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Effect of Feeding Different Level of Moringa oleifera Leaf Meal on Haemato-biochemical Profile of Vanaraja Chickens

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ABSTRACT

The present study aimed to evaluate the effects of dietary inclusion of Moringa oleifera leaf meal (MOLM) on the haemato-biochemical profile of Vanaraja chickens under farm conditions. A total of 300 birds were randomly assigned to five treatment groups (T1–T5) with 60 birds each for 56 days. T1 served as the control group receiving only the basal diet, while T2, T3, T4, and T5 were supplemented with 5%, 10%, 15%, and 20% MOLM, respectively. Haematological parameters such as haemoglobin, PCV, MCH, and MCHC were significantly (P<0.05) improved in the T3 group, while other indices remained unaffected. Serum biochemistry including total protein, globulin, urea, BUN, and creatinine showed significant differences (P<0.05), except glucose, albumin, A:G ratio, uric acid, calcium, phosphorus, AST, ALT and ALP. The findings suggest that 10% MOLM optimally enhances haematological profiles, while increasing MOLM levels may improve biochemical indicators, reflecting better overall health status of Vanaraja chickens.

Keywords: Haematology, Biochemical indicators, Moringa oleifera, Leaf meal, Vanaraja

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INTRODUCTION

The growing deficit of animal protein in developing nations has prompted the search for alternative, locally sourced feed ingredients to enhance livestock productivity while minimizing reliance on expensive conventional protein sources (Atawodi et al., 2008). Moringa oleifera leaf meal (MOLM) could be used as alternative feed resource in commercial livestock and poultry in the tropics (Agbede, 2003; Kumar et al., 2017 & 2018). In response to the escalating cost and scarcity of traditional feed components, researchers in developing countries are increasingly exploring non-traditional feed sources, with a focus on protein alternatives such as leguminous multipurpose trees and shrubs, which offer a rich supply of proteins, vitamins, and minerals for poultry nutrition (Elebha et al., 2018). Moringa plant (miracle tree) has been reported to have many medicinal uses such as possessing of hypocholesterolemic properties, antioxidant activity (Olugbemi et al., 2010c; Verma et al., 2009; Moyo et al., 2012; Worku, 2016). The chemical constituents of M. oleifera have bioactive compounds, secondary metabolites such as phenolic acids, gallic acid, ellagic acid, chlorogenic acid, ferulic acid, glucosinolates, quercetin, vanillin and kaempferol, which have nutritional, pharmaceutical and/or antimicrobial properties" (Mbikay, 2012; Brilhante et al., 2017). Supplementation of Moringa oleifera leaf meal also helped in improving immune competence and gut health of broilers. People are more aware about the quality products and protein source is one of the essential components to affect the performance. The study aimed to investigate the effects of Moringa oleifera leaf meal as dietary supplementation on haemato-biochemical parameters of Vanaraja chicken.

MATERIAL AND METHODS

Feeding, Management, Dietary Treatment and Laboratory Analysis

The experiment was carried out over a period of 56 days to evaluate the effect of dietary inclusion of Moringa oleifera leaf meal (MOLM) on the haemato-biochemical profile of Vanaraja chickens. The study was conducted at the Poultry Nutrition Research Unit, Department of Animal Nutrition, Bihar Veterinary College, Patna, India. All feed ingredients required for the entire experimental period were procured in a single batch. Their proximate composition was analyzed following AOAC (2005) guidelines, while calcium and phosphorus levels were estimated using the modified method of Talapatra et al. (1940), prior to feed formulation. Experimental rations were compounded in accordance with BIS (2007) standards. The major ingredients used in the diets included yellow maize, soybean meal, wheat bran, de-oiled rice bran, soybean oil, common salt, calcite powder, a mineral mixture, and necessary feed additives, as detailed in Table 1 and 2.

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Table 1: Chemical composition of feed ingredients used in experiment (% on DM basis).

