



Feeding Dried Distillers Grain in Goats

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Effect of Feeding Rice Dried Distillers Grain with Solubles (rDDGS) on the Growth Performance in Barbari Goats

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ABSTRACT

Rice dried distillers grain with solubles is an economical protein, energy substitute and easily available and also reduce the negative impact on environment. Present study was conducted to determine the effect of feeding varying levels of rice dried distiller grains (rDDGS) on growth performance, FCR and BCS of Barbari goats. Twenty-four Barbari goats of 1-2 year age were randomly allocated into 4 groups on average body weight basis (Control, T1, T2, and T3) having 6 animals in each group. Barbari goats fed with basal diet comprises wheat straw (particle size- 1.5 to 2.0 cm), chaffed green maize fodder and compounded concentrate mixture at a ratio of 20:30:50. Concentrate mixture was prepared by mixing barley grain, wheat grain, oat grain, wheat bran, gram chunni, mustard oil cake and mineral mixture in 20, 20, 10, 10, 10, 28 and 2 parts, respectively Control group of animals were fed with basal diet, Whereas, T1, T2 and T3 groups of animals were fed with basal diet supplemented with of 10%, 20% and 30% of rDDGS on dry matter basis, respectively for the period of 90 days. All the Barbari goats were weight fortnightly. Among the groups dietary rDDGS supplementation did not affect body weight, but fortnightly body weight gain, average daily gain, dry matter intake (kg)/100kg BW and body condition score affect significantly ($P>0.05$) in all the groups. In T2 group fortnightly body weight, ADG and BCS significantly highest than other groups. It may be concluded that, supplementation of rDDGS significantly affect body weight gain, average daily gain, dry matter intake and body condition score therefore inclusion level of 20% Rice dried distillers grain with solubles on DM basis replaced in ration of Barbari goats improved growth performance without any adverse effect.

KEYWORDS: Barbari goat, Body weight, Growth, rDDGS

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INTRODUCTION

Goat husbandry provides glimpses of future hope for employment generation, nutritional security and prosperity to the millions of small and marginal farmers in the country. As per the 20th livestock census goat population in the country in 2019 is 148.88 Million showing an increase of 10.1% over the previous census. At present, the country faces a net deficit of 35.6% green fodder, 10.95% dry crop residues and 44% concentrate feed ingredients (IGFRI, 2013). High cost and less supply of conventional animal feed ingredients and for achieving high productive potential, which requires specific feeding having higher nutrient requirements. (Novais et al., 2015; Souza et al., 2016). Use of

unconventional feed resources in place of conventional feed can reduce the cost of production. Rice Distillers Dried Grains with Solubles (rDDGS) is a byproduct of the processing of alcohol industry which is produced from the distillation of fermented rice (at 131°C and 2.6 kg/ m² pressure and yeast added to the cooked rice for fermentation) (Huang et al., 1999). It contains 30- 47% protein (NRC, 1989) and around 3500 kcal/ kg ME and does not contain any antinutritional factor, like trypsin inhibitors in soybean. Scientific studies regarding the effect of inclusion different concentration levels of corn DDGS in goat ration was mostly available. But the studies on rice DDGS was very few in small ruminant species and nil in case of Indian goat breeds.

Therefore, the present investigation was carried out to study the effect of feeding different levels of rDDGS on growth performance of Barbari goats.

MATERIALS AND METHODS

All of the procedures carried out and animal welfare were reviewed and approved by the Institutional Animal Ethics Committee of the, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India (IAEC/SVPUAT/2022/80). This experiment was conducted at Livestock Farm Complex II, Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut-250110 (U.P.). Total 24 female Barbari goats of similar age group (1-2 years) were divided randomly into 4 groups where 1st group was treated as control, and 2nd, 3rd and 4th groups were taken as treatment groups. Average body weight of animals were 14.90 kg, 14.92 kg, 14.90 kg and 14.92 kg in control, T1, T2 and T3, respectively. The nutrient requirement of Barbari goats was met by feeding concentrate mixture, wheat straw and available fodder as per NRC standards. Animals in control group fed with roughage based basal diet i.e., wheat straw (particle size- 1.5 to 2.0 cm), chaffed green

