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The impact of Ardu (*Ailanthus excelsa*) leaf powder feeding on Hemato-biochemical parameters in Pantja goats

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Abstract
An investigation was conducted on hematological parameters of sixteen Pantja goats, aged 6-8 months, as part of a 90 days feeding trial utilizing Ardu (*Ailanthus excelsa)* foliage powder. The goats were allocated at random into four treatment groups (C, T_1, T_2, and T_3), with each group consisting of four goats. As a result, the average weight of the goats in each group was approximately equivalent. The Control group (C) received a 100% concentrate supplement; T_1 received a 75% concentrate containing 25% Ardu leaf powder; T_2 received a 50% concentrate containing 50% Ardu leaf powder; and T_3 received a 25% concentrate containing 75% Ardu leaf powder.
Blood sample collection occurred on the 0th, 60th, and 90th days. Hematological parameters including hemoglobin, TEC, PCV, MCH, and MCV were found to be significantly (P0.05) lower in experimental group C compared to goats in treatment group T_3. However, these parameters were significantly and maximally higher (P0.05) in treatment group T_3. Conversely, the situation was reversed with regard to parameters including MCHC and TLC. The biochemical parameters analysis revealed that T_3 had the lowest and minimum values for serum glucose, serum cholesterol, LDL, serum triglyceride, ALT, and AST (all at least a P0.05). In contrast, C exhibited the highest levels of HDL, serum total protein, serum albumin, serum globulin, and serum calcium.

Keywords: Hematobiochemical parameters, Pantja goats, Ardu leaf powder

1. Introduction
The livestock industry is vital to the Indian economy. Twenty-five million individuals place livestock as their primary source of income. The livestock sector provides nearly 16 percent of the income of small-farm households, compared to 14 percent on average for all rural households. The livestock industry in India contributes to 25.6% of the agricultural GDP and 4.11% of the country's agricultural GDP. Goats, among the earliest domesticated livestock, are utilized globally for their milk, flesh, skin, and hair. At the moment, goats are among the most practical and well-liked creatures, particularly among those with limited resources. Global families and communities benefit from small-scale goat husbandry, which can be conducted in a variety of climate and environment.
Goat husbandry is gaining prominence in a world where the future is progressively determined by our ability to adapt to climate change. In addition to maintaining production levels, goats have a negligible impact on the environment, as they emit significantly less methane than other livestock. With a population of over two-thirds over the past forty years, the global goat population has increased to an estimated one billion. The Food and Agriculture Organization reports that over ninety percent of goats reside in developing countries, with the greatest proportion of the global goat population located in Asia. India has the second-largest goat population globally, trailing only China. The goat population in India increased by an astounding 10.1% between the previous census and 2019, reaching 148.89 million (Livestock Census, 2012) [1]. Pantja is a recently registered medium-sized dual-purpose (meat and milk) goat breed from the Uttarakhand Tarai region, among the numerous goat varieties in the country.

One of the greatest obstacles to animal production in India, especially in resource-poor rural areas, is the scarcity of forage and fodder for livestock; this accounts for roughly half of all losses in Indian dairy output. By 2025, it is anticipated that Indian livestock will experience a dry fodder deficit of 25 percent and a green fodder shortfall of 65 percent. *Ailanthus excelsa* and Ardu possess the capacity to function as animal fodder during periods of scarcity. The flour derived from its leaves is a highly palatable, protein-rich nutritional feed. Determine the impact of ardu leaf powder on the hemato-biochemical parameters of Pantja cattle; this was the primary objective of the research.

2. Materials and Methods

2.1 Study area

This study was conducted at the Goat Unit, Department of Livestock Production Management, College of Veterinary and Animal Sciences, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India.

2.2 Experimental animals

The experimental animals utilized in this study were chosen from the Pantja Field Unit, which housed the Pantja goats as part of the All India Coordinated Research Project on Ground Improvement. Individually weighed and obtained from the goat unit, a total of sixteen Pantja goats aged six to eight months were randomly divided into one control group and three treatment groups, each consisting of four goats. This was done to ensure that the average weight of the goats in each group was approximately equivalent.