Ingredients	DM	CP	EE	CF	TA	AIA	NFE	Ca	P	ME (kcal/kg)
Yellow maize	91.5	9.50	4.70	2.08	2.80	1.20	80.92	0.08	0.36	3330
Soyabean meal	92.5	45.0	0.24	5.85	7.05	1.10	41.86	0.23	0.58	2450
Wheat bran	90.5	14.0	3.61	10.50	6.60	1.40	65.29	0.21	1.18	2000
De-oiled rice bran	93.5	13.0	1.80	13.25	6.40	4.70	65.55	0.07	0.98	1800
Moringa oleifera leaf meal (MOLM)	94.53	25.27	6.84	9.92	11.50	1.45	46.46	1.70	0.30	2852

DM, dry matter; CP, crude protein; EE, ether extract; CF, crude fibre, TA, total ash; AIA, acid insoluble ash; NFE, nitrogen free extract; Ca, calcium; P, phosphorus; ME, metabolizable energy.

Table 2: Percentage composition of different experimental diets

Ingredients	T1	T2	T3	T4	T5
Moringa oleifera leaf meal (MOLM)	0.00	5.00	10.00	15.00	20.00
Yellow maize	54.00	51.00	48.00	46.00	44.00
Soya bean meal	32.00	30.00	28.00	26.00	24.00
Wheat bran	5.00	5.00	5.00	4.00	4.00
De-oiled rice bran	5.00	5.00	5.00	5.00	4.00
Soya oil	0.5	0.5	0.5	0.5	0.5
Common salt	0.30	0.30	0.30	0.30	0.30
Calcite	1.00	1.00	1.00	1.00	1.00
Mineral mixture	1.50	1.50	1.50	1.50	1.50
Premix	0.70	0.70	0.70	0.70	0.70

T1, served as control fed with basal ration; T2, basal ration mixed with 5% Moringa oleifera leaf meal (MOLM); T3, basal ration mixed with 10% MOLM; T4, basal ration mixed with 15% MOLM; T5 basal ration mixed with 20 % MOLM.

Composition of mineral mixture: Retinol (210 mg), Cholecalciferol (1.75 mg), Alpha-tocopherol (250 mg), Nicotinamide (1000 mg), Cobalt (150 mg), Copper (1200 mg), Zinc (9600 mg), Manganese (1500 mg), Iodine (325 mg), Iron (1500 mg), Potassium (100 mg), Magnesium (6000 mg), Selenium (10 mg), Sodium (5.9 mg), Sulfur (72 g), Calcium (255 g) and Phosphorus (127 g).

Three-hundred day-old Vanaraja chicks were procured from the Directorate on Poultry Research (DPR), Hyderabad, during the early winter season when ambient temperatures averaged around 32°C. Upon arrival, the chicks were individually weighed and randomly assigned to five experimental groups, each consisting of 60 birds. Each group was further subdivided into three replicates of 20 chicks. On the first day, all birds were fed crushed maize, followed by a transition to the experimental diets. Group 1 served as the control and received only the basal ration, while Groups 2, 3, 4, and 5 were supplemented with 5%, 10%, 15%, and 20% Moringa oleifera leaf meal (MOLM), respectively, mixed with the basal ration. The chicks were housed under electrically heated brooders during the early stages and reared under standard management practices throughout the trial. All recommended biosecurity measures and vaccination schedules were strictly followed during the experimental period.

Preparation of leaf meal

Moringa oleifera leaves used in the study were harvested from mature trees (over 12 months old) located on the campus of Bihar Veterinary College, Patna, India. Branches were pruned and spread evenly on the floor to dry for 3-4 days under shaded and well-ventilated conditions to preserve nutrient integrity. Once adequately dried, the branches were carefully threshed to separate the leaves from the twigs. The collected leaves were then ground using a hammer mill to produce a fine leaf meal. To maintain quality and prevent contamination, the processed leaf meal was stored in airtight nylon bags for the entire duration of the study.

