Quest Journals
Journal of Research in Agriculture and Animal Science
Volume 9 ~ Issue 10 (2022) pp: 54-59
ISSN(Online) : 2321-9459
www.questjournals.org

Research Paper

Effects of dietary supplementation of Sahjan (*Moringa oleifera*) and Neem (*Azadirachta indica*) leaf meal on the performance of Kadaknath layers

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ABSTRACT
The current research work was accomplished to study the effects of dietary supplementation of Moringa oleifera and Azadirachta indica leaf meal on the performance of Kadaknath layers on daily egg production, feed consumption, feed conversion ratio, egg quality traits, hematological and biochemical parameters, fecal parasitic load and economics. The trial was conducted for a period of 2 months. The experiment was performed in Seventy two (72), Kadaknath laying hens of 42 weeks age. The birds were randomly assigned to four dietary groups of 18 each with three replicates of 6 in each group. In the control group T_C, the birds were fed with normal basal diet and in rest of the 3 treatment groups the birds were fed with Moringa leaf meal (MLM) at level of 2% with basal diet in T_M group, Neem leaf meal (NML) at level of 2% with basal diet in T_N group and their mixture (MNLM) at level of 1% of MLM and 1% of NLM with basal diet in T_{MN} group. Results showed that the dietary supplementation of MLM,NLM and MNLM had no significant effect on body weight gain and feed intake but the egg production per bird increased ($P<0.05$) and the mean value recorded were 8.87, 8.00, 7.67 and 6.20 in $T_{MN,}T_{N,}T_{M,}T_C$ groups respectively, between 46-60 days interval. The supplementation of MLM, NLM and MNLM had no significant effect on the external egg quality parameters and albumen% but had significant effect on the yolk%, shell% and shell thickness. The FCR was also improved in the herbal supplemented groups against the control group with the highest improvement in MNLM supplemented group. The overall economic efficiency for MLM, NLM and MNLM were comparable and was highest in MNLM supplemented group. Considering above results it appeared that incorporation of 1% MLM and 1%NLM mixture level in the diet of Kadaknath laying hens was best over inclusion of sole 2% MLM and 2% NLM level in the diet of Kadaknath layers for enhancing production performance and economics of production .

Keywords: *production performance, egg quality, Kadaknath layers, moringa leaf meal, neem leaf meal, economics.*

***R**eceived 15 Oct., 2022; **R**evised 28 Oct., 2022; **A**ccepted 31 Oct., 2022 © The author(s) 2022.*
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I. INTRODUCTION

The Kadaknath, also known as Kalamasi, is one of India's most popular breeds of poultry. Kadaknath is largely bred by tribal populations in the Jhabua and Dhar districts of Madhya Pradesh, India. Compared to other exotic varieties of fowl, these birds have a higher resistance to disease in their natural habitat in free range. In general, the Kadaknath breed is well known for its black meat, which has exceptional meat quality, texture, flavour and an aphrodisiac quality as well as significant medicinal value. Black meat aids in the growth of blood cells, hemoglobin and the treatment of pulmonary diseases. According to numerous research, Kadaknath eggs are rich in nutrients and are also believed to heal headaches, post-delivery issues, asthma as well as nephritis. It contains vitamins, fat, protein, phosphorus, calcium, iron, nicotinic acid and vitamin B_6 are among

the many nutrients found in this supplement, which helps to alleviate pulmonary disease because of these qualities demand for Kadaknath has surged in recent years.