2.3 Housing of animals

The goats used for the experiment were maintained in pens (3×5 sq. ft.) with concrete floors that were well-ventilated and had *ad libitum* access to drinking water. The animals were housed in a semi-intensive housing system.

2.4 Experimental Feeds and Feeding Schedule

A feeding experiment was conducted using a complete randomized design (CRD) to explore the effects of administering ardu leaf powder to goats for duration of 90 days. Goats in group C were provided with 100% concentrate while grazing, while goats in groups T_1, T_2, and T_3 were fed ardu leaf powder instead of 25%, 50%, and 75% concentrate, respectively. To ensure that all essential nutrients were adequately supplied, each goat in the control group received a 100 gram concentrate along with a mineral mixture. Furthermore, grazing was not implemented.

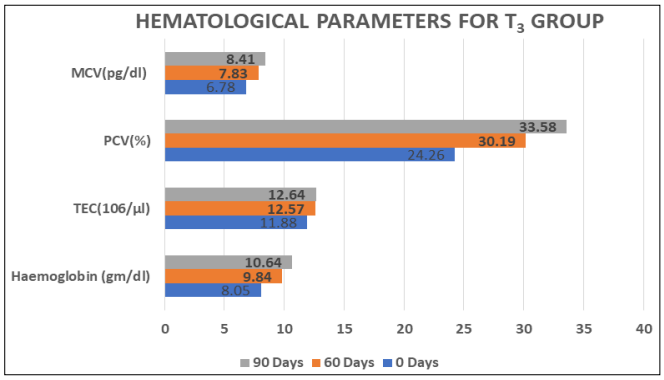
A Blood sample was collected for the trial. Five millilitre of blood was drawn from the jugular vein on 0, 30th, 60th and 90th day of the trial from each goat. Two ml of collected blood was transferred to EDTA vials and used for the estimation of hematological parameters whereas remaining was placed in a clean test tube for serum separation to the study of biochemical parameters.

3. Results and Discussion

The present study was conducted for 90 days, from January 2019 to April 2019, to assess the effect of Ardu feeding on the hematobiochemical parameters of Pantja goats.

3.1 Hematological Parameters

The investigation revealed an increase in hemoglobin concentration to within the expected range, indicating that the administration of Ardu leaf powder accelerated the perfusion of oxygen into the tissues of the animals that were fed. The goats assigned to groups C, T_1, T_2, and T_3 had hemoglobin levels of 8.10±0.11, 8.57±0.06, 8.77±0.06, and 9.15±0.07 g/dL on the 30th day of the experiment, respectively. By the 90th day of the experiment, those same values had decreased to 8.18±0.10, 9.46±0.08, 9.92±0.11, and 10.64±0.20 g/dL, respectively. Hemoglobin, the substance responsible for transporting oxygen to various tissues, is highly present in erythrocytes. Consequently, there is a direct correlation between the quantity of TEC and tissue oxygen uptake. The goats in treatment group T_3 exhibited the maximum TEC, which was significantly (p<0.05) greater than the mean value, whereas the TEC in group C was minimal and significantly (p<0.05) lower. Furthermore, it was observed that the PCV level in treatment group T_3 was significantly (p<0.05) greater than that of treatment groups T_2, T_1, and C. The MCV values for experimental group T_3 on the 60th and 90th days of the trial were 24.11±0.30 and 26.56±0.41 ml, respectively. It was determined that experimental group T_3 exhibited the highest and most significantly (p<0.05) greater MCV values. The MCHC results obtained were consistent with the findings of (Brown *et al.*, 2016) [2], who observed significant (p<0.05) variations in MCHC among goats fed *Setaria verticillata* hay supplemented with varying levels of *Vachellia karroo* leaf meal. The erythrocyte indices MCV, MCH, and MCHC are utilized in the detection of anemia. Findings of present experiment are in contrast to that of (Jiwuba *et al.*, 2016) [3] who found non- significant increase in hemoglobin level in West African Dwarf goats by feeding them different levels of *Moringa oleifera* leaves. Consistent MCV, MCH, and MCHC values established beyond a reasonable doubt that the experimental goats did not have anemia. The enhanced red blood cell indices observed in the experimental Pantja goats could potentially be attributed to the Ardu leaf meal's abundant composition (amino acids, calcium, and iron, among others), increased iron bioavailability for erythropoiesis, and improved element absorption.