Haemato-biochemical profiles

At the end of the trial, blood samples were collected from two birds per replicate, totalling six samples per treatment group, randomly selected to ensure representative data. Blood was drawn from the wing vein using sterile disposable syringes and distributed into two sets of vials, one containing EDTA as an anticoagulant and the other without. Samples in EDTA vials were used immediately for haematological analyses. Haemoglobin (Hb) concentration was estimated using the cyanmethemoglobin method (Drabkin and Austin, 1932), while packed cell volume (PCV) was determined via the micro-haematocrit technique (Campbell, 1995). Total RBC counts were performed using a Neubauer haemocytometer following the method of Natt and Herrick (1952). Differential leukocyte counts including neutrophils, lymphocytes, monocytes, eosinophils, and basophils were observed under a binocular microscope. MCV, MCH, and MCHC values were calculated using standard formulae based on Hb, PCV, and RBC values. Blood from non-anticoagulant vials was allowed to clot and centrifuged at 1500 rpm for 15 minutes to obtain serum. The serum was analyzed for biochemical parameters such as glucose, total protein, albumin, globulin, A:G ratio, urea, BUN, uric acid, creatinine, calcium, phosphorus, AST, ALT, and ALP using commercial colorimetric kits and a UV-visible double beam spectrophotometer (Model 2205, Systronics, India).

Statistical analysis

All data were statistically analyzed using the Statistical Package for the Social Sciences (SPSS, 2011). A generalized linear model (GLM) analysis of variance (ANOVA) was employed to compare differences among the treatment groups. When significant effects were observed, Duncan's multiple range tests were used for post-hoc comparisons to determine specific group differences. The statistical procedures followed were in accordance with the methodology outlined by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

In this study, a comprehensive set of haematological and biochemical parameters were evaluated to assess the effects of dietary supplementation. The haematological parameters included haemoglobin (Hb), packed cell volume (PCV), red blood corpuscles (RBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), as well as differential leukocyte counts neutrophils, lymphocytes, monocytes, eosinophils, and basophils. The biochemical parameters analyzed were glucose, total protein, albumin, globulin, albumin-to-globulin (A:G) ratio, total urea, blood urea nitrogen (BUN), uric acid, creatinine, calcium, phosphorus, aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP). These parameters were observed to determine the physiological and metabolic responses of Vanaraja chickens to dietary inclusion of Moringa oleifera leaf meal.

Haematological profile

The effect of dietary inclusion of Moringa oleifera leaf meal (MOLM) on the haematological profile of Vanaraja chickens is presented in Table 3. The average haemoglobin (Hb) concentration ranged from 9.42 g/dl to 11.20 g/dl, with a significant (P<0.05) increase observed in the T3 group (10% MOLM), which recorded the highest value (11.20 g/dl), while the lowest was noted in T5 (20% MOLM) at 9.42 g/dl. The packed cell volume (PCV) ranged from 29.00% to 30.83%, with the T3 group showing a significantly higher (P<0.05) value compared to other groups, which remained statistically comparable to each other. Red blood cell (RBC) counts did not differ significantly (P>0.05) among the treatment groups; however, a marginal increase was observed in T3. Mean corpuscular volume (MCV) was also statistically similar (P>0.05) across treatments. Mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) showed highly significant differences (P<0.01), with the highest values recorded in the T3 group. Differential leukocyte counts including neutrophils, lymphocytes, monocytes, eosinophils, and basophils did not show any significant variation (P>0.05) among the treatment groups when compared to the control.

