; ALT: alanine transaminase; AST: aspartate aminotransferas

group animals was 26.84±0.537, 25.04±0.393 and 26.21±0.642, respectively. There was no significant (P>0.05) difference in BUN level of experimental goats between the periods as well as between the groups (Table 1).

Aspartate Aminotransferase

Mean AST level (IU/L) in serum of WS, PS group and that of WP group was 61.68± 2.902, 69.20± 3.654 and 72.39± 2.910, respectively. No significant (P>0.05 difference or interaction was observed between dietary groups and periodic recordings (Table 2).

Alanine Transaminase

Mean ALT level (IU/L) were 15.28± 0.164, 15.93 ± 0.554 and 15.25± 0.179 in the serum of WS, PS and WP group animals. No significant (P>0.05) difference or interaction was observed among dietary groups and periodic recordings (Table 2).

Aspartate Aminotransferase: Alanine Transaminase Ratio (AST: ALT Ratio)

Mean AST:ALT ratio in WS, PS group and that of WP group was 4.05±0.207, 4.42±0.302 and 4.76±0.209, respectively. There was no significant (P>0.05) difference periodically as well as between the animals of dietary groups (Table 2).

DISCUSSION

The haematological parameters like haemoglobin are indicators of erythrocytic normalcy and general well-being of the animals (Radositits et al., 2007). The mean haemoglobin level of the experimental animals was within the normal range (8–12 g/dl) as per Kaneko et al. (1997) for goats. This suggests that the general health of all experimental goats in the present study remained optimum. No significant (P>0.05) difference in haemoglobin level between the periods as well as between the groups indicates no effect of dietary treatment.

Serum concentration of proteins depends upon a number of factors like extent, duration and nature of the hepatic disorder; the inflammatory or metabolic hepatic process and the presence of other organ disorders. The levels of total protein and serum albumin indicates biosynthetic capabilities of liver (Thapa and Walia, 2007) and hepatocellular toxicity is often indicated by decline in albumin:globulin ratio (Singh et al., 2011). An increase in the principal serum protein, albumin, indicates dehydration, whereas decrease in its level indicates liver, kidney, gastrointestinal disease and malnutrition (Kaneko et al., 1997).Mean total serum protein level in experimental goats was slightly lower than the normal reference range of 6.0-7.5 g/dl for goats (Kaneko et al., 1997), however, levels observed are similar to reports of previous workers with similar experimental

animals (Bashir et al., 2014, Mir et al., 2014, Ishfaq et al., 2017). Comparable (P>0.05) total protein levels obtained across periods and across different groups indicate that dietary regimens have not compromised the liver functionalities in terms of biosynthesis. Similar observations were recorded with serum albumin and globulin levels.

Blood urea nitrogen (BUN) levels are an indicator of protein nutrition status of the animal (Baker et al., 1995). The values of the BUN were higher than the normal range (10-20 mg/dl) as reported by Kaneko et al. (1997) for goats. Blood urea nitrogen levels are similar to that reported by Jan et al. (2015) while working with similar experimental animals. Protein digestion in ruminants results in unused ruminal ammonia being transported to the liver via the portal blood where it is converted to urea. This together with urea from deamination of amino acids arising from post-ruminal digestion and systemic protein turnover then circulates in the blood (Hammond and Chase, 1996). In healthy ruminants, BUN concentrations indicate the protein to energy ratio in the diet (Baker et al., 1995). Increased dietary protein with constant energy intake, increased solubility or degradability of dietary protein resulted with high BUN while increasing energy with constant protein intake and increased level of feed intake led to a decrease in BUN (Baker et al., 1995, Kirchgessner et al., 1986). The protein source used in concentrate mixture in present study is mustard oil cake that is known to contain high percentage of rumen degradable protein (Mahima et al., 2015) and this may be the reason for higher BUN levels in the experimental goats, irrespective of the dietary treatments.

The activity of AST and ALT is an indicator of damage to liver and muscles (Silanikove et al., 1996). These enzymes are most commonly used biomarkers for hepatic function assay. In contrast to ALT, which is liver specific, AST is a general marker of tissue damage. The ratio of serum AST to ALT can be used to differentiate liver damage from other organ damage (Nathwani et al., 2005). The comparable level of AST and ALT irrespective of dietary treatment, observed in this study reflects no adverse effect of type of straw on liver, kidney and muscle mass. This also suggests that the energy and protein intake of animals was sufficient to maintain body weight and to prevent muscle breakdown. No significant (P>0.05) difference or interaction was observed among dietary groups and periodic recordings.

CONCLUSION

Wheat and paddy straw can be used as sole roughage or in combination in goats' ration without effecting blood biochemical profile and serum enzymes of goats.

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CONFLICT OF INTEREST

The authors have no conflict of interest with each other or any organization.

AUTHORS CONTRIBUTION

This manuscript is the part of MVSc thesis work of the corresponding author under supervision of Dr Ankur Rastogi in Division of Animal Nutrition, SKUAST-J headed by Dr R.K.Sharma.

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