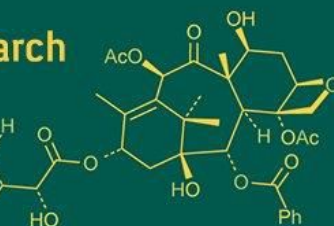
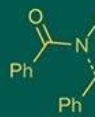


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Impact of dried distillers grains with solubles as a partial substitute for soybean meal on haematological indices in lactating Murrah buffaloes

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Abstract

The present study was conducted to evaluate the impact of dried distillers grains with solubles (DDGS) as a partial substitute for soybean meal on haematological indices, specifically haemoglobin (Hb) and packed cell volume (PCV), in lactating Murrah buffaloes. A total of twenty-one early lactating Murrah buffaloes (30±5 days in milk) were selected and randomly allocated into three dietary treatment groups, each comprising seven animals. The control group (T₀) was fed a conventional diet without DDGS, whereas in treatment groups T₁ and T₂, soybean meal was replaced with DDGS at 25% and 50%, respectively, in the concentrate mixture. The feeding trial was conducted for a period of 120 days under uniform management and feeding conditions. Blood samples were collected from all experimental animals on days 0, 60, and 120 of the trial prior to feeding. Haematological parameters, including haemoglobin concentration and packed cell volume, were analyzed using standard laboratory procedures. The results revealed that dietary inclusion of DDGS had no significant ($p>0.05$) effect on haemoglobin and PCV values across all treatment groups throughout the experimental period. Haemoglobin levels ranged from 9.51 to 9.95 g/dL, while PCV values varied between 37.05% and 37.57%, indicating that all values remained within the normal physiological range for lactating buffaloes. Although a slight numerical increase in Hb and PCV was observed in DDGS-supplemented groups over time, these differences were not statistically significant. The maintenance of stable haematological parameters suggests that partial replacement of soybean meal with DDGS did not adversely affect oxygen-carrying capacity or overall health status of the animals. In conclusion, DDGS can safely replace up to 50% of soybean meal in the diet of lactating Murrah buffaloes without any detrimental effects on haemoglobin and packed cell volume. Therefore, DDGS represents a viable, economical, and nutritionally sound alternative protein source for sustainable dairy production.

Keywords: DDGS, Murrah buffalo, haematology, deoiled soybean meal

1. Introduction

The livestock sector constitutes a vital component of the agricultural economy in India, contributing significantly to national income, employment, and nutritional security. In recent years, the sector has shown substantial growth with its 31% share in the gross value added (GVA) of agriculture increasing steadily (BAHS 2025) [2]. India possesses the largest livestock population in the world, including approximately 109.85 million buffaloes (20th livestock census). Buffalo contributes 43.15% to total national milk production (BAHS 2025) [2]. Among the recognized buffalo breeds, Murrah buffalo is regarded as one of the most productive dairy breeds due to its superior milk yield and adaptability to diverse environmental conditions.

Despite the rapid growth of the dairy industry, feed cost remains a major constraint, accounting for nearly 50-70% of total milk production expenses (Alqaisi *et al.*, 2014) [3]. The increasing demand and fluctuating supply of conventional feed ingredients particularly protein-rich sources such as deoiled soybean meal (DSBM), have further escalated production costs. Therefore, identifying alternative, cost-effective, and nutritionally efficient feed resources is essential for sustaining profitability in dairy farming systems.

Dried distillers grains with solubles (DDGS) is a co-product of the grain-based ethanol industry.

During ethanol production, the starch fraction of grains is fermented, leaving behind a nutrient-dense residue rich in crude protein, fat, fibre, and minerals. DDGS typically contains 27-35% crude protein, a significant proportion of which is rumen undegradable protein, making it particularly beneficial for lactating ruminants (Belyea *et al.*, 1989; Janicek *et al.*, 2008) [4, 10].

The utilization of DDGS in dairy diets has been associated with several advantages, including reduction in feed costs, improved feed intake, and enhanced nutrient availability. Moreover, the inclusion of DDGS has been reported to have no adverse effects on animal health, as reflected by stable haematological parameters (El-Shinnawy *et al.*, 2015; Dhami *et al.*, 2023) [7, 5]. Haematological indices serve as reliable indicators of the physiological, nutritional, and metabolic status of animals, and their evaluation is essential for assessing the safety and efficacy of alternative feed ingredients.

However, limited information is available regarding the effects of DDGS inclusion on the haematological profile of lactating Murrah buffaloes under Indian conditions. Therefore, the present study was undertaken to evaluate the impact of partial replacement of DSBM with DDGS on haematological parameters in lactating Murrah buffaloes.

2. Materials and Methods

2.1 Experimental Site and Animals

The experiment was conducted at the Livestock Production and Management Section, ICAR-IVRI, Izatnagar. Twenty-one early lactating Murrah buffaloes (30±5 days in milk) were selected and divided into three groups, each group containing 7 animals.

2.2 Feeding Management

The concentrate mixtures were formulated to be iso-nitrogenous and iso-caloric. DDGS replaced soybean meal

at 25% and 50% levels.

