

Effect of supplementation of moringa leaf powder (*Moringa oleifera*) on growth and production performance of Pratapdhan chicken under organic management system

J P MEENA¹, LOKESH GUPTA^{1✉}, S K SHARMA¹, SIDDHARTHA MISHRA¹ and D S GOSWAMI¹

Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan 313 001 India

Received: 18 February 2022; Accepted: 11 May 2022

ABSTRACT

The present study was carried out at poultry farm of Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur for a period of 22 weeks (18 to 40 weeks) for egg production. The objective of the study was to find out the optimum inclusion level of moringa leaf powder (MLP) in poultry diet and study the effect on production performance and economics of Pratapdhan chicken under organic management system. The dietary treatments consisted of the basal diet as control (T₁), Feed of organic origin (T₂), T₂+Moringa Leaf Powder @ 2.5% (T₃), T₂+Moringa Leaf Powder @ 5% (T₄), T₂+Moringa Leaf Powder @ 7.5% (T₅) and T₂+Moringa leaf powder @ 10%. The bodyweight of chicken ranged between 1259.75 g to 1425.67 g in different treatments at 22 weeks of age whereas at 32 weeks of age the bodyweights were significantly higher in T₃ and lowest in T₅ group. The feed intake among different treatment groups was found to be non-significant. The hen day egg production was maximum in T₄ at 56.91 eggs and T₅ at 56.32 as compared to the rest of the treatments.

Keywords: Chicken, Intake, *Moringa oleifera*, Organic, Pratapdhan

India is the third largest egg producer and fifth largest poultry meat producer in the world. The structure of India's poultry industry varies from region to region where both organized and traditional systems of poultry farming are followed. Small-scale poultry production will continue to offer opportunities for income generation and quality animal-source foods as long as there is rural poverty. Phytogetic promotes a group of natural growth promoters or non-antibiotic growth promoters used as feed additives derived from herbs and spices or other plants. Natural growth promoters of plant origin are generally believed to be safe and less harmful for human and animal health. *Moringa oleifera* has been known since ancient times, but very limited information is available in India on the effect of these medicinal plants on nutrient utilization efficiency in poultry. There has been an increased interest in the utilization of *Moringa oleifera* in improving ruminant farming and poultry performances (Abou Sekken 2015). The increasing popularity on the use of *Moringa oleifera* leaves in poultry nutrition necessitates thorough investigation into its nutritional values as well as its impacts on hematological parameters as a measure of both nutritional and anti-oxidant benefits in Poultry raised under high environmental temperature condition (Makkar and

Becker 1997). In view of high nutritional and anti-oxidant property of *Moringa oleifera* leaves, an experiment was planned for supplementation of different levels of moringa leaf powder in poultry.

MATERIALS AND METHODS

The study carried out at poultry farm of Rajasthan College of Agriculture Udaipur, for a period of 12 weeks (4 to 16 weeks) for growth and 10 weeks (18 to 28 weeks) for egg production. The study was to find out the optimum inclusion level, of moringa leaf powder in poultry diet and to observe the effect of MLP on growth and production performance in Pratapdhan chicken under organic management system.

Procurement of feed: The experimental diets were formulated as per BIS (2007) and presented in Table 1. The chemical analysis of the experimental diet was carried out as per AOAC (2012). The feed ad lib. and water were provided ad lib. to all the treatment groups throughout the experimental period.

Experimental birds: The experiment was conducted on 360 day old chicks of either sex which were taken from the hatchery unit of Poultry farm, Department of Animal Production, Rajasthan College of agriculture (MPUAT), Udaipur, Rajasthan.

Experimental design: The research work was conducted on Pratapdhan chicken for a period of 22 weeks (12 weeks for growth and 10 weeks for egg production performance). The birds were randomly divided into six treatments of

Present address: ¹Department of Animal Production, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan. ✉Corresponding author email: lokgupta76@gmail.com

three replicates (20 birds in each) and birds had free access to food and water during the experimental period. *Moringa oleifera* leaf powder was supplemented at four levels i.e. 2.5%, 5.0%, 7.5%, and 10% in various treatment groups.

Housing management: The experimental shed, its premises and the equipments were thoroughly cleaned and disinfected, and saw dust was provided as a bedding material for the birds. Immediately after arrival, the desired brooding temperature was maintained using electric bulbs. All the groups were provided similar environmental temperature and managemental conditions throughout the experimental period. The identical floor, feeding and watering space were also allotted to the experimental birds during the entire experimental period.

