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Evaluation of effect of combined feeding of wheat and paddy straw on calcium and phosphorus in goats

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Abstract
The present study scrutinized the effect of wheat and paddy straws when fed as a combination as compared to when fed as sole roughage on Ca and P balance in goats. 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 $W^{0.75}$ along with either wheat straw (WS); paddy straw (PS) or wheat-paddy straw as 60:40 mix (WP) *ad libitum*. Feeding trial for 30 days duration was conducted. Net balance of calcium was significantly higher ($P<0.05$) in WS (1.52±0.357) in comparison to PS (0.40±0.175) and WP (0.89±0.095) fed groups, whereas phosphorous balance does not different significantly ($P>0.05$) among different experimental groups, irrespective of the diets. It may be concluded that wheat and paddy straw can be used as sole roughage or in combination, however, calcium uptake is negatively affected under paddy straw based diet, which can be partially alleviated by using 60:40 combination of wheat and paddy straw.

Keywords: Goats, paddy straw, straw combination, wheat straw

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 [1, 2]. However, using it as a feedstuff for ruminant animals makes it an extremely important renewable resource [3].

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 [4]. In the mid-1960s, green revolution technologies led to the emergence of RW as the major production system covering an area of 10 million hectares spread over the Indo-Gangetic Plains of India [5]. With increased production of rice and wheat, residue production has also increased substantially. 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/Ha for paddy and wheat, respectively [6]. Cereal crops (rice, wheat, maize, millets) contribute 70% of the total crop residues (352 Mt) comprising 34% by rice and 22% by wheat crops, out of which, the RW system accounts for nearly one-fourth of the total crop residues produced in India [7]. Paddy and wheat are both important cereal crops of Jammu and Kashmir. Paddy is the main crop of Kashmir, followed by maize, oilseeds, pulses, vegetables, fodder and wheat. In Jammu region, wheat is the predominant crop followed by maize, paddy, pulses, oilseeds, fodder, vegetables and other crops [8]. About 290.99 thousand hectare of land in Jammu and Kashmir is under wheat cultivation, producing about 5819.5 thousandquintals of grain yield [8], concurrently producing roughly 1.5 times this weight as straw [6]. Simultaneously, about 265.88 thousand hectare of land in Jammu and Kashmir is under rice cultivation, producing about 4548 thousand quintals of grain yield [8], concurrently producing roughly more than twice this weight as straw [6].

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 [9]. It has poor nutritive value [10]. It contains less

lignin, but more silica and oxalic acid than other cereal straws [11, 12]. The slow and limited ruminal degradation of fibrous carbohydrates and the low content of nitrogen are the main limiting factors of rice straw, affecting its value as feed [13].

Wheat straw is generally low in crude protein and phosphorous, limited in calcium, and high in fiber and lignin [14]. As such, it typically causes a decrease in voluntary intake, slowing of passage rate, and a decrease in digestibility.

Straw intake and digestibility in ruminants are influenced by straw characteristics (including chemical composition, morphological and anatomical features, physical nature and palatability) [15]. These two straws although similar in their nutrient content are quite different in microstructure and non-nutritive chemical composition. Further, they also differ in their relative acceptability by livestock keepers as a feedstuff, which is also reflected in their market price. In our previous study Ganai *et al*. we determined the chemical composition and *in vitro* dry matter degrability (IVDMD) of wheat and paddy straw as a combination and concluded the straw combination of W60P40 was suitable for small ruminant feeding [16]. In appropriate to this notion the present study was envisaged to scrutinize the effect of these straws when fed as a combination as compared to when fed as sole roughage on Ca and P balance.

Materials and methods

The present study was conducted in the Division of Animal Nutrition of F.V.Sc. & A.H., SKUAST-J, R.S. Pura, Jammu during the month of May 2017. 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 group were subjected to three dietary treatments namely WS (Wheat straw *ad libitum* + concentrate mixture @20g /kg $W^{0.75}$); 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 deoiled 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 kept under uniform management conditions with the provision of individual housing in well-ventilated cement floored sheds. 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. Weighed quantities of concentrate mixture were offered to goats at 8:00 am in the morning and in evening. After its complete consumption, respective straw was fed to the animals on *ad libitum* basis.

To collaborate the effect of combined straw feeding on Ca and P balance, estimation of Calcium and Phosphorus was done as per the protocol described in AOAC (1995).

Statistical analysis

The data generated was then subjected to multivariate analysis [17]. The means bearing significant difference were ranked by Duncan's multiple range test as per Duncan (1955).