maize fodder and compounded concentrate mixture at a ratio of 20:30:50. Concentrate mixture was prepared by mixing (barley grain, wheat grain, oat grain, wheat bran, gram chunni, mustard oil cake and mineral mixture in 20, 20, 10, 10, 10, 28 and 2 parts) respectively. Animal in T1, T2 and T3 groups of animals were fed with basal diet supplemented with different percentage of rDDGS offered (as in TMR) @ 10%, 20% and 30% of dry matter, respectively at the time of feeding of individual animal. Samples of concentrate ingredients, wheat straw, green fodder, residues and faeces were ground and analyzed for dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF) and total ash (AOAC, 2000). Fibre fraction of feed and fodder were analysed by using detergent method of fibre estimation (Van Soest et al., 1991). The chemical composition of experimental diet and dietary components (on dry matter basis) were presented in Table 1. They were kept in pens equipped with automatic waters and feeders where they were free to move around. A routine vaccination and anthelmintic schedule for all animals on trial was followed by farm management.

Table 1. Chemical composition (%DM basis) of dietary feed ingredients fed to Barbari goats

Items	Wheat straw	Maize fodder	Concentrate	Rice dried distiller grains
Dry matter	90.4±0.25	22.7± 1.24	87.1±1.25	91.2±0.47
Organic matter	86.5±0.50	88.1±0.77	91.6±0.30	95.0±0.28
Total ash	14.5±0.50	11.7±0.77	8.41±0.30	4.98±0.28
Crude protein	3.07±0.13	9.43±0.79	21.0±0.82	30.9±2.02
Ether extract	0.57±0.07	3.39±0.20	3.59±0.32	8.72±3.22
Crude fibre	37.2±1.18	24.6±0.78	8.19±1.34	7.05±0.35
Nitrogen free extract	45.1±0.02	52.1±2.54	58.0±1.13	48.2±1.83
Neutral detergent fibre	85.5±2.50	61.0±1.00	35.5±0.50	34.0±0.52
Acid detergent fibre	53.7±0.79	49.5±1.50	14.0±1.00	13.2±0.95
Hemicellulose	31.7±3.29	9.50±0.50	21.5±1.50	20.7±0.42
Acid detergent lignin	3.85±0.15	2.40±0.20	1.35±0.05	1.95±0.04
Cellulose	49.0±0.64	47.1±1.30	13.6±0.95	11.4±0.48

Statistical Analysis

The experimental data were subjected to analysis by completely randomized design with the simple analysis of variance technique (Snedecor and Cochran, 1994) using Statistical Package for the Social Sciences (SPSS, 2011). Homogenous subsets have been separated by using Duncan's multiple range test described by (Duncan, 1955). Differences among treatments were considered to as significant when $P < 0.05$.

RESULTS AND DISCUSSION

Body weight and Metabolic body weight

The results of the growth performance in terms of body weight and metabolic body weight were given in Table 2. It revealed that supplementation of rDDGS at different levels did not affect ($P > 0.05$) the Body weight and Metabolic body weight of Barbari goats. The initial body weight (kg) of Barbari goats in group Control, T1, T2 and T3 was 14.9, 14.9, 14.9 and 14.9, respectively. The respective final body weight (kg) of Barbari goats after 90 days of feeding trial was 18.6, 19.9, 20.1 and 19.3. No significant effect of inclusion level of rDDGS on change in body weight was found during different fortnights. The results are conformity with the findings (Rao 2016; Huls et al., 2006) who concluded that DDGS can be included in the ration without any negative effect on lamb performance. Similarly, Zelinsky et al. (2006) and McEachern et al. (2009) observed no significant differences in performance when DDGS was included in finishing lamb ration. Mckeown et al. (2010) also reported that DDGS from corn, wheat or triticale could replace a mixture of barley grain and canola meal at 20% of dry matter without adversely affecting the growth rate in lambs. Similarly, Felix et al. (2012) reported that inclusion of DDGS at 20% level in diet dry matter was optimal. Initially metabolic body weights (kg $W^{0.75}$) of Barbari goats were 7.52, 7.52, 7.57 and 7.58 kg in control, T1, T2 and T3 groups, respectively. Final metabolic body weights of respective groups were 8.93, 9.38, 9.50 and 9.20 kg, respectively. The average values of all the fortnights were not significantly affected by feeding different levels of rDDGS in Barbari goats.