Table 3: Effect of different level of Moringa oleifera leaf meal on haematological profile in Vanaraja chickens

Attributes	T1	T2	T3	T4	T5	SEM	P-value
Hb (g/dl)	10.38 b	10.37 b	11.20 c	9.83 ab	9.42 a	0.311	<0.001
PCV (%)	29.50 a	29.33 a	30.83 b	29.00 a	29.33 a	0.643	0.072
RBC (x106 µL)	4.91	4.90	5.05	4.91	4.84	0.098	0.286
MCV (fL)	60.09	59.85	61.04	59.11	60.69	0.875	0.241
MCH (pg)	21.17 bc	21.18 bc	22.18 c	20.05 ab	19.48 a	0.628	0.002
MCHC (g/dl)	35.22 bc	35.40 bc	36.33 c	33.92 ab	32.09 a	1.000	0.003
Neutrophil (%)	26.67	26.83	27.67	27.50	28.00	2.151	0.967
Lymphocyte (%)	54.50	55.67	58.33	57.83	59.17	2.465	0.317
Monocyte (%)	5.83	5.67	5.67	5.17	5.33	0.727	0.886
Eosinophil (%)	3.17	3.33	3.17	3.02	3.00	0.663	0.985
Basophil (%)	0.83	0.67	0.83	0.68	0.66	0.359	0.970

^{abc} Values with different superscripts in a row differ significantly (P<0.05; P<0.01)

The present findings are in partial agreement with those of Zanu et al. (2012), who reported that broiler chickens fed diets containing 10% and 15% Moringa oleifera leaf meal (MOLM) had lower MCH values compared to birds on control and 5% MOLM diets, although the haematological indices overall were not significantly affected, suggesting the diets were nutritionally adequate. Similarly, Aderinola et al. (2013) observed a significant reduction in PCV values with increasing levels of MOLM in broiler diets, with the highest PCV in the control group and the lowest at 20% inclusion. They also reported a significant increase in white blood cell (WBC) count with higher levels of MOLM. In contrast, Mahmood et al. (2015) found that RBC counts increased significantly (P<0.05) in broilers receiving drinking water supplemented with Azadirachta indica (4%) and Moringa oleifera (6%) extracts, while Hb, WBC, and PCV remained unaffected. Additionally, Sharma et al. (2025) reported a significant (P<0.05) increase in Hb concentration in broilers fed 1% MOLM. In the present study, the lowest Hb value observed in the T5 group may be attributed to the presence of anti-nutritional factors such as saponins, flavonoids, and phenolic compounds in MOLM, which can chelate essential trace minerals like copper and iron, rendering them unavailable for haemoglobin synthesis.

Serum biochemical indices

The effect of dietary inclusion of Moringa oleifera leaf meal (MOLM) on various serum biochemical parameters of Vanaraja chickens is summarized in Table 4. The average blood glucose levels ranged from 156.03 to 159.98 mg/dl, showing no significant differences (P>0.05) among the treatment groups, although numerically higher values were observed in the T3 group compared to the control. Total protein concentrations ranged from 3.32 to 3.75 g/dl, with a significantly higher value (P<0.05) recorded in the T5 group compared to the control, while T3 remained statistically similar to T5. Albumin levels, ranging from 1.53 to 1.63 g/dl, did not differ significantly (P>0.05) across treatments. Globulin values ranged from 1.69 to 2.22 g/dl and were significantly higher (P<0.05) in the T5 group compared to the control, while values in T1 and T3 were comparable. The albumin-to-globulin (A:G) ratio, ranging from 0.70 to 0.97, showed no significant variation among the groups. Total urea levels (1.66-4.76 mg/dl) and blood urea nitrogen (BUN) levels (0.74-2.12 mg/dl) were significantly reduced (P<0.05) in the T4 group compared to control, while values for T4 and T5 remained statistically similar. Uric acid concentrations ranged from 4.13 to 5.06 mg/dl, with no significant differences among treatments. Serum creatinine levels (1.19-1.27 mg/dl) were significantly lower (P<0.05) in the T5 group compared to control, while T1 and T4 were comparable. The reduced creatinine levels suggest a lowered protein catabolism rate in birds supplemented with higher levels of MOLM. Calcium (7.96-8.75 mg/dl) and phosphorus (6.65–7.19 mg/dl) levels remained unaffected (P>0.05) across all groups. Similarly, serum enzyme levels AST (109.60-114.33 U/l), ALT (14.68-16.61 U/l), and ALP (13.10-15.29 U/l) showed no significant differences (P>0.05) among the treatment groups when compared to the control, indicating no adverse effects on liver function.

