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Impact of mulberry leaf supplementation on haemato-biochemical parameters in lactating camels

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Abstract

This study was conducted to evaluate the impact of replacing a part of concentrate mixtures with *Morus alba* (Mulberry) leaves on the haemato-biochemical parameters of lactating camels. Fifteen multiparous lactating camels were randomly assigned to two groups, T₁ and T₂ and subjected to a 180-day feeding trial. Group T₁ served as the control and received a concentrate without leaf supplementation, while Group T₂ was provided a concentrate containing 10% *Morus alba* leaves. Haematological and biochemical parameters were measured at both the commencement and conclusion of the study. The results revealed no statistically significant differences ($p > 0.05$) between the treatment groups in terms of haemoglobin levels, packed cell volume (PCV), mean corpuscular haemoglobin (MCH) and various serum biochemical parameters including total protein, albumin, globulin, albumin-globulin ratio and cholesterol. These findings suggest that the incorporation of *Morus alba* leaves into the diet does not adversely affect the haemato-biochemical health of lactating camels.

Keywords: Mulberry, lactating camels, haemato-biochemical parameters, dietary supplementation

Introduction

Camels are integral to the livelihood of populations in arid and semi-arid regions, where they play a crucial role in transportation, agriculture and sustenance. The nutritional management of camels, particularly lactating ones, is essential for maintaining their overall health and productivity (Sahoo and Sawal, 2021a) [4]. Proper dietary management not only supports the well-being of these animals but also ensures their optimal performance in various roles they fulfil within their communities. Recent studies have increasingly focused on the potential benefits of incorporating phyto-genic feed additives into the diets of various livestock species. These plants are recognized for their rich content of essential nutrients, including proteins, vitamins and minerals, as well as bioactive compounds that have been shown to enhance animal health and productivity. The use of such natural supplements is gaining attention as a sustainable and cost-effective strategy to improve animal nutrition, especially in regions where conventional feed resources may be scarce or expensive (Moyo *et al.* 2011) [3]. Despite the growing interest, there is still limited information regarding the specific effects of these phyto-genic compounds on the haemato-biochemical parameters of camels, particularly during lactation. This study aims to fill this gap by investigating the impact of replacing concentrate mixture with mulberry leaves on the haemato-biochemical health of lactating camels, providing insights that could inform better nutritional practices and support the sustainable management of camel populations in challenging environments.

Methodology

Experimental Design

A total of fifteen multiparous lactating camels were selected from a herd of 28 animals at the ICAR-NRCC camel dairy facility. The camels were randomly allocated to two treatment groups, T₁ and T₂ following a randomized block design (RBD). Group T₁ (control) received a pelleted concentrate feed without leaf supplementation, while Group T₂ was fed a pelleted concentrate containing 10% *Morus alba* (Mulberry) leaves. All camels had ad libitum access to roughage and water throughout the 180-day experimental period.

Haemato-Biochemical Analysis

Peripheral blood samples were collected on day 0 (baseline) and day 180 (end of the study) to assess haematological and biochemical parameters. Haematological parameters including haemoglobin (Hb), packed cell volume (PCV), red blood cell count (RBC) and mean corpuscular haemoglobin (MCH) were

measured using standardized laboratory techniques. Serum biochemical parameters—total protein, albumin, globulin, albumin-globulin (A:G) ratio, cholesterol—were analyzed using a Biotron BTR-830 photometer with commercially available kits. Statistical analyses were performed using SPSS version 20.0, with significance considered at $p < 0.05$.

Table 1: Effect of mulberry leaves supplementation on haematological parameters

Period	Treatments		Period Mean	SEM	P-value		
	T ₁	T ₂			T	P	T*P
Haemoglobin							
0d	12.34	12.40	12.37	0.226	0.642	0.586	0.731
180d	12.44	12.84	12.64	0.340			
Average	12.39	12.62					
SEM	0.279	0.340					
PCV							
0d	24.74	24.94	24.84	0.839	0.642	0.586	0.731
180d	25.07	26.36	25.71	1.030			
Average	24.91	25.64					
SEM	0.857	1.320					
MCH							
0d	12.57	12.44	12.50	0.134	0.894	0.387	0.653
180d	12.75	13.00	12.69	0.244			
Average	12.66	12.71					
SEM	0.254	0.214					