Table 2. Effect of feeding rice DDGS on Body weight (kg) and Metabolic body weight (kg $W^{0.75}$) in Barbari goats

Days	Body weight				SEM	P Value	Metabolic body weight				SEM	P Value
	Treatment						Treatment					
	Control	T1	T2	T3			Control	T1	T2	T3		
0	14.9	14.9	14.9	14.9	1.58	1.00	7.52	7.52	7.57	7.58	0.60	1.00
15	15.5	15.5	15.7	15.5	1.56	1.00	7.75	7.77	7.89	7.81	0.59	1.00
30	16.1	16.4	16.5	16.1	1.55	1.00	7.99	8.10	8.20	8.05	0.58	1.00
45	16.7	17.3	17.4	16.9	1.59	0.99	8.23	8.45	8.54	8.34	0.59	0.98
60	17.4	18.2	18.3	17.7	1.60	0.97	8.49	8.78	8.87	8.63	0.58	0.97
75	18.0	19.0	19.0	18.4	1.57	0.96	8.71	9.10	9.12	8.90	0.57	0.96
90	18.6	19.9	20.1	19.3	1.55	0.91	8.93	9.38	9.50	9.20	0.55	0.90
Average	16.7	17.37	17.4	17.0	1.57	0.99	8.23	8.45	8.57	8.36	0.58	0.99

Control - Basal Diet, T1 - Basal diet replaced with 10% rDDGS on DM basis, T2 - Basal diet replaced with 20% rDDGS on DM basis, T3 - Basal diet replaced with 30% rDDGS on DM basis

Dry matter intake

The results of effect of feeding rice DDGS on dry matter intake (kg/d) and dry matter intake (kg)/100kg BW of Barbari goats were given in Table 3. Dry matter intake (kg/d) due to inclusion of varying levels of rDDGS did not vary significantly from 0–90 days of study, though the intake in Barbari goats was high in T2 groups having 20% rDDGS. The result agrees with the findings of Buckner et al. (2007) and Vanemon et al. (2008) who reported no effect of increasing levels of DDGS on dry matter intake in finishing steers. No significant effect reported by Gurung et al. (2009) fed rDDGS upto 31% to growing goats without any compromise in DM intake. Similarly, Mckeown et al. (2010) observed that DDGS from corn, wheat or triticale could replace a mixture of barley grain and canola meal at 20% of diet DM without altering DMI. Felix et al. (2012) fed diets to growing lambs containing 0, 20, 40, or 60% rDDGS results higher dietary inclusion rates without affecting dry matter intake. In present study, the Dry matter intake (kg)/100kg BW increased significantly in T2 groups fed diet with having 20% rDDGS which corroborated with the results of Kleinschmit et al. (2006) and Anderson et al. (2006) study effect in dairy goats feeding 10% or 20% dried or wet distiller’s grains with soluble in 25% corn silage, 25% alfalfa hay and 50% of concentrate mixes to improved feed efficiency and energy-corrected milk/kg of DMI.

