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Research Article

EFFECT OF INCLUSION OF MAIZE DRY DISTILLERS GRAIN WITH SOLUBLES (DDGS) IN CONCENTRATE MIXTURE ON HAEMTO-BIOCHEMICAL PARAMETERS OF GROWING LAMBS

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ABSTRACT

An experimental study was conducted for 90 days on twenty-four growing lambs with uniform body weight and a similar sex ratio. The lambs were randomly divided into four experimental groups, viz. T_0, T_1, T_2 and T_3, with six lambs. All lambs were stall-fed with dry and green fodder along with a concentrate mixture formulated as per ICAR (2013). The control group (T_0) was offered a concentrate mixture containing common and conventional ingredients. In the experimental groups, DDGS (Dried Distillers Grains with Solubles) was included in the concentrate mixture at levels of 5% (T_1), 10% (T_2) and 15% (T_3). The overall mean values of Hb (g/dl), PCV (%) and TLC ($\times 10^3/\mu l$) were 9.77±0.59, 9.65±0.28, 9.63±0.26 and 9.61±0.26 g/dl; 28.55±0.85, 28.98±0.84, 28.91±0.78 and 28.83±0.78% and 5.22±0.13, 5.21±0.09, 5.32±0.21 and 5.27±0.11, respectively, in groups T_0, T_1, T_2 and T_3. The mean values of glucose, total protein, albumin, globulin and BUN were 51.82, 51.88, 52.00 and 51.91 mg/dl; 6.95, 6.90, 6.89 and 6.95 g/dl; 4.17, 4.16, 4.18 and 4.13 g/dl; 2.77, 2.73, 2.71 and 2.81 g/dl; and 16.84, 16.83, 16.85 and 16.90 mg/dl, respectively, in groups T_0, T_1, T_2 and T_3. All the hematological and biochemical parameters were found to be non-significant ($p>0.05$) among the treatment groups as compared to the control. It was therefore concluded that the inclusion of DDGS up to 15% in the concentrate mixture of growing lambs can be beneficial and does not exert any adverse effect on their hematological and blood-biochemical parameters.

Keywords: Blood Parameters, Concentrate mixture, DDGS, Lambs

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Livestock farming plays a key role in rural food security, women empowerment and youth and contributing to comprehensive socio-economic transformation of nation (Kekane, 2013). In India, sheep are mostly kept on common grazing pastures, wastelands, uncultivated lands, crop residue from cultivated crops, and tree lopping's. The sheep are mostly raised for their meat and wool. The scarcity and high prices of high-quality feeds in many underdeveloped nations severely restrict ruminant output. Furthermore, the cost of conventional feeds and fodder is high and also increasing day by day which leads to under-feeding of sheep's. In order to increase meat production, faster growth of sheep, it is necessary to provide adequate, balanced and also economical nutrition. Hence, to meet the daily nutritional requirement of ruminant animals like we need to look for newer, cheaper, locally available and nutrient rich feed sources like, dried distiller's grains with solubles (DDGS) and wet distillers grain with solubles (WDGS). Dried Distillers Grains with Solubles (DDGS) is remains after ethyl alcohol has been removed by distillation from the yeast fermentation of a grain or a grain mixture, using techniques common in the grain distilling industry. The by-products of the procedure used to produce ethanol are known as dry distiller's grains with solubles (DDGS). When starch is fermented to make ethanol, distillers grains become around three times more concentrated in crude fibre, crude protein, and crude fat; as a result, DDGS can take the place of protein sources in cow diets (Klopfenstein *et al.*, 2008). In the diet, the distillers grains containing solubles either dried or wet can be used as a source of protein (Sahin *et al.*, 2013). It is usually more cost-effective for producers to feed lambs WDGS or DDGS (Rao *et al.*, 2016). The DDGS are typically useful, affordable protein supply (Klopfenstein *et al.*, 2001; Pezzanite *et al.*, 2010). The DDGS can therefore be utilized as a source of protein in ruminant animals. There is, however, little research on DDGS derived from wheat and corn and its applicability as a component of ruminant feed, particularly for small ruminant animals. Therefore it was decided to carry this research trial with decided objectives.