Table 2: Effect of mulberry leaves supplementation on serum biochemistry in experimental camels

Period	Treatments		Period Mean	SEM	P-value		
	T ₁	T ₂			T	P	T*P
Total Protein (g/dl)							
0d	5.57	5.60	5.58	0.319	0.950	0.888	0.979
180d	5.62	5.62	5.64	0.447			
Average	5.60	5.62					
SEM	0.212	0.337					
Albumin (g/dl)							
0d	3.13	3.14	3.13 ^a	0.088	0.734	0.048	0.827
180d	3.28	3.33	3.31 ^b	0.092			
Average	3.20	3.23					
SEM	0.151	0.204					
Globulin (g/dl)							
0d	2.44	2.46	2.45	0.133	0.982	0.676	0.929
180d	2.34	2.34	2.33	0.154			
Average	2.39	2.38					
SEM	0.139	0.134					
A:G ratio							
0d	1.31	1.29	1.30	0.150	0.628	0.186	
180d	1.70	1.50	1.60	0.139			
Average	1.51	1.40					
SEM	0.189	0.128					
Total Cholesterols							
0d	78.78	78.27	78.52	1.270	0.679	0.475	
180d	77.12	74.50	75.80	1.016			
Average	77.95	76.38					
SEM	1.773	1.379					

^{ab} means bearing different superscripts in a column differ significantly

Results and Discussion

The study revealed no significant differences ($p > 0.05$) between the control (T₁) and treatment (T₂) groups in haematological parameters such as haemoglobin levels, PCV, RBC count and MCH. The average haemoglobin levels for Group T₁ and T₂ were 12.39 g/dL and 12.62 g/dL, respectively. For PCV (packed cell volume), the average values were 24.91% for T₁ and 25.64% for T₂. In the case of MCH (mean corpuscular haemoglobin), the averages were 12.66 pg for T₁ and 12.71 pg for T₂. Similarly, the analysis of serum biochemical

parameters—total protein, albumin, globulin, A:G ratio and cholesterol—showed no significant differences between the groups. For instance, the average total protein levels for Group T₁ and T₂ were 5.60 g/dL and 5.62 g/dL, respectively. For albumin, the average values were 3.20 g/dL for T₁ and 3.23 g/dL for T₂. The average globulin levels were 2.39 g/dL for T₁ and 2.38 g/dL for T₂. The A:G ratio averaged 1.51 for T₁ and 1.40 for T₂. Lastly, the average total cholesterol levels were 77.95 mg/dL for T₁ and 76.38 mg/dL for T₂. These findings align with previous studies such as, Anbarasu *et al.* (2004) [1] reported non-

significant effect of mulberry supplementation on serum ALT, AST, albumin and globulin levels in goats. Similarly, Zhou *et al.* (2014) observed no effect of mulberry leaves supplementation on BUN, total protein, albumin, glucose, cholesterol, ALT and AST in cattle. Li *et al.* (2020) ^[2] also reported non-significant effect on serum total protein, albumin, globulin, BUN and glucose values with mulberry leaf supplementation in the ration of lactating buffaloes. Wang *et al.* (2020) ^[5] observed non-significant effect on serum cholesterol on supplementation of mulberry leaves in the ration of goats. These results suggest that the inclusion of *Morus alba* leaves in the diet does not significantly influence the haemato-biochemical profile of lactating camels, thereby supporting the safety and efficacy of using *Morus alba* as a phytogenic feed additive over the long term.

Conclusions

The findings from this study indicate that the substitution of concentrate mixtures with 10% *Morus alba* leaves in the diet of lactating camels does not result in significant alterations in their haemato-biochemical health parameters. The observed stability in these parameters suggests that *Morus alba* leaves can be safely incorporated into camel diets without compromising their health. These results contribute to the broader understanding of the use of phytogenic feed additives in livestock nutrition, supporting their potential role in sustainable animal husbandry practices. This research underscores the feasibility of using *Morus alba* as a nutritionally beneficial and sustainable feed supplement for lactating camels, reflecting a growing trend towards the adoption of natural and plant-based additives in animal nutrition.

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