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# Effect of dietary supplementation of Rice dried distillers Grains (RDDGS) on blood profile in Nagavali Ram lambs

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**Abstract**
The investigation assessed how different levels of rice dried distiller grains (RDDGS) in the diet affect the serum-biochemical profile of Nagavali ram lambs over a 90-day period. Twenty-four lambs, aged 4 - 6 months and weighing 10 - 12 kg, were randomly assigned to 4 groups, each containing six animals. The control group received a standard diet consisting of super Napier green fodder and a concentrate mixture formulated according to lamb requirements. Treatment diets included RDDGS at levels of 0% ($T_1$), 50% ($T_2$), 75% ($T_3$), and 100% ($T_4$), replacing soybean meal while maintaining equal nitrogen content. Serum biochemical parameters were evaluated at the beginning (Day 0) and end (Day 90) of the study. Results revealed no significant differences ($p$>0.05) in serum biochemical parameters among the groups, indicating that incorporating RDDGS up to 100% in lamb diets did not adversely affect the health of Nagavali ram lambs. These findings suggest that RDDGS can be used as a substitute for soybean meal in lamb diets without detrimental effects.

**Keywords:** RDDGS, serum-biochemical profile, ram lambs

## Introduction
Sheep rearing in India has a long and significant history, deeply intertwined with the country's agricultural and economic landscape. The practice of sheep farming, or sheep rearing, involves the breeding and raising of sheep for various purposes, including meat, wool, and other by-products. India has a diverse range of sheep breeds, each adapted to specific climatic conditions and local requirements. Despite its significance, the sheep rearing industry in India faces challenges such as inadequate infrastructure, limited feed and fodder sources. Sheep farmers facing economic constraints may find it challenging to invest in supplemental feed and nutritional supplements during periods of scarcity. This can further exacerbate the impact of feed shortages on the health and productivity of the flock. To overcome this challenge we need an alternative feed resource which is cheaper and safe for use. Rice Distillers Dried Grains with Solubles (RDDGS) is a byproduct of the rice ethanol production process. RDDGS is a byproduct of industry that is created from the fermentation of rice (distilled at 2.6 and 131 °C) yeast added to the cooked rice and pressure applied at kg/m2 for throughout the alcoholic beverage manufacturing process. Accessing serum biochemical parameters in sheep fed with Rice DDGS is crucial for comprehensive nutritional assessment and health monitoring. These parameters offer valuable insights into the utilization of Rice DDGS, helping researchers understand its nutritional efficacy and whether it meets the sheep's dietary requirements. Additionally, monitoring changes in biochemical parameters enables early detection of potential health issues or metabolic disturbances associated with the diet, allowing for prompt intervention. Furthermore, evaluating serum biochemical parameters aids in assessing the performance and productivity of the animals, contributing to the refinement of diet formulations and feeding strategies to optimize benefits while ensuring animal health. Ultimately, this data assists farmers and producers in making informed decisions regarding the cost-effectiveness of incorporating Rice DDGS into sheep diets, thus promoting sustainable and efficient sheep farming practices. There are very less studies available on effect of RDDGS on sheep. Therefore, this study was conducted to evaluate the effect of RDDGS on serum biochemical parameters in ram lambs.

## Materials and Methods

### Location of the experiment

The experiment was carried out at small animal experimental shed of Livestock Research station, Garividi, Vizianagaram district, Andhra Pradesh.

### Experimental animals and duration

Twenty four ram lambs with average body weight and age of 10-12 kg and 4 - 6 months were used in the study. Prior consent (Project No.16/IAEC/NTRCVSC/2023) was obtained from CCSEA via the Institutional Animal Ethics Committee (IAEC) of Sri Venkateswara Veterinary University (SVVU) in order to carry out the study. The trial was began on July 15 and concluded on October 15 of the year 2023. (6 fortnights total).