For decades, standard synthetic feed additives such as antibiotic growth promoters, anti-fungal agents ,antioxidants, and anti-parasitic agents have been utilised in chicken feed to meet the increasing demand for animal protein. However, they caused numerous challenges, such as traceability in animal products and consumer antibiotic resistance, which became public health issues. (Wallace *et al.*, 2010; Ao *et al.*, 2011; Kirkpinar *et al.*, 2011;Embuscado, 2015;). Due to these problems scientists have turned their attention to safe natural additives such as phytobiotics in poultry feed because of growing consumer demand for chicken and escalating pressure to decrease or eliminate antibiotic use in poultry feed for reasons of human health. As a result of their natural, no residue in tissues and eggs, and less harmful qualities, phytobiotics have become an increasingly popular feed ingredient in poultry diets. Among all the medicinal plants *Moringa oleifera* (Sahjan) and *Azadirachta indica* (Neem) are widely researched plants. Neem belongs to the family Meliaceae and botanically known as *Azadirachta indica*, *A Juss.* It is recognized as "sacred gift of nature". The chief active principles found in neem leaves are nimbin, nimbinene, 6-desacetylnimbiene, nimbandiol, nimbolide and quercetin (Mitra et al., 2000). Neem plant parts such as fruits, seeds, leaves, barks and roots contain compounds with proven antiseptic, antibiotics, antiviral, antipyretic, anti-inflammatory, anti-ulcer, antifungal and hypocholesterolemic properties (Onyimonyi *et al.* 2009). Similarly, Moringa is a fast–growing, drought–resistant tree of the family Moringaceae, native to Indian subcontinent. The antioxidants ascorbic acid, flavonoids, phenolics and carotenoids found in *Moringa oleifera* leaf meal (B.Moyo 2011). The leaves of M. oleifera are the most nutritious part, being a significant source of vitamin B complex, vitamin C, pro-vitamin A as beta-carotene, vitamin K, manganese, and protein among other essential nutrients(Leone 2015). Moringa and neem leaf meal are examples of versatile plants that are utilised as feed additives in layer feed for Kadaknath birds to improve egg production, improve egg quality attributes, reduced fecal parasitic load, and also to be used as a cost-effective feed additive by farmers.

II. MATERIALS AND METHODS

2.1 Experimental design, Moringa and neem leaf meal preparation

The research work was conducted at Livestock Farm Complex, C.V.Sc & A.H., A.N.D.U.AT., Kumarganj, Ayodhya. In the trial 72 Kadaknath laying hens of 42 weeks old were randomly distributed among four groups with 18 layers in each treatment with three replications in each. The experiment was carried out for a period of 60 days. Moringa and Neem leaves were obtained from LFC, Kumarganj, Ayodhya. The leaves were spread out on a clean floor and allowed to dry in a ventilated room for 4-5 days and after which they were kept in hot air oven for 1 hour at 37°C. The dried leaves were grounded by an electric grinder and were kept in air tight polythene bags separately and were used as an additive in layers feed.

In T_C, the birds were fed with regular basal diet, while in the other treatment groups T_M, T_N, T_{MN}, the birds were fed Moringa leaf meal (MLM) at level of 2% with basal diet, Neem leaf meal (NML) at level of 2% with basal diet and, their mixture (MNLM) at level of 1% of MLM and 1% of NLM with basal diet respectively. The birds were housed in a deep litter system and managed in accordance with regular procedures and a measured quantity of feed was given on daily basis.

Table 1- Ingredients of basal diet

S.No.	Ingredient	Amount (g/kg)
1	Wheat	139.5
2	Corn	334
3	Sunflower meal	208
4	Soybean meal 48% CP	135.5
5	Vegetable oil	58
6	Dicalcium phosphate	16
7	Limestone	100
8	Salt	3.5
9	DL- methionine	2
10	L-lysine hydrochloride	1
11	Vitamin mineral premix*	2.5

*Vitamin and mineral premix provided per kg of diet: Vitamin A, E and minerals for e.g. Manganese, iron, copper, cobalt, selenium and zinc.

2.2 Production Performances Parameters

During the experimental period, body weight, feed intake, total egg production per bird and total egg mass in each groups were recorded at 15 days interval. The Feed conversion ratio (FCR) was calculated as kilograms of feed consumed divided by kilograms of egg produced. Egg production (%) was calculated as: number of egg laid per replicate divided by number of hen per replicate multiplied by 100.

2.3 Egg Traits

The external egg quality was studied on 15 days of interval during the period of trial. Ten eggs were randomly chosen from each group to measure the external egg quality parameters but for internal egg quality traits 10 eggs were collected from each group at the end of the trial. The collected eggs were weighed, eggshell weights, albumen and yolk were measured and expressed as percentage of the whole egg's weight. Egg length, egg width was measured using vernier calipers. Egg shape index was calculated by dividing egg width by egg length and multiplied by 100. Eggshell thickness was determined after emptying the egg of its content and air drying the egg shell for 24 hours, after which it was determined with the help of a micrometer screw gauge.

2.4 Economics

Relative economics of feeding under different dietary treatment was calculated after the end of experimental trial. Net Profit = Gross revenue – Total cost of production

Economic efficiency is calculated by dividing net profit by Total cost of production.