Bodyweight: The bodyweights of birds were recorded individually at biweekly intervals and from this data the average weekly bodyweight gain per bird was calculated for various treatment groups.

Feed consumption and FCR: Weekly feed consumption was calculated by offering the measured quantity of feed at the beginning of the week and subtracting the left over residue. The feed conversion ratio (FCR) was calculated by dividing the weekly feed consumption by weekly weight gain. The weekly feed conversion ratio was determined by using the formula given here.

$$\text{Feed Conversion Ratio (FCR)} = \frac{\text{Feed consumed (g)}}{\text{Bodyweight gain (g)}}$$

The egg production and egg quality parameters were studied from 18 to 40 weeks age of birds.

Statistical analysis: The data on weekly live body weights, body weight gain, feed consumption and feed efficiency were analyzed by using two way factorial Randomized Block design and other parameters were analyzed by using simple complete Randomized Design as per methods described by snedecor and cochrane (1994).

RESULT AND DISCUSSION

Biweekly bodyweight: In this study, bodyweight

of individual hen was recorded 22 weeks onwards at biweekly interval. The bodyweight of hen ranged between 1259.75 g to 1425.67 g in different treatments at 22 weeks of age, whereas at 32 weeks of age the bodyweight was significantly higher in T₃ and significantly lower in T₅. Table 2 These results were in accordance with Onunkwo and George (2015). Similarly, Voemesse *et al.* (2019) found that *M. oleifera* leaf meal was used in layer chickens' diet from 1 day old to 55 weeks of age to investigate the effects on growth performance. *M. oleifera* leaf meal was used at three different levels (0%, 1%, and 3%). In the laying period, from 21 weeks to 55 weeks, feed intake was lower in moringa fed groups, but the laying per cent and FCR were higher in supplemented fed groups than the non-supplemented groups. The higher bodyweight gain and egg production can be related to improved digestibility in supplemented groups due to different active components in moringa leaves. The author concluded that feeding moringa leaf meal at 1% level had positive effects on the growth and egg production in laying hens. In addition, *Moringa oleifera* at 10% level showed high egg production in laying hens. Also, results found by Kakengi *et al.* (2007), Olugbemi *et al.* (2010) and Abou-Elezz *et al.* (2011) and were in accordance with our findings.

Biweekly feed intake: The biweekly feed intake in birds given conventional feed, organic feed or organic feed supplemented with MLP at 2.5, 5, 7.5 and 10% levels are presented in Table 3. The total feed intake from 22 to 40

Table 1. Nutrient composition of starter, grower and layer

Nutrient (%)	Pre starter	Starter	Finisher group
Crude protein	23.01	22.03	20.00
Calcium	1.00	1.09	1.02
Available Phosphorus	0.46	0.45	0.46
Lysine	1.31	1.20	1.10
Methionine	0.50	0.49	0.45
Me, Kcal/kg	2991.91	3097.12	3183.80

*The experimental diets were formulated as per BIS (2007).

Table 2. Effect of Moringa leaf powder on biweekly bodyweights (g) of Poultry chicken

Age (Weeks)	T ₁ Control (Conventional feed)	T ₂ (Organic feed)	T ₃ (T ₂ + MLP @ 2.5%)	T ₄ (T ₂ + MLP @ 5%)	T ₅ (T ₂ + MLP @ 7.5%)	T ₆ (T ₂ + MLP @ 10%)	SEM
22	1270.88 ±56.59cd	1259.75 ±116.44cd	1339.97 ±43.02abc	1425.67 ±66.04a	1362.84 ±70.06abc	1336.20 ±89.14abc	63.09
24	1322.62 ±111.25b	1348.59 ±173.66ab	1391.87 ±73.85ab	1505.64 ±5.54a	1415.62 ±98.54ab	1380.12 ±53.53ab	82.05
26	1392.02 ±105.19b	1423.77 ±143.51ab	1417.49 ±112.07ab	1587.24 ±1.12a	1429.77 ±86.95ab	1424.54 ±113.64ab	84.79
28	1267.0 ±33.36	1328.91 ±104.62	1396.01 ±62.97	1444.60 ±37.36	1372.98 ±162.72	1329.25 ±131.15	82.39
30	1337.58 ±19.85	1380.73 ±80.85	1369.29 ±22.81	1463.39 ±38.11	1367.09 ±146.47	1359.48 ±179.92	83.48
32	1361.82 ±94.03ab	1372.93 ±110.37ab	1481.45 ±16.15a	1413.50 ±28.55ab	1273.20 ±22.0b	1385.58 ±216.98ab	87.98