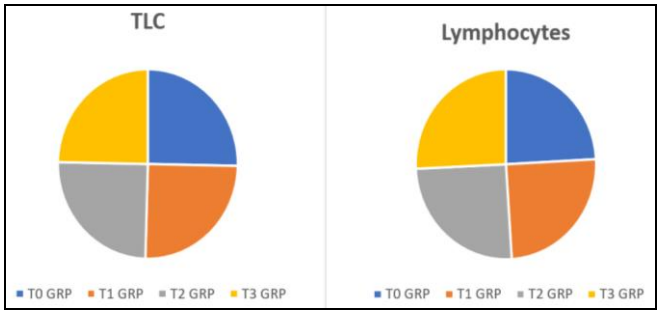


Graph 1: Haematological Parameters of Pantja goats

A decrease in TLC within the expected range and an increase in Ardu leaf powder in the feed indicate the absence of an active infection; thus, the animals are in excellent health and have robust immunity. Pantja goats appeared to have a robust immune system, providing a rapid and effective defense against pathogens, according to the current study.

Although the average number of lymphocytes in each group of Pantja goats fed varying concentrations of Ardu leaf powder appeared to vary considerably, they were all within the normal physiological range. Furthermore, it was determined that there was no significant difference in monocyte counts at 0, 30, 60, and 90 days across all treatment groups. This suggests that the administration of ardu leaf powder to goats had no impact on their monocyte counts. The

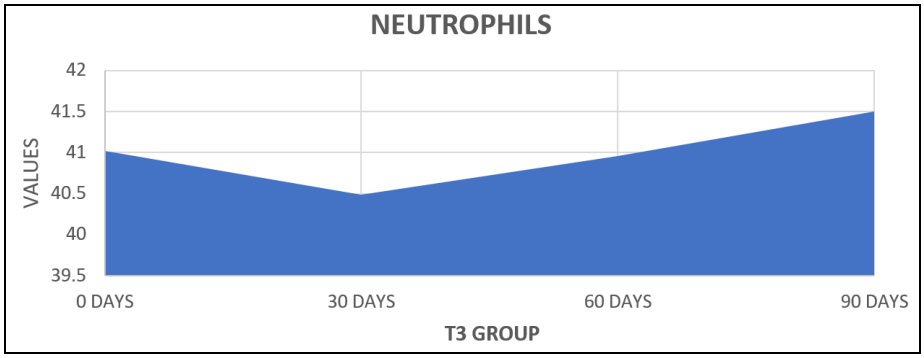
present results are consistent with those of (Oni *et al.*, 2012) [4], who demonstrated that there was no observable variation in monocyte counts among goats that were fed dried cassava leaves.



Graph 2: TLC, Lymphocytes Count of Pantja goats

Due to the statistical insignificance of all results, the administration of ardu leaf powder had no effect on the neutrophil count at 0, 30, and 90 days of experimentation for all groups of Pantja goats in this study, as determined by statistical analysis of neutrophil.

It was determined that the minimum eosinophil count in group T_3 was statistically equivalent to the eosinophil levels in group T_2. Elevated eosinophil counts may indicate the presence of allergies or fungal and parasitic infections. A decrease in eosinophil percentage in the current study indicates a defense mechanism against foreign substances. As a result, it is possible to deduce that providing animals with ardu leaf flour may enhance their immune response against infections. (Reece *et al.*, 2015) [5] reported that the TLC, monocyte, lymphocyte, eosinophil, and neutrophil counts of every experimental goat in the treatment groups were all within the expected range.