Table 1: Three dietary group

Groups	Treatments
T ₀	Green fodder and wheat straw-based diet + concentrate mixture as per dairy farm practices
T ₁	Green fodder and wheat straw-based diet + DDGS containing concentrate mixture (25 % replacement of Deoiled Soyabean Meal)
T ₂	Green fodder and wheat straw-based diet + DDGS containing concentrate mixture (50 % replacement of Deoiled Soyabean Meal)

Table 2: Chemical composition of DDGS and DSBM

Chemical composition	DDGS	DSBM
DM (%)	88.22	90.95
M (%)	11.78	9.05
CP (%)	37.62	49.55
CF (%)	6.01	4.27
EE (%)	10.34	0.56
NFE (%)	40.44	37.36
TA (%)	5.59	8.26
GE (Kcal/g)	5.71	4.28

Table 3: Composition of concentrate mixture containing different levels of DDGS

Feed ingredients (%)	Dietary treatments		
	Control	T ₁ (25%)	T ₂ (50%)
Maize	35	32	29
DSBM	17	12.75	8.5
DDGS	0	8.25	15.5
Wheat bran	45	44	44
Mineral mixture	2	2	2
Salt	1	1	1
TDN (%)	73.61	73.67	73.60
CP (%)	18.07	18.06	18.06

Table 4: Chemical composition of feeds offered (% DM basis) during lactation trial

Attributes	Concentrate			Green fodder (Napier)	Wheat straw
	Control	Treatment 1	Treatment 2		
DM (%)	87.23	87.73	87.33	25.40	92.52
M (%)	12.77	12.27	12.67	88.85	94.1
CP (%)	18.64	18.66	18.68	8.32	2.96
EE (%)	0.34	1.70	1.73	3.03	0.94
NDF (%)	17.30	16.95	17.26	52.52	72.71
ADF (%)	9.57	9.43	9.50	32.75	52.70
TA (%)	4.83	5.55	6.02	11.15	5.90
AIA (%)	0.32	0.72	0.78	5.60	4.25

2.5 Blood Sampling and Analysis

Blood samples were collected via jugular vein on days 0, 60, and 120 before feeding. Haematological parameters were determined using standard procedures.

2.6 Statistical Analysis

Data were analyzed using ANOVA (SPSS version 26) and differences among treatments were tested at $p < 0.05$ significance level

2.7 Ethical Approval

The experimental procedures involving animals were conducted in accordance with the guidelines of the Institutional Animal Ethics Committee (IAEC) and approved by the Committee for the Purpose of Control and

Supervision of Experiments on Animals (CPCSEA), Government of India. The study protocol was reviewed and approved by the IAEC of ICAR-Indian Veterinary Research Institute (IVRI), Izatnagar, ensuring that all animal handling and experimental procedures complied with standard ethical norms and welfare regulations.

3. Results

3.1 Hematological profile

Table 5 provides the mean hemoglobin (Hb) and packed cell volume (PCV) values for lactating Murrah buffaloes across different treatments. Hb levels ranged from 9.51±0.26 g/dL to 9.95±0.16 g/dL, with no significant differences ($p > 0.05$) observed due to dietary treatments or period-treatment interactions. However, Hb levels showed a tendency to

increase significantly at the 120th day compared to the baseline (day 0). Similarly, PCV values were consistent across dietary treatments, with ranges between $37.05 \pm 0.58\%$ and $37.57 \pm 0.50\%$, showing no significant variations ($p > 0.05$).

Table 5: Effect of DDGS on serum hematological parameters in lactating murrah buffaloes

Haemoglobin				
Days	Control	Treatment 1	Treatment 2	P value
0	9.53 ± 0.28	9.71 ± 0.30	9.68 ± 0.22	0.891
60	9.62 ± 0.33	9.82 ± 0.33	9.95 ± 0.16	0.969
120	9.51 ± 0.26	9.75 ± 0.21	9.85 ± 0.16	0.900
Overall	9.58 ± 0.16	9.76 ± 0.15	9.79 ± 0.10	0.874
PCV				
0	37.27 ± 0.63	37.20 ± 1.26	37.35 ± 0.49	0.992
60	37.05 ± 0.58	37.01 ± 1.19	37.08 ± 0.41	0.998
120	37.54 ± 0.55	37.50 ± 1.21	37.57 ± 0.50	0.996
Overall	37.29 ± 0.32	37.23 ± 0.67	37.33 ± 0.26	0.899

4. Discussion

The present study evaluated the effect of partial replacement of deoiled soybean meal (DSBM) with dried distillers grains with solubles (DDGS) on the haematological and biochemical profile of lactating Murrah buffaloes. The results clearly indicate that DDGS inclusion up to 50% did not exert any adverse effect on animal health, as reflected by stable blood parameters.

The haemoglobin (Hb) and packed cell volume (PCV) values remained unchanged across treatments, suggesting that oxygen-carrying capacity and overall physiological status of the animals were not compromised. These findings are in agreement with earlier reports, where DDGS supplementation did not significantly affect haematological parameters (Dhami *et al.*, 2023) [5]. Stable Hb and PCV levels are considered reliable indicators of adequate nutrient intake and good health status (Nworgu *et al.*, 2007) [11].

5. Conclusion

The present study demonstrated that dried distillers grains with solubles (DDGS) can effectively replace up to 50% of deoiled soybean meal in the diet of lactating Murrah buffaloes without any adverse effects on their haematological profiles. The stability of haemoglobin and packed cell volume indicates that DDGS inclusion did not impair the physiological or health status of the animals. Overall, DDGS emerges as a safe, nutritionally efficient alternative protein source in dairy buffalo feeding.

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