Table 4: Effect of different level of Moringa oleifera leaf meal on serum biochemistry in Vanaraja chickens

Attributes	T1	T2	T3	T4	T5	SEM	P-value
Glucose (mg/dl)	156.03	156.14	159.98	156.08	157.61	4.627	0.893
Total protein (g/dl)	3.62 bc	3.39 ab	3.51 abc	3.32 a	3.75 c	0.129	0.020
Albumin (g/dl)	1.61	1.56	1.63	1.63	1.53	0.113	0.867
Globulin (g/dl)	2.01 ab	1.83 a	1.88 ab	1.69 a	2.22 b	0.155	0.027
A:G ratio	0.84 ab	0.87 ab	0.90 ab	0.97 b	0.70 a	0.117	0.243
Urea (mg/dl)	4.76 c	3.37 b	3.02 b	1.66 a	1.97 a	0.330	<0.001
BUN (mg/dl)	2.12 c	1.51 b	1.35 b	0.74 a	0.88 a	0.147	<0.001
Uric acid (mg/dl)	4.82	4.13	4.71	4.67	5.06	0.578	0.598
Creatinine (mg/dl)	1.27 b	1.25 ab	1.22 ab	1.27b	1.19 a	0.032	0.104
Calcium (mg/dl)	8.02	7.96	8.75	8.56	8.30	0.550	0.551
Phosphorus (mg/dl)	7.19	7.17	7.01	6.65	6.80	0.297	0.312
SGOT (U/lit)	111.46	109.60	112.16	114.33	111.99	11.96	0.997
SGPT (U/lit)	14.68	16.61	15.39	15.70	15.13	1.402	0.712
ALP (U/lit)	15.29	15.08	13.57	13.10	13.50	1.269	0.315

[abc] Values with different superscripts in a row differ significantly (P<0.05; P<0.01)

The present findings align well with several earlier studies investigating the effects of Moringa oleifera leaf meal (MOLM) on serum biochemical parameters in poultry. Aderinola et al. (2013) reported that inclusion of Moringa in broiler diets led to significant differences (P<0.05) in serum biochemical indices, particularly with higher MOLM levels, while SGPT and SGOT values remained unaffected, findings consistent with the current results. Similarly, Sharma et al. (2025) observed significant (P<0.05) increases in total protein and globulin levels in broilers fed 1% MOLM, which corroborates the present data. Donkor et al. (2013) found MOL supplementation enhanced serum levels of calcium, sodium, potassium, albumin, and chloride in poultry, supporting the nutritional value of Moringa leaves. Divya et al. (2014) reported a significant (P<0.05) decrease in serum creatinine with increasing MOL levels, indicating reduced protein catabolism also observed in the current study. Egu (2019) noted significant changes in serum urea, glucose, and calcium (P<0.05) with MOLM supplementation, except for ALT, which remained unchanged, mirroring the current findings. Overall, these consistent trends reinforce that MOLM inclusion in poultry diets improves protein utilization and supports metabolic health

CONCLUSION

Therefore, it can be concluded from the present study that supplementation of Moringa oleifera leaf meal (MOLM) at 5%, followed by 10%, resulted in significant improvement in the haemato-biochemical profile of Vanaraja chickens. The positive effects observed on key health indicators highlight the potential of MOLM as a valuable alternative protein and nutrient source. Considering its nutritional benefits and availability, inclusion of 10% MOLM in the diet is recommended for backyard poultry production under both farm and field conditions to enhance bird health and productivity sustainably.

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