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MATERIALS AND METHODS

Twenty-four (24) growing lambs aged 3-4 months, with uniform body weights (14.74, 14.76 and 14.76 kg) and a similar sex ratio (3 males: 3 females), were selected for a 90-day experimental study. The lambs were randomly allocated into four experimental groups, namely T_0, T_1, T_2 and T_3, with six lambs in each group. All animals were stall-fed with dry and green fodder along with a concentrate mixture formulated according to ICAR (2013) nutrient requirements. The concentrate mixture was prepared using locally available feed ingredients. The control group (T_0) received a concentrate mixture composed of common ingredients such as maize grain, jowar grain, groundnut cake and cottonseed cake. The

experimental groups were supplemented with DDGS at varying inclusion levels: 5% in T_1, 10% in T_2 and 15% in T_3.

Blood samples were collected from the experimental lambs at 0^{th}, 30^{th}, 60^{th} and 90^{th} day intervals. The haemato-biochemical analyses were conducted at the Central Instrumental Facility (CIF), Krantisinh Nana Patil College of Veterinary Science, Shirwal (Dist.-Satara, Maharashtra State). Haematological parameters such as haemoglobin (Hb), packed cell volume (PCV) and total leukocyte count (TLC) were estimated using a haemo-analyser (Model FALCON 260). The biochemical parameters analyzed included blood urea nitrogen (BUN), SGPT (ALT), SGOT (AST), serum albumin, and serum total protein. Statistical analysis was performed following the methods described by Snedecor and Cochran (1994). The data obtained from various response parameters were subjected to one-way ANOVA as per a completely randomized design (CRD) using SPSS Statistics software for Windows, version 2019.

RESULTS AND DISCUSSION

The overall mean haemoglobin (Hb) values for groups T_0, T_1, T_2 and T_3 were recorded as 9.77±0.59, 9.65±0.28, 9.63±0.26 and 9.61±0.26 g/dl, respectively, indicating that the inclusion of DDGS in the diet did not exert any adverse effect on haemoglobin levels. The Hb and PCV values observed were within the normal physiological range. The overall mean packed cell volume (PCV) values for groups T_0, T_1, T_2 and T_3 were 28.55±0.85, 28.98±0.84, 28.91±0.78 and 28.83±0.78, respectively. Similarly, the total leukocyte count (TLC) values for T_0, T_1, T_2 and T_3 were found to be 5.22±0.13, 5.21±0.09, 5.32±0.21 and 5.27±0.11, respectively.

The Hb, PCV and TLC values did not show any significant difference among the treatment groups and all values remained within the normal physiological range. The present findings are in agreement with the results of Felix *et al.* (2012) and Umesh Kumar Prajapat (2020), who reported no significant effect of the studied factors on haemoglobin, packed cell volume (PCV), and red blood cell count. The glucose values of the animals increased across all four groups, yet remained within the normal physiological range (Bhattacharya, 2011).

Table 1. Per cent Ingredient Composition of Concentrate Mixture

Ingredients	T_0	T_1	T_2	T_3
Maize	30	30	30	30
Jowar	10	10	10	11
Wheat bran	11	11	11	11
Groundnut cake	11	11	10	8
Cottonseed cake	20	15	13	12
DDGS	0	5	10	15
Tur chunni	17	17	15	12
Salt	0.5	0.5	0.5	0.5
Mineral+Vitamin mixture	0.5	0.5	0.5	0.5
Total	100	100	100	100

Table 2. Chemical composition of DDGS.

Sr. No.	Nutrient	DDGS
1.	Dry Matter (%)	89.18
2.	Organic Matter (%)	90.95
3.	Crude Protein (%)	29.32
4.	Ether Extract (%)	8.54
5.	Crude Fibre (%)	6.58
6.	Nitrogen Free Extract (%)	46.52
7.	Total Ash (%)	9.05

Average proximate composition on Dry Matter Basis (DMB)

The overall mean glucose values were recorded as 51.82±0.29, 51.88±0.35, 52.00±0.42 and 51.91±0.16 mg/dl in groups T_0, T_1, T_2 and T_3, respectively. These results indicate that glucose levels were numerically higher in the DDGS-fed groups; however, the differences were statistically non-significant, suggesting that varying levels of DDGS inclusion in the concentrate diet did not exert any adverse effect on blood glucose concentration.