Table 3. Effect of feeding rice DDGS on Dry matter intake (kg/d) and Dry matter intake (kg)/100kg BW in Barbari goats

Days	Dry matter intake (kg/d)						Dry matter intake (kg)/100kg BW					
	Treatment			SEM	P Value	Treatment			SEM	P Value		
	Control	T1	T2			T1	T2	T3				
0	0.35	0.37	0.37	0.32	0.04	0.72	2.35 ^b	2.47 ^{bc}	2.51 ^c	2.13 ^a	0.03	0.00
15	0.42	0.42	0.43	0.36	0.04	0.64	2.66 ^b	2.70 ^b	2.73 ^b	2.30 ^a	0.02	0.00
30	0.43	0.47	0.48	0.43	0.05	0.81	2.58 ^a	2.84 ^{ab}	2.94 ^b	2.66 ^{ab}	0.07	0.01
45	0.44	0.49	0.50	0.45	0.05	0.79	2.59 ^a	2.79 ^{ab}	2.90 ^b	2.64 ^{ab}	0.07	0.02
60	0.49	0.54	0.56	0.50	0.05	0.71	2.76 ^a	2.95 ^{ab}	3.06 ^b	2.80 ^a	0.06	0.00
75	0.51	0.57	0.59	0.52	0.05	0.64	2.80 ^a	3.00 ^{ab}	3.09 ^b	2.84 ^a	0.05	0.00
90	0.54	0.60	0.63	0.56	0.05	0.54	2.86 ^a	3.03 ^{ab}	3.14 ^b	2.90 ^a	0.05	0.00
Average	0.47	0.52	0.53	0.47	0.05	0.73	2.65 ^{ab}	2.82 ^{bc}	2.91 ^c	2.61 ^a	0.04	0.00

Control –Basal Diet, T1 - Basal diet replaced with 10% rDDGS on DM basis, T2 - Basal diet replaced with 20% rDDGS on DM basis, T3 - Basal diet replaced with 30% rDDGS on DM basis. Means bearing different super script in a row differ significantly (P<0.05).

Body weight gain and Average daily gain

The results of fortnightly body weight gain and average daily gain (g) in Barbari goats were given in Table 4. Fortnightly body weight gain (kg) ranged from 0.60 to 1.06 kg. At first, second and sixth fortnight, showed significant increase in body weight gain as compared to control. The overall gain was found significantly higher ($P < 0.05$) in T1, T2 groups than control and T3. Similar findings reported by Buckner et al (2007) reported animals fed 20% DDGS washighest as compared to other levels of DDGS. Depenbusch et al. (2009) reported daily BW gain and final BW responded quadratically ($P < 0.03$) with increasing levels of DDGS, with maximum response at 15% DDGS. Gutierrez et al. (2009) documented similar report in Suffolk lambs body weight gain was reduced when lambs were fed 30% RDGS diet (0.221 kg/d) compared with feeding the 0 and 15% RDGS diets (0.284 and 0.285 kg/d, respectively). Average daily gain at second, fourth and sixth fortnight T2 group showed significantly increase for the group having 20% rDDGS (T2) and decrease significantly in T3 group supplemented with 30% rDDGS. Overall Average daily gain (g) were varies significantly between the groups and found higher ($P < 0.05$) in T2 group. Similar report documented by Shwerab et al. (2010) reported high ADG in breeding ewes on inclusion of 20% DDGS in the ration. Yossifov et al. (2012) in lambs reported significant effect observed in ADG during increased inclusion level.

Table 4. Effect of feeding rice DDGS on fortnightly Body weight gain and Average daily gain (g) in Barbari goats