Results and discussion

Calcium and Phosphorus balance data of the experimental goats is presented in Table 1 & 2, respectively. The calcium intake and its outgo in faeces and urine (g/d) was comparable ($P>0.05$) among goats, irrespective of the diets, however, when expressed as percentage of live weight and g/kg W0.75, the intake was highest ($P<0.01$) in WS group and lowest in PS group, with intermediate values for WP group. Net balance of calcium was significantly higher ($P<0.05$) in WS (1.52±0.357) in comparison to PS (0.40±0.175) and WP (0.89±0.095) fed groups. All experimental animals had positive calcium balance. Calcium retention (% of intake) was significantly higher ($P<0.05$) in WS (36.67±7.955) in comparison to PS (10.89±4.046) and WP (22.95±3.253) fed groups. Also calcium retention (% of absorbed) was significantly higher ($P<0.05$) again in WS (72.13±4.082) in comparison to PS (31.26±9.702) fed groups. Oxalate is known to form complexes with divalent calcium (Ca^{2+})ions [18] making them unavailable for assimilation [19, 20, 21, 22]. This effect may occur in intestine, resulting in elimination in faeces [23] and/or in blood, resulting in elimination via urine [24,25]. It may be hypothesized that high oxalate content in paddy straw led to its binding with calcium, making it unavailable for anabolism, which is reflected in lower calcium intake (% L. wt.) and calcium balance value in paddy straw fed group and intermediate values for WP group. This was also reflected in retention percentage.

Phosphorus intake, outgo, net balance and its retention (% of intake and% of absorbed) does not different significantly ($P>0.05$) among different experimental groups. Positive calcium and phosphorus balance of all experimental animals, irrespective of the dietary regimen, suggests that the paddy straw inclusion even as sole roughages not a limiting factor for adult male goats. However, it will be an important consideration, when included in diet for species with higher calcium demand such as growing ruminants and lactating animals.

Although, there was significant ($P<0.01$) difference in the phosphorus content of wheat and paddy straw, no significant ($P>0.05$) difference in intake, outgo, net balance and retention (% of intake and% of absorbed) of phosphorous was present among different experimental groups. This may be explained on the basis that unlike calcium, straw are poor source of phosphorous and most of the phosphorous received by the animals is sourced from concentrate mixture, which was similar across treatment groups. Therefore, the variation in phosphorous content of straw was not reflected in phosphorous intake and balance data.

Table 1: Effect of combined feeding of wheat and paddy straw on calcium balance of goats

Attributes	Groups			SEM	P value
	WS	PS	WP		
Calcium intake					
g/d	4.18±0.493	3.52±0.340	4.02±0.279	0.209	0.466
% L. Wt.	0.015^{c}±0.0002	0.012^{a}±0.0001	0.014^{b}±0.0002	0.0004	0.000
g/Kg W $^{0.75}$	0.34^{c}±0.009	0.28^{a}±0.006	0.32^{b}±0.003	0.008	0.000
Calcium excretion (g/d)					
Faeces	2.13±0.556	2.29±0.395	2.48±0.334	0.228	0.840
Urine	0.53±0.034	0.83±0.161	0.64±0.036	0.058	0.123
Total	2.66±0.533	3.12±0.278	3.12±0.331	0.213	0.654
Calcium balance (g/d)	1.52^{b}±0.357	0.40^{a}±0.175	0.89^{ab}±0.095	0.171	0.019
Calcium Retention					
% of intake	36.67^{b}±7.955	10.89^{a}±4.046	22.95^{ab}±3.253	4.002	0.022
% of absorbed	72.13^{b}±4.082	31.26^{a}±9.702	57.72^{b}±2.547	5.611	0.002

^{abc}Values bearing different superscripts within a row differ significantly.

Table 2: Effect of combined feeding of wheat and paddy strawon phosphorus balance of goats

Attributes	Groups			SEM	P value
	WS	PS	WP		
Phosphorus intake					
g/d	1.99±0.227	1.69±0.155	1.92±0.131	0.096	0.477
% L. Wt.	0.0071c±0.0001	0.0057a±0.0001	0.0066b±0.0001	0.0002	0.000
g/Kg W 0.75	0.16c±0.004	0.13a±0.002	0.15b±0.001	0.004	0.000
Phosphorus excretion (g/d)					
Faeces	0.58±0.162	0.59±0.118	0.58±0.146	0.076	0.998
Urine	0.17±0.016	0.19±0.018	0.17±0.015	0.009	0.700
Total	0.75±0.150	0.78±0.120	0.75±0.158	0.078	0.989
Phosphorus balance (g/d)	1.24±0.108	0.91±0.170	1.17±0.065	0.072	0.172
Phosphorus Retention					
% of intake	62.86±3.564	53.38±6.956	62.37±6.059	3.304	0.475
% of absorbed	87.59±1.632	81.83±2.904	87.30±1.580	1.316	0.143

^{abc}Values bearing different superscripts within a row differ significantly.