The results of the present study are in agreement with the findings of Etman *et al.* (2014). However, they differ from those of Omer H. and Soha Abdel-Magid (2015), who reported a significant decrease in glucose values in the treatment group compared to the control group. The average serum total protein values of the

Table 3. Chemical Composition of Green Paragrass and Jowar Straw and Concentrate Mixture

Sr.No.	Nutrient	Green Paragrass	Jowar Straw	T_0	T_1	T_2	T_3
1.	Dry Matter (%)	23.95	91.78	92.81	92.76	92.65	92.53
2.	Organic Matter (%)	93.39	93.51	93.87	93.68	93.57	93.73
3.	Crude Protein (%)	5.3	3.67	17.92	18.17	18.11	18.24
4.	Ether Extract (%)	1.45	1.36	4.46	4.38	4.54	4.41
5.	Crude Fibre (%)	21.22	29.13	12.82	12.11	12.61	12.64
6.	N.F.E.	65.42	59.35	58.67	59.02	58.31	58.44
7.	Total Ash (%)	6.61	6.49	6.13	6.32	6.43	6.27

Average proximate composition on Dry Matter Basis (DMB)

Table 4. Details of effect of DDGS on Haematological parameters of Sheep

Days	Treatment				P Value
	T_0	T_1	T_2	T_3	
Hemoglobin (g/dl)					
0	9.25±0.14	9.46±0.08	9.15±0.18	9.33±0.16	NS
30	9.26±0.11	9.31±0.04	9.55±0.10	9.40±0.12	NS
60	9.18±0.12	9.36±0.06	9.46±0.12	9.31±0.04	NS
90	10.36±0.09	10.50±0.15	10.38±0.08	10.40±0.05	NS
Mean±SE	9.77±0.59	9.65±0.28	9.63±0.26	9.61±0.26	NS
Packed Cell Volume (%)					
0	27.75±0.42	28.40±0.26	27.45±0.55	28.00±0.48	NS
30	27.80±0.33	27.95±0.14	28.65±0.31	28.20±0.37	NS
60	27.55±0.38	28.10±0.20	28.40±0.36	27.95±0.14	NS
90	31.10±0.29	31.50±0.47	31.15±0.26	31.20±0.15	NS
Mean±SE	28.55±0.85	28.98±0.84	28.91±0.78	28.83±0.78	NS
Total Leucocyte Count ($\times 10^3$/µl)					
0	4.96±0.11	5.13±0.13	5.11±0.09	5.10±0.09	NS
30	5.13±0.12	5.00±0.21	4.85±0.16	5.04±0.21	NS
60	5.21±0.14	5.37±0.07	5.51±0.07	5.45±0.06	NS
90	5.60±0.14	5.37±0.27	5.84±0.11	5.49±0.07	NS
Mean±SE	5.22±0.13	5.21±0.09	5.32±0.21	5.27±0.11	NS

Table 5. Details of effect of Lemongrass oil on Blood Biochemical parameters of Lambs