### Experimental treatments and feeding

In completely randomized design ram lambs were divided based on body weights in four treatment groups with six animals each. The initial mean body weight in control, $T_1$, $T_2$, $T_3$ groups was 11.57kg,11.90kg, 11.73kg and 11.42 kg respectively. Animals were kept in individual pen with *ad libitum* provision of chopped Super Napier. Concentrate mixture was prepared by mixing maize, DORB, soybean cake, mineral mixture and salt. Individual ingredient composition of concentrate mixtures was presented in Table 1. Four different concentrate mixtures were prepared by replacing soybean meal with RDDGS at 0 in $T_1$, 50 in $T_2$, 75 in $T_3$ and 100% in $T_4$. The animals in $T_1$, $T_2$ and $T_3$ group were fed individually with basal diet supplemented with different percentage of RDDGS under standard management conditions for a period of 90 days. The animals were provided with fresh and clean water throughout the experimental duration. The chemical composition of concentrate mixture fed to ram lambs was given in table 2.

### Blood collection for serum biochemical analysis

Blood samples for serum biochemical analysis were collected from ram lambs at start and end of the experiment from jugular vein in sterilized tubes. Tubes were allowed to clot at room temperature and serum was separated by centrifugation. Serum samples were then stored at -20 ºC till analysis of various biochemical parameters *viz*. total protein (g/dL), albumin (g/dL), globulin (g/dL), serum glucose (mg/dL), triglycerides (mg/dL), cholesterol (mg/dL), urea (mg/dL), creatinine(mg/ dL) AST(IU/dl) and ALT(IU/dl). Serum analyses were conducted using diagnostic kits from M/s. ERBA Diagnostics Mannheim GmbH and M/s. Span Diagnostics Private Limited. Total proteins, albumin, glucose, triglycerides, cholesterol, and HDL-C were measured using established methods (Tietz, 1986, Trinder, 1969; Seidel et al., 1983) [16, 17, 11]. Blood urea nitrogen was assessed enzymatically (Talke and Schubert, 1965) [15], and creatinine levels were determined by Jeffe's method (Bowers, 1980) [2]. Enzyme analysis for SGOT/AST and SGPT/ALT followed the International Federation of Clinical Chemistry method (Bradley et al., 1972) [3]. The observed serum biochemical values were then compared with normal physiological values for sheep depicted in Clinical Biochemistry of Domestic Animals by Kaneko *et al*. (2000) [9].

### Statistical analysis

The experimental data was subjected to analysis by completely randomized design with the simple analysis of variance technique (Snedecor and Cochran 1994) [12] using Statistical Package for the Social Sciences (SPSS 2011) [13]. Homogenous subsets were separated by using Duncan's multiple range test described by (Duncan 1955) [7]. Differences among treatments were considered significant at $p<0.05$.

## Results and Discussion

### Hematological parameters

The findings indicated that there were no noteworthy ($p>0.05$) variations in blood profile between the control group and various dietary treatments enriched with varying levels of RDDGS, except for WBC (×103/µl), and lymphocytes (%). These specific parameters were observed to be significantly influenced by the supplementation of RDDGS in Nagavali ram lambs (Table 3). All the blood parameters studied were well within the normal physiological range. Due to main effect of treatment, i.e. incorporation of RDDGS in ram lamb ration, the mean values of WBC (×103/µl) and lymphocytes (%) were found to be 6.27, 55.75; 6.32 and 55.67; 6.79 and 56.29; 7.05 and 57.81, in Control, $T_1$, $T_2$ and $T_3$ groups, respectively. The current research aligns with Konia's (2016) [18] discoveries, as they similarly noted the absence of a substantial impact on hemoglobin (Hb), packed cell volume (PCV), and total erythrocyte count (TEC) when incorporating DDGS into piglet ration. Yadav (2023) similarly found that, apart from significant impacts on WBC (×103/µl), neutrophil (%), and lymphocytes (%) resulting from RDDGS supplementation in Barbari goat diet, no other notable differences ($p>0.05$) were detected in the blood profile between the control group and diverse dietary treatments featuring varying levels of RDDGS.