*Significant level was (P≤5); SEM, Standard error of mean.

weeks of age was almost similar in different treatment groups and the differences in the feed intake among different treatment groups were found to be non-significant. Lu *et al.* (2016) observed that *M. oleifera* leaf meal had no effect on feed intake in Hy-Line Grey commercial layers, but birds fed with moringa leaf meal at 15% levels showed deeper egg yolk colour than the non-supplemented group. Similar results were also reported by Abou-Elezz *et al.* (2011) and Kakengi *et al.* (2007).

Production performance: Data have shown that MLP supplementation at 5% or more significantly reduce age in the first egg laid and years in sexual maturity in chickens. The average egg weight at 40 weeks of age was between 39.35 to 41.40 g and the difference was not statistically significant. Hen day egg production was higher in T₄ group (56.91 eggs) and T₅ group (56.32) compared to other treatments. A similar trend was found in hen house egg production suggesting that MLP infusion of 5% or 7.5% improves egg production. Similarly, the effectiveness of feed conversion was better in T₄ and T₅ compared to other treatments. The efficacy of the lowest feed conversion was found in T₁ group (Table 4). Higher weight gain and egg production may be associated with improved digestion in additional groups due to the various

active components in the moringa leaves. It was concluded that feeding moringa leaf powder at 1% had a positive effect on the growth and production of eggs in breeding hens. In addition, *Moringa oleifera* at 10% levels showed higher egg production in laying hens (Siddhuraju and Becker 2003). Available literature has shown that efforts to improve poultry production and production through the development of nutritious food using *Moringa oleifera* also received similar results Jayanti *et al.* (2017) showed that an excellent rate of weekly feed conversion (FCR) was obtained using 0.2% *Moringa oleifera* leaf powder at all times compared with controls and other treatments. The best rate of cumulated feed conversion was found in all treatment groups compared to the control group.

Egg quality: Egg quality characteristics are shown in Table 5. The difference in the quality parameters of different eggs between different treatment groups was small and statistically significant, other than egg colour, as the MLP level increased by more than 5% the value of egg yolk colour increased significantly. Total egg quality range was better for MLP supplemented foods at 5 or 7.5% compared to other treatment groups. Mahfuz and Piao *et al.* (2019) observed significant findings in *M.oleifera*'s role in breeding hens summarizing that egg quality parameters,

Table 3. Effect of Moringa leaf powder on biweekly feed intake (g) under organic management

Age (Weeks)	T ₁ Control (Conventional feed)	T ₂ (Organic feed)	T ₃ (T ₂ + MLP @ 2.5%)	T ₄ (T ₂ + MLP @ 5%)	T ₅ (T ₂ + MLP @ 7.5%)	T ₆ (T ₂ + MLP @ 10%)	SEm±
22	1115.47±81.03	1089.23±40.41	1074.5±14.63	1055.2±16.32	1087.56±19.84	1066.54±17.69	32.29
24	1174.26±85.31	1165.23±43.23	1136.55±15.47	1142.56±17.67	1175.26±21.44	1148.56±19.06	34.19
26	1295.43±94.11	1262.78±46.85	1262.85±17.19	1245.78±19.27	1265.12±23.07	1260.45±20.91	37.55
28	1366.52±99.27a	1318.26±48.91ab	1300.25±17.70ab	1268.45±19.62b	1299.56±23.71ab	1312.89±21.78ab	39.41
30	1439.54±104.58a	1387.5±51.48a	1345.26±18.32b	1345.12±20.80b	1325.89±24.18b	1367.22±22.68ab	41.44
32	1535.26±111.53a	1454.88±53.98ab	1387.12±18.89b	1375.2±21.27b	1389.56±25.35b	1399.45±23.22b	43.90
34	1475.56±107.19	1385.95±51.42	1405.56±19.14	1387.12±21.46	1394.5±25.44	1425.58±23.65	42.38
36	1505.89±109.39a	1407.43±52.22b	1435.43±19.55ab	1412.87±21.85ab	1425.5±26.00ab	1440.86±23.91ab	43.21
38	1528.45±111.03	1485.87±55.13	1486.9±20.25	1487.5±23.01	1497.52±27.32	1512.87±25.10	44.32
40	1555.78±113.02	1589.56±58.98	1527.6±20.80	1502.5±23.24	1535.68±28.01	1554.73±25.79	45.55
Total	13612.16±988.91	13416.69±497.84	13362.02±181.98	13202.3±204.23	13356.15±243.67	13489.15±223.83	3.95

