



Research Article

EFFECT OF INCORPORATION OF GRAM (*Cicer arietinum* L.) STRAW IN TOTAL MIXED RATION ON *IN VITRO* STUDIES IN CATTLE

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Abstract- The study was conducted the effect of incorporation of gram (*Cicer arietinum*) straw in total mixed ration on *in-vitro* studies on cattle. The two treatments were T₁ (control): concentrate mixture (45%) + wheat straw (55%) and T₂ (Treatment): concentrate mixture (45%) + gram straw (80% replacement of wheat straw). The energy and protein requirements of cattle were met as per ICAR (1998) standards. The concentrate to roughage ratio was kept at 45:55. The TMR without gram straw was designated as G0 (control), gram straw was incorporated in TMR as replacement of wheat straw @ 100, 80, 60, 40 and 20 % and were designated as G1, G2, G3, G4, and G5, respectively, for *in vitro* studies. The statistical analysis of data revealed significant (P<0.05) decrease in *in vitro* dry matter digestibility IVDMD in G0, G3, G4, and G5 treatment group as compared to G1 and G2 groups. The statistical analysis of data revealed significant (P<0.05) decrease in *in-vitro* organic matter digestibility (IVOMD) in G0, G3, G4 and G5 treatment group as compared to G1 and G2 groups.

Keywords- Gram straw, *in vitro*, Cattle.

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Introduction

Livestock production account for 40% of the world's gross agriculture production [1]. India has 304.4 million total bovine populations out of which 199.1 million are cattle and 105.3 million are buffaloes. Beside this there remains large amount of population which include growing calves. Cattle rearing in India are primarily dependent upon herbage from natural range lands and crop residues. The alternative resource is by improving the natural range lands through introduction of pastures and legumes [2]. Gram (*Cicer arietinum*), known as chickpea, is the pulse crop in India with 75 % of the world acreage and production. India is the largest producer and consumer of pulses in the world. Emphasis has been given to gram straw in the study as gram (*Cicer arietinum*) is one of the most important pulse crop of India and nearly 8.95 million tonnes of gram straw is produced annually in the country. Large amounts of straw remain after gram threshing. [3,4]. Gram straw could appear to be a valuable edible bio mass due to its high nutritive value and feeding qualities and can serve as potential feed resource during the lean period of May-July when even grasses and vegetation are highly scarce. Feeding of crop residues particularly leguminous straws for livestock as a major roughage source has been observed during harvest season as they are most abundantly available. Gram straw generally contains more protein, greater energy and lower cell wall contents than cereal straws [5]. Straw is one of the main by-products from cereal and legume crops. Gram straw is higher in nutritive value than cereal straws (44-46% TDN and 4.5-6.5% CP) [6]. Gram straw has relatively high metabolisable energy content (7.7 MJ/Kg DM) and can be used as a ruminant feed. In view of the available information, attempt has been made to study the effect of feeding gram straw based TMR on the performance of cattle.

Materials and Methods

The present study was conducted Animal Nutrition Research Station Farm, College of Veterinary Science and Animal Husbandry, AAU, Anand, Gujarat during July to August 2016. *In-vitro* studies were conducted to arrive at the optimum level of incorporation of gram straw with various levels sore placement of wheat straw in total mixed ration (TMR). The TMR was prepared by mixing concentrate mixture, wheat straw and gram straw. The concentrate and roughage ratio was kept at 45:55. The TMR without gram straw was designated as G0(control), gram straw was incorporated in TMR as replacement of wheat straw @100, 80, 60, 40 and 20% and were designated as G1, G2, G3, G4, and G5, respectively, for *in-vitro* studies. The ingredient used for TMR formulation is given [Table-1.1].

Table-1.1 Ingredient composition of total mixed ration (%) with replacement of wheat straw by gram straw.

Ingredients	G0	G1	G2	G3	G4	G5
	0	100	80	60	40	20
% Replacement of wheat straw by gram straw						
Wheat straw	55	0	11	22	33	34
Gram straw	0	55	44	33	22	11
Concentrate	45	45	45	45	45	45

Four cattle (150-200 kg B.W.) of similar age and uniform conformations were selected and fed [7] standard stomeet their nutrient needs as donor of rumen inoculums for *in-vitro* study. Rumen liquor was collected at 2h post feeding through stomach tube against negative pressure created by auction pump. For *in-vitro* studies, 10 ml of SRL along with 40ml of fresh McDougall buffer was added

to the syringes containing substrate. The syringes containing substrate along with rumen liquor and buffer were incubated at $39\pm1^{\circ}\text{C}$ for 48h in at win shakers water bath. After 24 and 48h of incubation, the content of each syringe was filtered through pre-weighed Gooch crucible, dried and weighed. Simultaneously, the blank was also incubated without TMR sample. The *in-vitro* total gas production (IVTGP), *in-vitro* dry matter digestibility (IVDMD) and *in-vitro* organic matter digestibility (IVOMD) were estimated.