### Serum biochemical profile

Serum biochemical profile of ram lambs was presented in Table No. 4 shows no significant ($p>0.05$) difference among the treatments were observed for all serum parameters. All values are within the reference range as depicted in Clinical Biochemistry of Domestic Animals by Kaneko *et al.* (2000) [9]. The total protein, albumin and globulin were no affected ($p>0.05$) by the inclusion of RDDGS among all the treatments. In agreement with this, Abudabos *et al.* (2021) [1] reported that the inclusion of graded levels of DDGS had no impact ($p>0.05$) on serum parameters such as total protein, albumin, and globulin in Najdi lambs. Similarly, Obeidat *et al.* (2018) [10] observed that replacing SBM with corn DDGS had no effect ($p>0.05$) on serum total protein, albumin, and globulin parameters in Awassi lambs. Wafaa and Mahmoud (2016) [18] found that incorporating DDGS into the diets of Barki Lambs had no significant ($p>0.05$) effect on total protein, albumin, and globulin compared to the control diets. Gabr *et al.* (2010) [8] also reported that inclusion of DDGS lamb diets up to a 20% level had no effect ($p\geq0.05$) on serum total protein, albumin, globulin, and A:G ratio. In contrast, Revealed that the serum total protein increased in the sheep fed ration supplemented with the increasing level of DDGS but difference was not statistically significant ($p>0.05$).

In the present study, the inclusion of RDDGS at 50%, 75%, and 100% levels, replacing conventional soybean meal in the concentrate mixture, showed no significant effect ($p$>0.05) on serum ALT (U/L) and AST (U/L) compared to the control. In line with this, Obeidat *et al.* (2018) [10] in Awassi lambs, Steppa *et al.* (2017) [14] in lactating ewes and Waffa and Mahmoud in Barki lambs reported that incorporation of DDGS had no effect ($p$>0.05) on ALT and AST activity. Dey *et al.* (2020) [5] observed no effect ($p$>0.05) on ALT and AST activity when RDDGS was fed to Jersey cross-bred calves in the concentrate mixture. In contrast, Gabr *et al.* (2010) [8] reported that incorporating DDGS at 15% and 20% in lamb fattening diets increased ALT activity ($p$<0.05).

Inclusion of RDDGS had no effect ($p$>0.05) on serum glucose, triglycerides and total cholesterol, HDL-C, LDL-C VLDL-C value. In line with present findings, Abudabos *et al.* (2021) [1] reported that the inclusion of graded levels of DDGS up to 50% had no impact ($p$>0.05) on the concentrations of glucose and triglycerides in ram lambs. Obeidat *et al.* (2018) [10] found that the partial replacement of SBM and barley grain with corn DDGS had no effect ($p$>0.05) on glucose concentration in ram lambs. Gabr *et al.* (2010) [8] reported that incorporating DDGS had no effect ($p$≥0.05) on serum glucose, triglycerides, and total cholesterol content in lambs. Dhami *et al.* (2023) [6] reported that inclusion of DDGS and sorghum roughage in crossbred heifers had no effect ($p$>0.05) on cholesterol content.

The inclusion of RDDGS up to 100% replacement had decreased urea concentration numerically across the treatments and increased the creatinine concentration but difference was not statistically significant ($p$>0.05). In line with this, Abudabos *et al.* (2021) [1] reported that the inclusion of graded levels of DDGS up to 50% had no effect ($p$>0.05) on urea content in male lambs. Similarly, Obeidat *et al.* (2018) [10] found that the partial replacement of SBM and barley grain with CDDGS had no effect ($p$>0.05) on urea content in lambs. Steppa *et al.* (2017) [14] reported that incorporating DDGS had no effect ($p$>0.05) on creatinine and urea content in lambs. Dey *et al.* (2020) [5] in Jersey cross-bred calves and Chandrika *et al.* (2021) [14] in buffalo calves reported that the inclusion of DDGS had no effect ($p$>0.05) on urea and creatinine content. In contrast, Waffa and Mahmoud (2016) [18] reported that significant ($p$<0.05) increase in blood urea nitrogen level at 40 and 50% level of DDGS supplementation in Barki lambs may be due to increased protein intake.