2.5 Statistical analysis

All the data obtained from the experiment was subjected to Analysis Of Variance using standard statistical procedures described by Snedecor and Cochran (2004). The significance mean difference was tested by Duncan's New Multiple Range Test.

III. RESULTS AND DISCUSSION

The effect of dietary supplementation of MLM, NLM and MNLM in the treatment groups do not have a considerable effect on the feed intake and body weight of Kadaknath birds (Table 2 and 3). Our findings are in agreement with Hermogenes *et al*., (2014) who evaluated no significant effect of MLM on the body weight of chicken layers and Ubua *et al.,* (2018) who observed no significant effect of neem leaf meal on the body weight of broiler birds. But Igugo (2014) showed contradictory results with respect to MLM.

Table 2 Effect the of dietary supplementation of MLM, NLM and MNLM on the Feed Intake (Kg) of Kadaknath birds on 15 days interval

DAYS	T_C	T_M	T_N	T_{MN}	P- value
15	1.67 ±0.06	1.75±0.029	1.65 ±0.019	1.69±0.037	0.320
30	1.65 ±0.032^{a}	1.74±0.023^{b}	1.77±0.020^{b}	1.70±0.037^{ab}	0.028
45	1.69±0.025^{a}	1.70±0.029^{a}	1.81±0.0274^{b}	1.67±0.024^{a}	0.002
60	1.64±0.042^{a}	1.78 ±0.028^{b}	1.68±0.022^{a}	1.70±0.015^{a}	0.004

Mean with same superscripts do not differ significantly.

Table 3 Effect of the dietary supplementation of MLM, NLM and MNLM on the body weight (kg) of Kadaknath birds on 15 days interval.

DAYS	T_C	T_M	T_N	T_{MN}	P- value
0	1.27±0.360^{b}	1.24±0.232^{ab}	1.19±0.015^{a}	1.25±0.027^{ab}	0.127
15	1.32±0.039^{b}	1.29±0.018^{ab}	1.23±0.015^{a}	1.31±0.035^{ab}	0.119
30	1.34±0.040	1.33±0.020	1.28±0.014	1.32±0.034	0.461
45	1.35±0.039	1.36±0.019	1.32±0.0199	1.36±0.026	0.740
60	1.35±0.041	1.39±0.019	1.34±0.018	1.37±0.024	0.503

Means with same superscripts do not differ significantly.

The total egg production/bird presented in Table 4 showed significant influence from 31-60 days interval in all herbal supplemented group against the control group. The mean value of total egg production/bird on 60th day was highest in T_{MN} group (8.87) followed by T_N group (8.00) followed by T_M group (7.67) and all the herbal supplemented group differ significantly ($P<0.05$) from T_C group (6.20). Results showed significant difference ($P<0.05$) in the total egg production percentage and the mean value of T_C group (34.26%), T_M (37.03%), T_N (38.89%) and highest mean value was recorded in T_{MN} (43.05%). Our findings are similar to Soliman and Kamel (2020) who concluded that supplementation of ginger, cinnamon, thyme, cumin black seed and pomegranate peels on laying hens improved the egg production. But contrary to it Saki *et al.,* (2014) who observed that phytogenic feed additives mixture have no effect on egg production.

Table 4.Effect of dietary supplementation of MLM, NLM and MNLM on the total egg production/bird (TEP) in Kadaknath layers on 15 days interval

DAYS	T_C	T_M	T_N	T_{MN}	P- value
15	6.20±0.243	5.47±0.336	5.80±0.262	6.20±0.355	0.261
30	$6.07±0.267^a$	$5.87±0.236^a$	$6.27±0.300^{ab}$	$7.07±0.384^b$	0.036
45	$6.20±0.175^a$	$7.67±0.398^b$	$8.00±0.478^{bc}$	$8.87±0.363^c$	<0.001
60	$6.20±0.243^a$	$7.67±0.398^b$	$8.00±0.478^{bc}$	$8.87±0.363^c$	<0.001

Means with same superscripts do not differ significantly.