*Significant level was P≤5; SEM, Standard error of mean.

Table 4. Effect of supplementation of Moringa leaf powder on production performance of chicken reared under organic management

Parameter	T ₁ Control (Conventional feed)	T ₂ (Organic feed)	T ₃ (T ₂ + MLP @ 2.5%)	T ₄ (T ₂ + MLP @ 5%)	T ₅ (T ₂ + MLP @ 7.5%)	T ₆ (T ₂ + MLP @ 10%)	SEm±
Age at first egg (d)	172±11.31a	162±5.59ab	160±4.72b	123±5.59c	125±3.55c	131±2.17c	5.06
Age at sexual maturity (d)	193±12.70a	175±6.04b	185±5.46ab	152±6.91c	157±4.46c	157±2.60c	5.79
Egg weight in g (40 weeks)	39.48±2.60	39.60±1.36	39.35±1.16	39.93±1.81	41.4±1.17	40.13±0.66	1.29
<i>Egg Production (40 weeks)</i>							
Hen day egg production	47.66±3.13c	50.33±1.42bc	50.67±1.49bc	56.91±1.96a	56.32±2.56a	52.37±0.86b	1.67
Hen house egg production	34.88±2.29c	35.89±1.01c	38.64±1.14b	43.77±1.51a	43.68±1.98a	41.19±0.68b	1.26
Survivor egg production	65.57±4.31ef	74.62±2.12bc	72.07±2.13cd	85.15±2.94a	75.80±3.44bc	68.58±1.13de	2.34
Feed conversion efficiency (kg feed /dozen egg)	3.75±0.17a	2.78±0.09b	2.74±0.04b	2.45±0.16c	2.47±0.07c	2.88±0.086b	0.09

*Significant level was P≤5; SEM, Standard error of mean.

Table 5. Egg quality traits in birds fed diets supplemented with Moringa leaf powder

Particulars	T ₁ Control (Conventional feed)	T ₂ (Organic feed)	T ₃ (T ₂ + MLP @ 2.5%)	T ₄ (T ₂ + MLP @ 5%)	T ₅ (T ₂ + MLP @ 7.5%)	T ₆ (T ₂ + MLP @ 10%)	SEM±
Egg weight (g)	43.67±5.50	46.67±5.13	46.33±5.13	47.33±5.68	44.67±7.63	43.00±2.0	4.44
Shape index (%)	73.95±1.71	72.39±3.94	73.44±1.33	73.59±1.84	72.79±2.46	73.07±1.57	1.89
Colour	6.35±0.03b	6.59±0.07b	6.87±0.08b	7.01±0.09a	7.15±0.17a	7.75±0.12a	0.10
Haugh unit (score)	69.35±13.55	65.25±15.15	70.37±15.40	74.40±12.12	72.50±10.41	66.07±6.28	10.24
Egg shell weight (g)	4.3±0.31	4.5±0.45	4.8±0.06	4.7±0.12	4.7±0.43	4.5±0.07	0.23
Egg shell thickness (mm)	0.30±0.02	0.30±0.03	0.34±0.01	0.32±0.01	0.32±0.03	0.31±0.01	0.01
Yolk wt. (g)	14.2±1.03	14.8±1.49	16.3±0.22	15.6±0.42	15.7±0.26	15.8±1.08	0.79
Overall grade	A	A	A	AA	AA	A	-

*Significant level was $P \leq 5$; SEM, Standard error of mean.

including egg size, texture, colour, shell thickness, and egg yolk, have a direct and indirect effect on egg buyers. Similarly, Abou-Elezz *et al.* (2011) found that the diet of the *Moringa oleifera* leaf can improve the egg yolk colour and percentage of albumen. Similar results were observed by Olugbemi *et al.* (2010) and Shad Mahfuz and Xiang Shu Piao (2019).