**Table 1:** Ingredient composition of concentrate mixtures (parts/100 parts)

| Feed Ingredients | $T_1$ | $T_2$ | $T_3$ | $T_4$ |
|---|---|---|---|---|
| Maize | 31 | 34 | 35 | 31 |
| DORB | 36 | 33 | 32 | 36 |
| Soybean meal | 30 | 15 | 7.5 | 0 |
| Rice DDGS | 0 | 15 | 22.5 | 30 |
| Mineral mixture | 2 | 2 | 2 | 2 |
| Salt | 1 | 1 | 1 | 1 |
| Total | 100 | 100 | 100 | 100 |

**Table 2:** Chemical composition of concentrate mixture

| Nutrient | CM-1 | CM-2 | CM-3 | CM-4 |
|---|---|---|---|---|
| Dry matter | 91.34 | 91.30 | 91.32 | 91.33 |
| Organic matter | 90.67 | 91.15 | 90.57 | 91.28 |
| Crude protein | 20.05 | 20.07 | 20.07 | 20.08 |
| Ether extract | 2.96 | 2.78 | 3.43 | 3.84 |
| Crude fibre | 14.76 | 15.17 | 12.84 | 12.23 |
| Nitrogen free extract | 52.90 | 53.13 | 54.23 | 55.13 |
| Total ash | 9.33 | 8.85 | 9.43 | 8.72 |

**Table 3:** Effect of feeding rice DDGS on hematological parameters in Nagavali Ram Lambs

| Parameter | Control | $T_1$ | $T_2$ | $T_3$ | SEM | P-Value |
|---|---|---|---|---|---|---|
| Hb (g/DL) | 14.04 | 14.20 | 14.24 | 14.32 | 0.13 | 0.39 |
| PCV (%) | 35.67 | 36.10 | 36.07 | 36.41 | 0.46 | 0.87 |
| RBC($\times 10^6$ /µl) | 11.35 | 11.49 | 11.53 | 11.67 | 0.19 | 0.68 |
| WBC($\times 10^3$ /µl) | $6.27^a$ | $6.32^a$ | $6.79^{ab}$ | $7.05^b$ | 0.39 | <0.01 |
| Neutrophil (%) | $32.28^b$ | $31.95^b$ | $30.88^a$ | $30.82^a$ | 0.28 | <0.01 |
| Lymphocytes (%) | $55.75^a$ | $55.67^a$ | $57.17^b$ | $58.02^c$ | 0.18 | <0.01 |
| Eosinophils (%) | 3.18 | 3.21 | 3.21 | 3.26 | 0.07 | 0.85 |

Means bearing different superscript in a row differ significantly ($p$<0.05).

**Table 4:** Effect of feeding RDDGS on blood biochemical parameters in Nagavali ram lambs

| Parameter | Control | $T_1$ | $T_2$ | $T_3$ | SEM | P-Value |
|---|---|---|---|---|---|---|
| Total Protein (g/dl) | 7.16 | 7.00 | 7.05 | 7.18 | 0.87 | 0.31 |
| Albumin (g/dl) | 2.8 | 2.94 | 2.79 | 2.86 | 0.93 | 0.28 |
| Globulin (g/dl) | 4.35 | 4.06 | 4.26 | 4.33 | 0.14 | 0.11 |
| A: G Ratio | 0.66 | 0.73 | 0.66 | 0.66 | 0.16 | 0.21 |
| ALT (IU/dl) | 25.55 | 25.78 | 26.58 | 27.49 | 0.75 | 0.11 |
| AST (IU/dl) | 104.06 | 103.47 | 104.34 | 104.65 | 0.21 | 0.17 |
| Glucose (mg/dl) | 59.13 | 61.45 | 57.97 | 58.84 | 0.47 | 0.42 |
| Triglycerides (mg/dl) | 50.13 | 44.87 | 52.64 | 44.25 | 0.26 | 0.27 |
| Total Cholesterol (mg/dl) | 53.41 | 52.12 | 54.04 | 53.30 | 0.18 | 0.41 |
| HDL-C (mg/dl) | 19.14 | 20.47 | 20.83 | 21.47 | 0.12 | 0.34 |
| LDL-C (mg/dl) | 22.63 | 22.68 | 22.68 | 23.01 | 0.14 | 0.27 |
| VLDL-C (mg/dl) | 10.03 | 8.97 | 10.52 | 8.65 | 0.19 | 0.31 |

Means bearing different superscript in a row differ significantly ($p$<0.05).

## Conclusion

The results of the present study regarding growing ram lambs show that inclusion of DDGS up to 100% levels replacing SBM was economical and had no harmful effect on serum biochemical profile as these values are within normal physiological range. Hence, RDDGS can be included in concentrate up to 100% levels in ram lambs.

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