Conclusion

Wheat and paddy straw can be used as sole roughage or in combination, however, calcium uptake is negatively affected under paddy straw based diet, which can be partially alleviated by using 60:40 combination of wheat and paddy straw.

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References

1. Andreae MO. Emission of trace gases and aerosols from biomass burning. Global Biogeochemical Cycles. 2001; 15(4):955-966.
2. Zeng X, Ma Y, Ma L. Utilization of straw in biomass energy in china. Renewable and Sustainable Energy Reviews. 2007; 11(5):976-987.
3. Severe J, ZoBell DR. Technical aspects for the utilization of small grain straws as feed energy sources for ruminants: emphasis on beef cattle. Utah State University-Extension publication, 2012, 95.
4. Paroda RS, Woodhead T, Singh RB. Sustainability of rice-wheat production systems in Asia, RAPA Publication 1994/11.FAO, Bangkok, 1994.
5. Singh Y, Sidhu HS. Management of cereal crop residues for sustainable rice-wheat production system in the Indo-Gangetic plains of India. Proceedings of Indian National Science Academy. 2014; 80(1):95-114.
6. Lal R. World crop residues production and implications of its use as a biofuel. Environment International. 2005; 31:575-584.
7. Sarkar A, Yadav RL, Gangwar B, Bhatia PC. Crop Residues in India. Technical Bulletin. Directorate of Cropping System Research, Modipuram, India, 1999.
8. GJ&K. Economic Survey 2014-15 (Volume 1), Directorate of Economics and Statistics, Government of Jammu and Kashmir, Jammu and Kashmir, India, 2015.
9. Kadam KL, Forrest LH, Jacobson WA. Rice straw as a lignocellulosic resource: collection, processing, transportation, and environmental aspects. Biomass and Bioenergy, 2000; 18:369-389.
10. Sarnklong C, Cone JW, Pellikaan W, Hendriks WH. Utilization of Rice Straw and Different Treatments to Improve Its Feed Value for Ruminants: A Review, Asian-Australasian Journal of Animal Sciences. 2010; 23(5):680-692.
11. Van Soest PJ. Limiting factors in plant residues of low biodegradability. Agriculture and Environment. 1981; 6(2-3):135-143.
12. Juliano BO. Rice hull and *rice straw*. In: B.O. Juliano (ed.), Rice Chemistry and Technology. 2nd ed. American Association of Cereal Chemists, St Paul, MN, USA, 1985.
13. Van Soest PJ. Review: rice straw, the role of silica and treatments to improve quality. Animal Feed Scienceand Technology. 2006; 130:137-171.
14. Anderson DC. Use of cereal residues in beef cattle production systems. Journal of Animal Science. 1978; 46:849-861.
15. Reed JD, Capper BS, Neate PJH. Plant breeding and the nutritive value of crop residues. Proceedings of a workshop held at ILCA, Addis Ababa, Ethiopia, 7-10 December 1987. ILCA, Addis Ababa, 1988.

16. Ganai IA, Rastogi A, Sharma RK, Wali A, Saharan V. Chemical composition and *in vitro* dry matter degradability of combination of wheat and paddy straw for small ruminant feeding. Journal of Entomology and Zoology Studies. 2017; 5(4):1755-1760.
17. Snedecor GW, Cochran WG. Statistical methods. 8thEdition, East West Press Private Limited, New Delhi, 1994.
18. Savag GP, Vanhanen L, Mason SM, Ross AB. Effect of cooking on the soluble and insoluble oxalate content of some New Zealand foods. Journal of Food Composition and Analysis. 2000; 13:201-206.
19. Talapatra SK, Ray S, Sen C. Calcium assimilation of ruminants on oxalate-rich diets. Journal of Agriculture Science. 1948; 38:163.
20. Watts PS. Effects of oxalic acid ingestion by sheep 1. Small doses to chaff fed sheep. The Journal of Agricultural Science (Cambridge). 1959a; 52:244-249.
21. Watts PS. Effects of oxalic acid ingestion by sheep 2. Large doses to sheep on different diets. The Journal of Agricultural Science (Cambridge). 1959b; 52:250-255.
22. Gorb TW, Maksakow WJ. Influence of oxalate-rich feed on mineral metabolism and some physiological values in ruminants. Arch. Tierernahrung. 1962; 12:27-35.
23. Ward G, Harbers LH, Blaha JJ. Calcium-containing crystals in alfalfa: their fate in cattle. Journal of Dairy Science. 1979; 62(5):715-722.
24. Lincoln SD, Black B. Halogeton poisoning in range cattle. Journal of American Veterinary Medical Association. 1980; 176:717-718.
25. Blaney BJ, Gartner RJW, Head TA. The effects of oxalate in tropical grasses on calcium, phosphorus and magnesium availability to cattle. Journal of Agricultural Sciences (Cambridge). 1982; 99:533-539.