Effect of dietary inclusion of MLM, NLM and MNLM on the total egg mass and fcr in Kadaknath layers at the end of the trial showed significant difference (P<0.05) from the control group. T_{MN} recorded significantly highest total egg mass and lower fcr and highest followed by T_N and T_M group respectively and presented statistically in Table 5 and 6. The earlier studies conducted by Ufele *et al.,* (2020) supplemented Moringa leaves in combination with herbs and observed significantly (P<0.05) lower FCR in its combination fed broiler groups as compared to control group birds. On the contrary Gayatri *et al. (*2020) found no effect of MOLM supplementation on fcr in Vanaraja laying hens. Similar to present study on the dietary supplementation of neem leaf meal to improve the FCR was observed by Olabode A. D., (2015) who found better FCR in the laying birds, in contrast Soliman and Kamel (2020) found that supplementation of ginger, cinnamon, thyme, cumin black seed and pomegranate peels in laying hens have no significant (P≤0.05) effects on feed consumption or feed conversion ratio.

Table 5 Effect of dietary supplementation of MLM, NLM and MNLM on total egg mass (g) in Kadaknath layers on 15 days interval

DAYS	T_C	T_M	T_N	T_{MN}	P- value
15	265.75±15.61	250.56±15.72	265.99±14.33	284.05±14.74	0.487
30	$249.76±10.11^a$	$266.30±14.39^a$	$284.11±14.13^{ab}$	$315.75±17.06^b$	0.012
45	$278.35±10.31^a$	$337.66±18.20^b$	$353.74±23.76^b$	$419.79±18.56^c$	<0.001
60	$270.73±9.73^a$	$409.27±25.44^b$	$410.62±28.30^b$	$432.46±18.78^b$	<0.001

Means with same superscripts do not differ significantly.

Table 6 Effect of dietary supplementation of MLM, NLM and MNLM on Feed Conversion Ratio (FCR) in Kadaknath layers at 15 days interval

DAYS	T_C	T_M	T_N	T_{MN}	P- value
15	$7.74±0.285^b$	$7.46±0.07^{ab}$	$7.40±0.113^{ab}$	$7.18±0.146^a$	0.158
30	$7.92±0.126^d$	$7.56±0.170^c$	$7.08±0.101^b$	$6.40±0.068^a$	<0.001
45	$7.34±0.276^c$	$6.39±0.094^b$	$6.03±0.214^b$	$4.80±0.112^a$	<0.001
60	$7.27±0.136^b$	$5.07±0.190^a$	$4.93±0.115^a$	$4.66±0.118^a$	<0.001

Means with same superscripts do not differ significantly.

The effect on the external egg qualities and internal egg qualities on supplementing MLM, NLM and MNLM in the diet of Kadaknath layers were recorded and statistically shown in table

7 and 8 respectively. There were no positive influence of the supplementation of MLM, NLM and MNLM on the overall mean value of egg wt., shape index and L/W ratio in the diet of Kadaknath layers over 60 days of the experimental period. The internal egg quality such as albumen%, yolk%, shell%, shell thickness (mm) in Kadaknath layers were recorded at the end of the trial. The statistical data showed that the mean value of albumen% in T_M (55.39) and T_{MN} (55.68) show significant difference from T_C (54.38). The mean value of yolk% in dietary treatment groups T_M (32.83), T_N (33.39) and T_{MN} (33.02) was significantly lower (P<0.05) than T_C (34.76) group but T_M, T_N and T_{MN} differed non-significantly to each other. The value of shell% in T_M group (11.43) was differed significantly from T_C (10.85) but comparable to T_N (11.11) and T_{MN} (11.27), with T_C group recorded lowest egg shell%. In case of shell thickness (mm) T_M group (0.506) show significantly higher value in comparison to T_C (0.447) and T_N group but statistically similar with T_{MN} (0.476). T_{MN} showed no significant difference with T_C, T_M and T_N (0.446). With respect to Moringa as a dietary feed additive on external quality of egg in Kadaknath layer our finding are same as Farhana Sharmin *et al*., (2021) who supplemented MOL in the diet of native laying chickens and concluded that egg weight, shape index, length and width of eggs were not differ significantly from T_1 (control) group.

With respect to Neem as a dietary feed additive on external quality of egg in Kadaknath layer our findings are in agreement with Olabode A. D., (2015) and Odoh *et al.,* (2016) both fed diets containing neem leaf meal to laying birds and revealed that the dietary treatments did not significantly (P>0.05) effect egg weight, egg width and shape index. With respect to Moringa as a dietary feed additive on internal quality of egg in Kadaknath layer present finding are similar to Farhana Sharmin *et al*., (2021) who supplemented MOL 0.5% (T_2), MOL 1.0% (T_3) and MOL 1.5% (T_4) in the diet of native laying chickens and concluded that egg shell

thickness (mm), shell weight (gm) differ significantly from T_1 (control) group and for albumen % and egg weight our finding is similar to the Swain *et al.*, (2017) conducted a study on the effect of dietary inclusion of MLM on the performance of Vanaraja layers and observed non significance difference on albumen% .