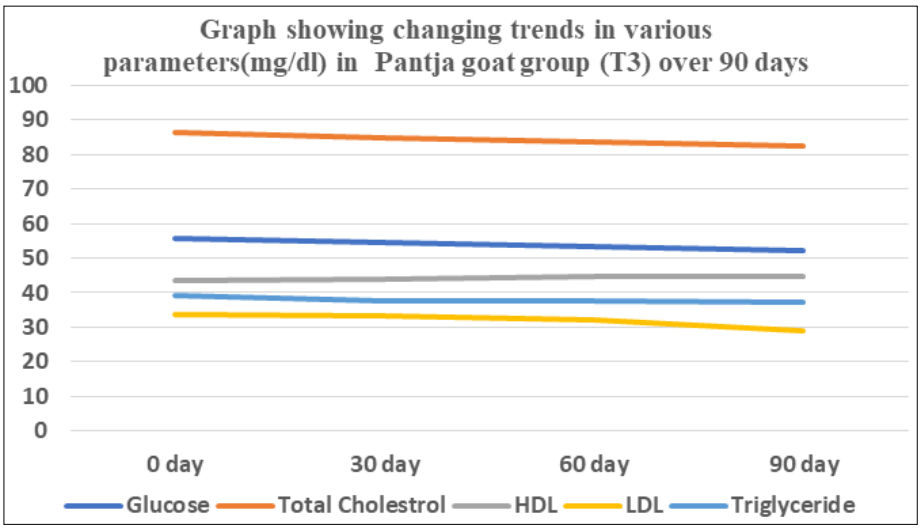


Graph 3: Neutrophil Count of Pantja goats

3.2 Biochemical Parameters

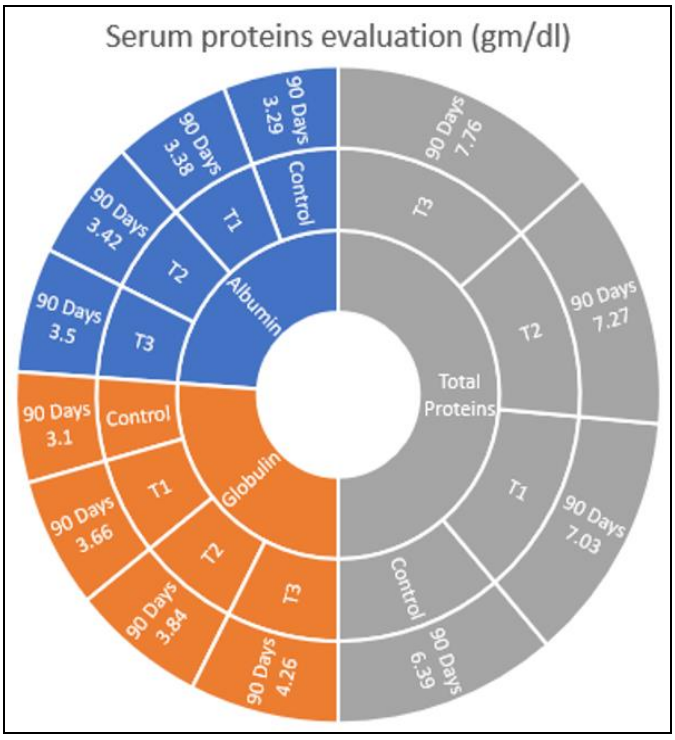
Significant (P0.05) reductions in serum glucose levels were observed in the Pantja ruminant treatment groups (maximum in T_3), as determined by the present study's findings. This suggests that ardu leaf powder provided adequate dietary energy. In a study conducted by (Szymanowska *et al.*, 2017) [6], goat young that were supplemented with alfalfa protein-xanthophyll concentrate exhibited a noteworthy (p<0.01) decline in total cholesterol. Comparable outcomes were noted when Pantja goats were fed ardu leaf powder. These findings underscore the positive impact that green leaf feeding has on the total cholesterol levels of goats. An increase in high density lipoprotein (HDL) cholesterol, which is commonly referred to as protective cholesterol or healthy cholesterol in animals, was noted in the treatment groups that consumed ardu powder diets for the Pantja goats. At the 60th and 90th days of the investigation, the HDL values for groups C, T_1, T_2, and T_3 were as follows: 43.45±0.03, 43.94±0.10, 44.22±0.14, 44.86±0.15, and 43.52±0.13, 43.96±0.11, 44.24±0.13, and 44.88±0.15 mg/dl, respectively.

Additionally, the findings indicated that the goats assigned to the experimental groups exhibited considerably reduced levels of LDL and triglycerides in comparison to the control group (p<0.05). This could be due to the fact that goats utilize lipid components more efficiently or the fact that consuming leaves stimulates bile acid secretion, a process that emulsifies cholesterol and results in its elimination via feces.