Days	Body weight gain				Average daily gain				SEM	P Value
	Treatment				Treatment					
	Control	T1	T2	T3	Control	T1	T2	T3		
15	0.60 ^a	0.65 ^{ab}	0.82 ^b	0.63 ^{ab}	40.0 ^a	43.1 ^{ab}	54.6 ^b	41.7 ^{ab}	3.35	0.02
30	0.63 ^a	0.86 ^c	0.83 ^{bc}	0.64 ^{ab}	42.3 ^a	57.6 ^c	55.4 ^{bc}	42.7 ^{ab}	3.22	<0.01
45	0.62	0.94	0.92	0.78	41.6	63.0	61.2	52.2	6.55	0.12
60	0.68	0.89	0.91	0.76	45.4	59.6	60.7	51.0	6.18	0.27
75	0.62	0.80	0.70	0.74	41.2	53.1	46.4	49.3	4.52	0.32
90	0.60 ^a	0.85 ^{ab}	1.06 ^b	0.85 ^{ab}	40.1 ^a	57.0 ^{ab}	70.5 ^b	56.6 ^{ab}	5.84	0.01
Average	3.76 ^a	5.00 ^{bc}	5.24 ^c	4.41 ^{ab}	41.8 ^a	56.0 ^{bc}	58.1 ^c	48.9 ^{ab}	2.00	<0.01

Control –Basal Diet, T1 - Basal diet replaced with 10% rDDGS on DM basis, T2 - Basal diet replaced with 20% rDDGS on DM basis, T3 - Basal diet replaced with 30% rDDGS on DM basis. Means bearing different superscript in a row differ significantly ($P < 0.05$)

FCR and BCS

The results of effect of feeding rice DDGS on feed conversion ratio (FCR) and body condition score (BCS) of Barbari goats were given in Table 5. The FCR (kg feed consumed / kg weight gain) value ranged from 8.25 to 14.33 during different fortnights. No significant effect of rDDGS inclusion on feed conversion ratio was reported among the groups, though it was better in Barbari goats supplemented with 10% rDDGS (T1) and 20% rDDGS (T2). The findings corroborate with report of Huls et al. (2006), Schauer et al. (2008), Avila Stagno et al. (2013) and Rao (2016) also reported that partial replacement of SBM and portion of corn with DDGS has no effect on feed to gain ratio. Inclusion of different levels of rDDGS on BCS in Barbari goats was significant at 60 days and found highly significantly affected at 75 and 90 days. Body condition score ranges from 2.23 to 3.23. Amongst the groups BCS was high in Barbari goats supplemented with 20% rDDGS (T2) group.

Table 5. Effect of feeding rice DDGS on feed conversion ratio (FCR) and body condition score (BCS) in Barbari goats

Days	Feed conversion ratio				SEM	P Value	Body condition score				SEM	P Value
	Treatment						Treatment					
	Control	T1	T2	T3			Control	T1	T2	T3		
15	11.1	10.1	7.98	9.28	1.71	0.60	2.43	2.48	2.49	2.44	0.05	0.76
30	10.3	8.37	9.02	10.2	1.24	0.63	2.52	2.56	2.67	2.57	0.04	0.09
45	10.9	8.25	8.62	8.62	1.26	0.44	2.62	2.68	2.77	2.71	0.04	0.13
60	11.8	9.27	9.78	10.2	1.54	0.68	2.73 ^a	2.80 ^{ab}	2.90 ^b	2.82 ^{ab}	0.03	0.02
75	13.5	11.0	14.0	11.6	2.23	0.74	2.83 ^a	2.97 ^b	3.07 ^b	2.97 ^b	0.03	<0.01
90	14.3	11.0	9.53	10.1	1.66	0.21	2.97 ^a	3.18 ^b	3.23 ^b	3.17 ^b	0.03	<0.01
Average	12.0	9.72	9.83	10.0	1.36	0.59	2.64 ^a	2.75 ^{ab}	2.81 ^b	2.71 ^{ab}	0.03	0.01

Control –Basal Diet, T1 - Basal diet replaced with 10% rDDGS on DM basis, T2 - Basal diet replaced with 20% rDDGS on DM basis, T3 - Basal diet replaced with 30% rDDGS on DM basis. Means bearing different superscript in a row differ significantly (P<0.05)

CONCLUSIONS

It may be concluded that, supplementation of rDDGS significantly influence body weight gain, average daily gain, dry matter intake and body condition score therefore inclusion level of 20% Rice dried distillers grain with solubles on DM basis replaced in ration of Barbari goats improved growth performance without any adverse effect.

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