Table 7 Effect of the dietary supplementation of MLM, NLM and MNLM on the egg external quality in Kadaknath layers from 45-60 days

Attributes	**T_C**	**T_M**	**T_N**	**T_{MN}**	**P- value**
Egg Wt.	45.01±0.667	45.17±0.506	45.13±0.380	44.88±0.557	0.981
Shape Index	72.35±0.322	72.73±0.237	72.82±0.191	72.54±0.298	0.607
L/W ratio	1.38±0.063	1.38±0.045	1.37±0.004	1.38±0.006	0.642

Means with same superscripts do not differ significantly.

Table 8 Effect of dietary supplementation of MLM, NLM and MNLM on the egg internal quality parameters in Kadaknath layers at the end of the trial

Attributes	**T_C**	**T_M**	**T_N**	**T_{MN}**	**P- value**
Egg weight (g)	44.37±1.925	48.99±1.606	44.40±1.356	45.10±1.378	0.140
Albumen%	$54.38±0.530^a$	$55.69±0.298^b$	$55.39±0.445^{ab}$	$55.68±0.160^b$	0.068
Yolk%	$34.76±0.568^b$	$32.83±0.278^a$	$33.39±0.369^a$	$33.02±0.132^a$	0.003
Shell %	$10.85±0.22^a$	$11.43±0.114^b$	$11.11±0.119^{ab}$	$11.27±.050^{ab}$	0.041
Shell thickness (mm)	$0.447±0.019^a$	$0.506±0.017^b$	$0.446±0.010^a$	$0.476±0.012^{ab}$	0.026

Means with same superscripts do not differ significantly

The cost of feed per egg produced during the experimental period was determined with and without MLM, NLM, and MNLM nutritional supplementation. The feed consumption per bird(kg/bird) in T_C, T_M ,T_N and T_{MN} groups in 60 days was 6.54, 6.92, 6.91 and 6.72 respectively and T_M and T_N show significantly higher value from T_C but there was no significant difference in feed consumption among the herbal supplemented groups.

Table 9 Economics of production of Kadaknath layers fed on MLM, NLM and MNLM.

Attributes	**T_C**	**T_M**	**T_N**	**T_{MN}**	**P-value**
Cost of feed (Rs./Kg)	29.34	29.34	29.34	29.34	
Feed consumed per bird	$6.54±0.150^a$	$6.92±0.069^b$	$6.91±0.43^b$	$6.72±0.078^{ab}$	0.016
Cost of feed consumed/bird (Rs.)	$191.82±4.40^a$	$203.07±2.01^b$	$202.76±1.26^b$	$197.42±2.29^{ab}$	0.001
Miscellaneous cost/bird(Rs.)	6	6	6	6	
Egg production /bird	$20.56±0.185^a$	$22.22±0.101^b$	$23.33±0.114^c$	$25.83±0.904^d$	<0.001
Sell price of per egg	10	10	10	10	
Total sell price of eggs	$205.56±1.85^a$	$222.22±1.01^b$	$233.33±1.14^c$	$258.33±0.09^d$	<0.001
Profit (Rs./bird)	$17.32±4.47^a$	$19.15±1.92^a$	$30.57±1.85^b$	$60.91±2.55^c$	<0.001
Economic Efficiency	$0.028±0.015^a$	$0.064±0.01^a$	$0.119±0.009^b$	$0.273±0.015^c$	<0.001

Means with same superscripts do not differ significantly

The data showed that the sole supplementation of moringa had no significant influence on the economic efficiency in comparison to sole supplementation of neem leaf and also their mixture.

IV. CONCLUSION

From the findings of the present study, it is concluded that the performance of Kadaknath layers was examined in terms of feed intake, body weight increase, feed conversion efficiency, egg production, egg quality features and production economics. On a broad scale, the results postulate the following conclusion i.e., supplementation of MNLM (1% MLM+1% NLM) level appeared best over inclusion of 2% MLM and 2% NLM level.

REFERENCES

[1]. Abbas R.J., Ali N.A., Alkassar A.M. and Jameel Y.J. 2018. Haematological and biochemical indices of broiler chicks fed at different levels of *Moringa oleifera* leaf meal. Biochemical and Cellular Archives, **18(2)**: 1931-1936.