Graph 4: Biochemical Parameters of Pantja goats

As stated by (Kaneko *et al.*, 2008) [7], the serum total protein concentrations of all ruminant groups fell within the expected range. The mean total protein concentrations of the treatment groups T_2, T_1, and C were significantly (P0.05) lower than those of the group T_3, which was identified as having the maximum concentration. The elevated concentrations of albumin, globulin, and total protein in this investigation suggest that the ardu leaf powder might comprise a negligible quantity of tannins, which are recognized to impede nutrient permeability across intestinal mucosa and enhance excretion of endogenous protein (subsequently eliminated via feces), thus potentially having no impact on protein metabolism. In contrast, the results reported by (Temitope *et al.* 2017) [8] indicate that goats nourished with 15% leaf meal of *Vernonia amygdalina* and *Tithonia diversifolia* exhibited notably reduced levels of blood albumin (p<0.05). At the 90th day of the trial, the average globulin concentrations for treatment groups C, T_1, T_2, and T_3 were 3.10±0.02, 3.66±0.07, 3.84±0.07, and 4.26±0.04 g/dl, respectively. Group T_3 had the highest and most substantially elevated globulin value.

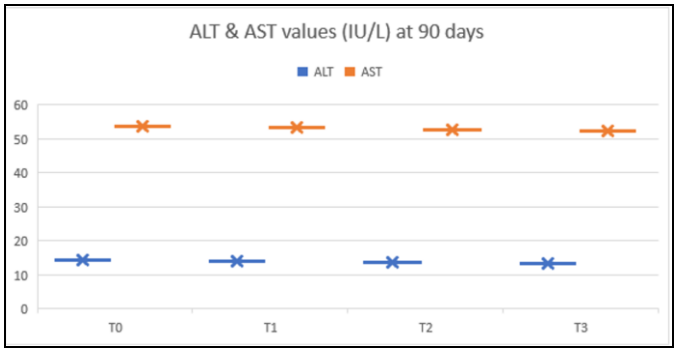


Graph 5: Serum total protein concentration of Pantja goats

The current investigation revealed that the BUN levels of all experimental groups at 0, 30, 60, and 90th days, when administered varying concentrations of dried cassava leaf-based concentrate diets, were not statistically significant in support of the hypothesis proposed by (Oni *et al.*, 2012) [4]. Creatinine measurements are indicative of the quantity of muscle protein present in animals. Elevated consumption of Ardu leaf powder did not resulted in any discernible effect on the serum creatinine levels of Pantja goats in the present investigation. This finding suggests the absence of waste catabolism, suggesting that the experimental animals were not subsisting on their protein stores.

At the 90th day of the investigation, the calcium concentrations in the treatment groups C, T_1, T_2, and T_3 were determined to be 8.82±0.05, 9.16±0.04, 9.24±0.07, and 9.60±0.11 mg/dl, respectively. T_3 had significantly higher calcium concentrations (P0.05) than treatment groups T_2, T_1, and C. Furthermore, it was observed that the calcium levels in treatment groups T_2 and T_1 were not significantly different. The mean concentrations of AST and ALT in group T_3 were observed to be negligible and notably low (p<0.05). On the contrary, it was observed that the concentrations of ALT and AST in all treatment groups of Pantja goats were all within the expected range (Matthews, 1999) [9].

The findings of this study, which investigated the impact of ardu leaf powder on AST and ALT, are consistent with those of (Yusuf *et al.*, 2012) [10], who observed a significant (p<0.05) decrease in AST and ALT levels in West African dwarf goats fed a maximum of 25% *Panicum* and 75% *Newbouldia Laevis* leaves.



Graph 6: ALT, AST concentration of Pantja goats

4. Conclusion

Ardu leaf powder has emerged as the most sustainable feeding option for farmers as it is less costly, more readily accessible, and provides the best results for growth and health. Therefore, supplementing with ardu leaves may be suggested to help the financial conditions of the struggling farmers. The use of ardu leaves and powder in the production of goat meat and milk can be further discussed. To optimize their proper quantity of inclusion in goat diets, a study is required to characterize this and other tree leaves for nutrient digestibility and antinutritional factor content.

5. Conflict of interest: The Authors declare that there is no conflict of interest.

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