INTERNATIONAL JOURNAL OF BUSINESS, SOCIAL AND SCIENTIFIC RESEARCH
ISSN: 2309-7892 (Online), 2519-5530 (Print), Volume: 6, Issue: 4, Page: 32-36, July - December 2018

DIETARY EFFECT OF MULBERRY LEAF (*Morus alba*) MEAL IN THE REDUCTION OF BLOOD CHOLESTEROL OF LAYING HENS

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[**Citation:** M. Kamruzzaman, M. S. Islam, K. A. Ferdous, M. A. Haque, F. Afroz and M. K. Rahman (2018). Dietary Effect of Mulberry Leaf (*Morus alba*) Meal in the Reduction of Blood Cholesterol of Laying Hens. *Int. J. Bus. Soc. Sci. Res.* 6(4): 32-36. Retrieve from http://www.ijbssr.com/currentissueview/14013291]

Received Date: 13/08/2017 *Acceptance Date: 11/09/2018* *Published Date: 12/09/2018*

Abstract

The study was conducted at the poultry farm and Dairy and poultry science laboratory, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur district from 18 Jan-18 April, 2011. The objective of this study was to determine the effects of various dietary levels of mulberry (*Morus alba*) leaf meal on production performance, egg qualities and blood cholesterol of laying hens. In this study, Forty-eight 30-wk-old laying hens (Hi-sex brown) were divided into 4 dietary groups each with 4 replications (three birds/replication) and offered manually prepared diets supplemented with 0, 3, 6 and 9% mulberry leaf meal for 8 weeks. Eggs were collected and weighted daily. Laying performance, egg quality and feed conversion ratio were evaluated. Results showed that the feed intake, egg production, egg weight, egg mass, feed conversion ratio, body weight and egg qualities were insignificant among the treatment groups. The blood cholesterol was found to decrease ($P < 0.05$) at 3.0, 6.0 and 9.0 % of mulberry leaves inclusion. Likewise, triglyceride was also found to decrease ($P < 0.05$) at 3.0 to 9.0 % of inclusion. Based on the results, it could be concluded that the supplementation of mulberry leaf meal up to my investigation level (9%) has potentiality in reduction of blood cholesterol.

Key Words: Mulberry leaves, performance, egg quality, cholesterol.

Introduction

Poultry production has greatly flourished during last three decades in Bangladesh. Poultry is one of the most important sectors of livestock that provides cheapest animal protein (nutritious egg and meat) for human consumption within shortest period of time. Poultry feed ingredients animal protein sources in particular, are very expensive and scarce due to high competition among poultry, human and other animals resulting in the escalating cost of these ingredients. The feed cost usually constitutes the major proportion which ranges between 60-75% of the total cost of poultry production and protein cost account for over 15% of the total feed cost in livestock and poultry farming (Ojewola *et al.*, 2005). The prices of conventional protein source feed ingredients such as groundnut cake; fish meal and soybean meal are always high and cannot permit profit maximization in poultry ventures. In view of this, current research interest in the poultry industry is aimed at finding alternatives to those elusive feed ingredients. The list of possible feed alternatives includes tree fodder mulberry leaves (*Morus alba)* as a source of dietary protein for commercial livestock and poultry operations. Mulberry grows well in the tropics and subtropics. It is reported to have excellent nutritional value as forage. It is grown extensively for its leaves which are used for raising silkworms in the sericulture industry. Mulberry leaves are rich in protein (15-35%), minerals (Ca 2.42-4.71%, P 0.23-0.97%) and metabolizable energy (1130-2240 kcal/kg) with absence of or negligible anti-nutritional factors (Sarita *et al.*, 2006). Ordinary chicken eggs provide protein, vitamins, and lipids that contain high levels of cholesterol. Thus, eggs are considered to be a high-cholesterol food. The American Heart Association recommended that cholesterol consumption for each person should be limited up to 300 mg per day and the whole egg yolk consumption should be limited to three to four

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per week. In recent days, consumers pay more attention to health and are thus lowering their consumption of high-cholesterol food. But, the consumers have to intake eggs at regular interval which contain cholesterol that risk for health. Therefore, low-cholesterol eggs would not only be beneficial to public's health but also bear business advantage. The mulberry leaves reduced the concentration of serum lipids and athermanous thickening of arterial intima in hypercholesterolemia rabbits. Although much work has been done on the utilization of rats, mice and rabbits, reports on the use of mulberry leaves in poultry feeds are limited. Thus there is a need to study the mulberry leaves supplementation in poultry diets on production performance, carcass quality, egg quality, and cholesterol and triglyceride in blood, meat and egg. (Dot et al., 2000)

Therefore, present piece of research work was undertaken with the following objectives:

i) To observe whether the MLM has potentiality in reduction of blood cholesterol.

ii) To observe whether the dietary supplementation of MLM up to 9% level causes any alteration of egg quality characteristics and production performance.