[2]. Ao. X., Yoo, J.S., Zhou, T.X., Wang, J.P., Meng, Q.W., Yan, L., Cho, J.H. & Kim, I.H., 2011. Effects of fermented garlic powder supplementation on growth performance, blood profiles and breast meat quality in broilers. Livest.. Sci. 141, 85-89.

[3]. Embuscado, M.E., 2015. Spices and herbs: Natural sources of antioxidants – a mini review. J. Func. Foods. PP, 1-9.

[4]. Farhana Sharmin, Md. Sazedul Karim Sarker, Nathu Ram Sarker & Shakila Faruque 2021. Dietary effect of Moringa oleifera on native laying hens' egg quality, cholesterol and fatty-acid profile *ITALIAN JOURNAL OF ANIMAL SCIENCE* **VOL. 20**, NO. 1, 1544–1553.
[5]. Hermongenes P, Paguina Q, Rina, Balba, Christian, Flores and Rudy.2014.Utilization and evaluation of *Moringa oleifera* L. as poultry feeds, APCBEE Procedia,**8**:343-347.
[6]. Igugo, R.U. 2014. An assessment of the use of varying levels of Moringa oleifera leafmeal as a substitute for vitamin plus mineral premix in finisher broiler diet.*Journal of Experimental Research*, **2(2)**: 88-92.
[7]. Kırkpınar, F., Bora Ünlü, H. & Özdemir, G., 2011. Effects of Oregano and Garlic essential oils on performance, carcase, organ and blood characteristics and intestinal microflora of broilers. Livest. Sci. **137**, 219-225.
[8]. Leone, A.; Spada, A.; Battezzati, A.; Schiraldi, A.; Aristil, J.; Bertoli, S. 2015 Cultivation, genetic, ethnopharmacology, phytochemistry and pharmacology of Moringa oleifera leaves: An overview. Int. J. Mol. Sci, **16**, 12791–12835. [CrossRef]
[9]. Mitra RB, Szezypel A, Perez A, Gonzale, 2000 Estrada. Efficiency of Neem oil (A. indica A. juss) in hens naturally infested with ectoparasistes. Revista Cubana de Ciencia Avicola. **24(2)**:125-131.
[10]. Moyo, B.; Masika, P.; Hugo, A.; Muchenje, V. 2011 Nutritional characterization of Moringa (Moringa oleifera Lam.) leaves. Afr. J. Biotechnol. 10, 12925–12933.
[11]. Naglaa Kamal Soliman1 and Sahar Mostafa Kamel 2020. Effect Of Herbs On Productive Performance Of Laying Hens, Some Blood Constituents And Antioxidant Activity In Egg Yolk Egypt. Poult. Sci. Vol. **(40) (II)**: (493-505).
[12]. Odoh LI, Lawrence B and Jonathan OI. 2016. Effects of Graded Levels of Neem (*Azadirachta indica*) Leaf Meal on Egg Production and Quality of Eggs of Shika Brown Layers, *Journal of Nature Sciences Research*,**6(15)**:64-69.
[13]. Onyimonyi, A.E., Olabode, A.D and Okeke, G.C 2009. Performance and economic characteristics of broilers fed varying levels of neem leaf meal. Int. Journal of Poultry Science. **8(3)**:256-2.
[14]. Saki A.A., Harcini R.N., Rahmatnejad E. and Salary J. 2012. Herbal additives and organic acids as antibiotic alternatives in broiler chickens' diet for organic production. *African Journal of Biotechnology*, **11(8)**: 2139-2145.
[15]. Swain BK,Naik PK, Chakurkar EB and Singh NP.2017. Effect of supplementation of *Moringa oleifera* leaf meal on the performance of Vanaraja laying hens, *Indian Journal of Animal Sciences*,**87(3)**:353-355.
[16]. Ufele A.N., Nwafor C.J., Offor V. and Nwankwo S. 2020. Effects of *Azadirachta Indica* and *Moringa oleifera* leaves on the growth performance and packed cell volume of broiler chicken. *Animal Research International*, **17(2):** 3658-3664.
[17]. Wallace, R.J., Oleszek, W., Franz, C., Hahn, I., Baser, K.H.C., Mathe, A. & Teichmann, K., 2010. Dietary plant bioactive for poultry health and productivity. Brit. Poult. Sci. 51, 461-487.