From this study it can be concluded that egg production was higher in organic as compared to conventional fed group when the diet was supplemented with 5 and 7.5% MLP, but subsequent increase in MLP level decreases egg production. The efficiency and economics of egg production were better in the groups supplemented with 5 and 7.5% MLP. From the growth and production data, it may be concluded that the MLP may be included at up to 5% level for growth and 5 or 7.5% level for egg production with advantage.

ACKNOWLEDGEMENTS

The authors are grateful to division of Agricultural Education, ICAR, New Delhi for providing financial support through Niche Area of Excellence on Organic Poultry.

REFERENCES

- Abou-Elezz F M K, Sarmiento-Franco L, Santos-Ricalde R and Solorio-Sanchez F. 2011. Nutritional effects of dietary inclusion of *Leucaena leucocephala* and *Moringa oleifera* leaf meal on Rhode Island Red hens' performance. *Cuban Journal of Agriculture Science* **45**: 163–69.
- Abousekken M S M. 2015. Performance, Immune response and carcass quality of broilers fed low protein diets contained either *Moringa oleifera* leaves meal or its extract. *Journal of American Science* **11**(6): 153–64.
- AOAC 2012. *Association of Official Analytical Chemist*. Official Method of Analysis of AOAC international, 19th Edn. Washington D.C., U.S.A.
- BIS. 2007. *Nutrient Requirements of Poultry*. Bureau of Indian Standards, 5th revision, New Delhi, India.
- Gakuya D W, Mbugua P N, Kavoi B and Kiama S G. 2014. Effect of supplementation of *Moringa oleifera* leaf meal in broiler chicken feed. *International Journal of Poultry Sciences* **13**(4): 208–13.
- Jayanti L A, Manwar S J, Khose K K and Wade M R. 2017. Effect of supplementation of *Moringa oleifera* leaf powder on growth performance of broilers. *Journal of Poultry Science and Technology* **5**(03): 28–34.
- Kakengi A V M, Kaijage J T, Sarwatt S V, Mutayoba S K, Shem M N and Fujihara T. 2007. Effect of *Moringa oleifera* leaf meal as a substitute for sunflower seed meal on performance of laying hens in Tanzania. *Livestock Research and Rural Development* **19**(8): 120.
- Lu J, Wang H J, Zhang S G, Wu and G H Qi. 2016. Evaluation of *Moringa oleifera* leaf in laying hens: Effects on laying performance, egg quality, plasma biochemistry and organ histopathological indices, *Italian Journal of Animal Science* **15**(4): 658–65.
- Mahfuz S and Xiang S P (2019). Application of *Moringa oleifera* as a natural feed supplement in poultry diets *Animals* **(9)**: 1–19.
- Makkar H P S and Becker K. 1997. Nutrients and anti-quality factors in different morphological parts of the *Moringa oleifera* tree. *The Journal of Agricultural Science* **128**: 311–22.
- Olugbemi T S, Mutayoba S K and Lekule F P. 2010. Effect of *Moringa (Moringa oleifera)* inclusion in cassava based diets fed to broiler chickens. *International Journal of Poultry Science* **9**(4): 363–67.
- Onunkwo D N and George O S. 2015. Effect of *Moringa oleifera* leaf meal on the growth performance and carcass characteristics of broiler birds. *IOSR. Journal of Agriculture and Veterinary Science* **8**(3): 63–66.
- Sidduraju P and Becker K. 2003. Antioxidant properties of various solvent extracts of total phenolic constituents from three different agroclimatic origins of drumstick tree (*Moringa oleifera* Lam.) Leaves, *Journal of Agricultural and Food Chemistry* **51**(8): 2144–55.
- Snedecor G W and Cochran W G. 1994. *Statistical Methods*. 9th edn. Affiliated East-West Press, Iowa State University Press.
- Voemesse K, Tete A, Nideou D, N'nanle O, Tete-Benissan A, Oke O E, Gbeassor M, Decuyper E and Tona K. 2019. Effect of *Moringa oleifera* leaves meal in the diet in layer performance, haematological and serum biochemical values, *European Poultry Science* **83**: 1399/eps. 263.