Result and Discussions

The TMR was prepared by mixing concentrate mixture, wheat straw and gram straw. In present study wheat straw was replaced by gram straw at different level as 55:0 (100% wheat straw), 0:55 (100% gram straw), 11:44 (80% gram straw), 22:33 (60% gram straw), 33:22 (40% gram straw) and 44:11 (20% gram straw) under TMR T₁ (control), T₂, T₃, T₄, T₅ and T₆, respectively. The TMR without gram straw was designated as G₀ (control), gram straw was incorporated in TMR as replacement of Wheat straw @ 100, 80, 60, 40 and 20% and were designated as G₁, G₂, G₃, G₄, and G₅, respectively, for determination of optimum level of replacement of wheat straw and incorporation of gram straw based on *in vitro* digestibility of DM, OM and *in vitro* total gas production (TGP) profile.

In-vitro Dry Matter Digestibility (IVDMD):

The data on IVDMD of TMR without gram straw- G₀ (control), and for various treatments G₁, G₂, G₃, G₄, and G₅ from *in-vitro* study at 24 h incubation period are presented in [Table 1.1] and same data are also depicted. The average values of *in vitro* dry matter digestibility at 24 h incubation for G₀, G₁, G₂, G₃, G₄, and G₅ treatment groups were observed as 66.47, 69.36, 69.21, 66.50, 66.30 and 62.41%, respectively. The statistical analysis of data revealed significant ($P<0.05$) decrease in IVDMD in G₀, G₃, G₄, and G₅ treatment group as compared to G₁ and G₂ groups. Same results in *in-vitro* studies of legume straw [8, 9].

In-vitro Organic Matter Digestibility (IVOMD):

The average values of IVOMD at 24h incubation for various levels of gram straw replacement in TMR with wheat straw are presented in [Table 1.2] and the same data are presented graphically. The average values of IVOMD at 24 h incubation for G₀, G₁, G₂, G₃, G₄, and G₅ treatment groups were observed as 65.84, 69.08, 69.14, 66.52, 65.24 and 65.82%, respectively. The statistical analysis of data revealed significant ($P<0.05$) decrease in IVOMD in G₀, G₃, G₄ and G₅ treatment group as compared to G₁ and G₂ groups.

In-vitro Total Gas Production (IVTGP):

The average values for *in vitro* total gas production at 24 h incubation for G₀, G₁, G₂, G₃, G₄, and G₅ treatment groups were observed as 99.0, 97.5, 97.0, 96.75, 96.75 and 97.25 ml/500 mg TMR, respectively [Table-1.2]. No significant differences ($P<0.05$) in gas production were observed among the experimental groups.

Table-1.2 The average pH, IVDMD%, IVOMD% and TGP (ml) during *in vitro* study (24 h incubation)

Group	TGP	IVDMD	IVOMD
G ₀	99.0 $\pm$ 0.41	66.47 $\pm$ 0.53a	65.84 $\pm$ 0.61a
G ₁	97.5 $\pm$ 0.65	69.36 $\pm$ 0.36b	69.08 $\pm$ 0.47b
G ₂	97.5 $\pm$ 0.65	69.21 $\pm$ 0.59b	69.14 $\pm$ 0.48b
G ₃	96.75 $\pm$ 1.11	66.50 $\pm$ 0.25a	65.52 $\pm$ 0.33a
G ₄	96.75 $\pm$ 0.63	66.30 $\pm$ 0.26a	65.24 $\pm$ 0.80 a
G ₅	97.25 $\pm$ 0.75	66.41 $\pm$ 0.20a	65.82 $\pm$ 0.17 a
P value	0.311	0.000	0.000
abMeans with different superscripts in a column for a parameter differ significantly ($P<0.05$)			

Conclusion

The average values of *in vitro* dry matter digestibility at 24 h incubation for G₀, G₁, G₂, G₃, G₄, and G₅ treatment groups were observed as 66.47, 69.36, 69.21, 66.50, 66.30 and 62.41%, respectively. The statistical analysis of data revealed significant ($P<0.05$) decrease in IVDMD in G₀, G₃, G₄, and G₅ treatment group as

compared to G₁ and G₂ groups. The average values of IVOMD at 24 h incubation for G₀, G₁, G₂, G₃, G₄, and G₅ treatment groups were observed as 65.84, 69.08, 69.14, 66.52, 65.24 and 65.82%, respectively. The statistical analysis of data revealed significant ($P<0.05$) decrease in IVOMD in G₀, G₃, G₄ and G₅ treatment group as compared to G₁ and G₂ groups. The study revealed that optimum level of incorporation of gram straw with wheat straw in TMR for feeding of cattle was G₁ (100% gram straw) and G₂ groups (80% gram straw).

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Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Abbreviations: IVDMD- *in vitro* dry matter digestibility, IVOMD- *in vitro* organic matter digestibility, TGP- Total Gas production TMR- Total mixed Ration, DM- Dry matter, OM- Organic matter, CP- Crude protein, EE- Ether extract, NFE- Nitrogen free extract

Conflict of Interest: None declared

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