Days	Treatment				P Value
	T_0	T_1	T_2	T_3	
Average blood Glucose (mg/dl)					
0	50.95±0.20	50.88±0.05	50.73±0.13	50.84±0.07	NS
30	52.02±0.12	51.94±0.10	52.5±0.21	52.16±0.24	NS
60	52.02±0.10	52.22±0.12	52.27±0.07	52.28±0.12	NS
90	52.30±0.10	52.48±0.16	52.53±0.10	52.57±0.14	NS
Mean±SE	51.82±0.29	51.88±0.35	52.00±0.42	51.91±0.16	NS
Total Protein (g/dl)					
0	6.69±0.05	6.67±0.03	6.67±0.01	6.74±0.04	NS
30	6.80±0.008	6.73±0.07	6.81±0.04	6.83±0.09	NS
60	7.04±0.02	6.97±0.03	6.98±0.06	7.04±0.002	NS
90	7.28±0.03	7.25±0.04	7.13±0.06	7.19±0.03	NS
Mean±SE	6.95±0.13	6.90±0.13	6.89±0.10	6.95±0.10	NS
Average Serum Albumin (g/dl)					
0	3.99±0.02	4.09±0.06	4.12±0.06	3.85±0.04	NS
30	4.23±0.008	4.20±0.03	4.22±0.03	4.22±0.06	NS
60	4.23±0.06	4.17±0.06	4.19±0.01	4.12±0.002	NS
90	4.26±0.04	4.21±0.003	4.19±0.02	4.23±0.05	NS
Mean±SE	4.17±0.06	4.16±0.02	4.18±0.02	4.13±0.06	NS
Average Serum Globulin (g/dl)					
0	2.70 ±0.07	2.57 ±0.07	2.54 ±0.07	2.78 ±0.07	NS
30	2.56 ±0.01	2.53 ±0.09	2.59 ±0.05	2.61 ±0.124	NS
60	2.81 ±0.05	2.80 ±0.06	2.78 ±0.06	2.92 ±0.02	NS
90	3.02±0.14	3.03±0.11	2.93±0.15	2.96±0.15	NS
Mean±SE	2.77±0.09	2.73±0.11	2.71±0.08	2.81±0.07	NS
Blood Urea Nitrogen (mg/dl)					
0	16.83±0.02	16.81±0.03	16.81±0.04	16.91±0.03	NS
30	16.90±0.03	16.89±0.03	16.91±0.01	16.93±0.03	NS
60	16.74±0.02	16.73±0.04	16.77±0.02	16.78±0.07	NS
90	16.90±0.04	16.90±0.04	16.92±0.01	16.98±0.01	NS
Mean±SE	16.84±0.03	16.83±0.03	16.85±0.03	16.90±0.04	NS

experimental groups T_0, T_1, T_2 and T_3 were recorded as 6.95±0.13, 6.90±0.13, 6.89±0.10 and 6.95±0.10 g/dl, respectively. The data on serum total protein revealed no significant differences among the treatment groups. These findings are consistent with the reports of Omer *et al.* (2015) and Ahn *et al.* (2016). However, Etman *et al.* (2014) observed that serum total protein levels increased with higher DDGS inclusion in the rations of animals.

The average serum albumin values of lambs in groups T_0, T_1, T_2 and T_3 were 4.17±0.06, 4.16±0.02, 4.18±0.02 and 4.13±0.06 g/dl, respectively. Statistical analysis showed that serum albumin values were within the normal physiological range, with no significant differences among the treatment groups. These findings are in line with those reported by Omer *et al.* (2015). However, Ahn *et al.* (2016) reported lower serum albumin concentrations in steers fed rations containing WDGS, which contrasts with the present findings.

The average serum globulin values for groups T_0, T_1, T_2 and T_3 were found to be non-significant across all treatment groups. The globulin values were within the normal physiological range (Bhattacharya, 2011). The overall mean globulin concentrations were 2.77±0.09, 2.73±0.11, 2.71±0.08 and 2.81±0.07 g/dl for groups T_0, T_1, T_2 and T_3, respectively, indicating that varying inclusion levels of DDGS in the concentrate diet did not have any adverse effect on globulin levels. These findings are in agreement with those of Ahn *et al.* (2016). However, they contradict the observations of Omer *et al.* (2015), who reported significantly decreased serum globulin levels in calves fed concentrate mixtures containing DDGS at 0%, 5%, and 10%.

The average serum blood urea nitrogen (BUN) values of lambs in groups T_0, T_1, T_2 and T_3 were recorded as 16.84±0.03, 16.83±0.03, 16.85±0.03 and 16.90±0.04 mg/dl, respectively.

The data pertaining to serum BUN values of growing lambs were statistically analyzed and found to be well within the normal physiological range, with no significant differences observed among the treatment groups T_0, T_1, T_2 and T_3. The present findings are in agreement with those of Ahn *et al.* (2016) who reported normal BUN concentrations in steers fed concentrate mixtures containing WDG at 28% inclusion level in the feed.

CONCLUSION

It can be concluded that the inclusion of DDGS in the concentrate mixture for sheep is beneficial and does not exert any adverse effects on the hematological and blood-biochemical parameters of growing lambs. Therefore, the findings support the use of DDGS as an economical and sustainable feed ingredient for lambs, offering a viable alternative that maintains animal health, metabolic efficiency and organ integrity.

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