Materials and methods

This study was conducted at the poultry farm and dairy and poultry science laboratory, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur district from 18 Jan-18 April, 2011. In an 8-week experiment period, 48 Hi-sex brown laying hens (age 30 weeks) were assigned to four dietary treatments with four replication of three (3) birds in each. The experimental birds were housed in cages. Each compartment of the poultry cages has the dimensions of 35 cm length, 20cm breath and 37cm height where two birds were kept in each compartment. The cages and the poultry house were disinfected and fumigated properly before placing the birds. Mulberry leaves were collected from the local area of Dinajpur district. The leaves were initially cut into small pieces and then sun-dried for about fifteen (15) days. The sun-dried mulberry leaves were milled into a powder. The diets were formulated to as per recommendation of the National Research Council (NRC, 1994) to satisfy the nutrients requirement of the laying hens. Diets were supplied with 0 (control), 3, 6 and 9% sun-dried mulberry leaf meal. Feed and water were provided *adlibitum*. The chemical composition of experimental diets is shown in the table 1. During the experimental period, eggs were collected and weighed daily. Data on feed intake were collected weekly. Initial and final body weights of birds were taken. The eggs used in the experiment were collected per hen on day zero (0) and after 15 days interval up to two months. Egg production recorded daily but external and internal quality characteristics of eggs were determined bi-weekly. Egg qualities were measured from those eggs laid by birds of different diets group. At the end of the experiment, two birds of each replicates were selected at random and blood taken from the vein and centrifuged at 3,000 rpm for 20 min. The blood plasma was stored at –30 °C until analyzed. The cholesterols and triglycerides were determined using the technique and measured by spectrophotometer.

Statistical analyses

Data were analyzed by analysis of variance using Completely Randomized Design with factorial arrangement of time and treatments (Steel and Torrie, 1986). The significance differences between the treatment means were calculated by the Duncan's Multiple Range Test (Duncan 1955). All analyses were performed by Mstat-c and SPSS Program.

Table 1: Chemical composition of experimental diets

Feed ingredients	**Dietary level of mulberry leaf meal(MLM)**			
	T_1(Kg) (0%)	**T_2(Kg) (3 %)**	**T_3(Kg) (6 %)**	**T_4(Kg) (9 %)**
Maize	53	53	51	51
Soybean meal	22.6	21.1	20.1	20.1
Rice polish	11.5	10	10	9
Meat & bone meal	4	4	4	2
Oyster shell	7.8	7.8	7.8	7.8
DCP	0.75	0.75	0.78	0.75
Mulberry leaves	0	3	6	9
Salt	0.35	0.35	0.35	0.35
Vitamin-mineral premix*	*	*	*	*

Feed ingredients	Dietary level of mulberry leaf meal(MLM)			
	T_1(Kg) (0%)	T_2(Kg) (3 %)	T_3(Kg) (6 %)	T_4(Kg) (9 %)
Calculated composition:				
ME (Kcal/Kg)	2727.9	2742.3	2693.9	2698.5
CP (%)	17.77	17.53	17.06	16.69
CF (%)	3.28	3.52	3.05	3.20
Ca (%)	3.51	3.45	3.6	3.49
P (%)	0.45	0.50	0.70	0.46
Lysine (%)	0.94	0.96	0.90	0.85
Methionine (%)	0.28	0.32	0.34	0.35

Results and Discussion

Laying performances

Egg production: The hen day egg production observed in different dietary treatments was almost similar and the differences were statistically non-significant (P> 0.05) (Table 2). Result indicates that the feeding of mulberry leaf meal up to 9 percent in the diet of laying hen has no detrimental effect on egg production. Feeding of mulberry leaf meal in up to 6 percent levels showed slightly higher egg production whereas the production was slightly decreased when the birds received 9 percent mulberry leaf meal in the diet. These results are closed with the previous report of Lokaewmanee *et al.* (2009), however slightly differed from the observations of Ravindran *et al.* (1986), who found decreased egg production with the increased of the mulberry leaf meal. Similarly, egg production of White Leghorn birds was not different from the control groups by feeding up to 9% mulberry leaf meal (Suda, 1999).

Body weight: Body weight in different dietary treatments during experimental periods was almost similar and the differences were not significant (P> 0.05) (Table 2).These results indicate that inclusion up to 9 percent mulberry leaf meal had no adverse effect on body weight. However, the body weight slightly improved in the dietary treatment at 6 percent mulberry leaf meal in comparison to T_1 (control). This is in agreement with the results of Machii (2000) who observed there was no adverse effect of mulberry leaf meal on body weight when mulberry leaves were given as part of the diet to domestic fowl.

Feed intake: Feed intake of laying hens in different dietary treatments during experimental periods was almost statistically similar and the differences were non-significant (P> 0.05) (Table 2). So, the result clearly showed that mulberry leaf meal up to 9 percent dietary level had no detrimental effect on feed consumption. Similar results have been observed by Lokaewmanee *et al.* (2009) who found that there was no adverse effect in feed intake compared to control. But, Ravindran *et al.* (1986), Limcangco-Lopez (1989), Udedibie and Opara (1998), Odunsi (2003) and Akande *et al.* (2007) reported a reduction in feed intake with increased dietary leaf meals in the diets for broilers and laying hens. A decrease in feed intake for increased levels of mulberry leaf may be due to bulkiness and unpalatable taste which may affect the appetite of the birds.

Feed conversion ratio: Feed conversion ratio in different dietary treatments at 3, 6 and 9 percent level was almost similar and the differences were non-significant P> 0.05(Table 2).The results indicate that there was no detrimental effect on feed conversion ratio after feeding up to 9 percent level of mulberry leaf meal. This is in agreement with the results of Machii (2000) who observed there was no adverse effect of mulberry leaf meal on feed conversion ratio (FCR) when mulberry leaves were given as part of the diet to domestic fowl.

External and internal egg quality: It was observed that the shape index, shell thickness, albumin weight, albumin index, yolk weight, yolk index and Haugh of the eggs laid by hens fed different diets were almost similar during experimental periods and the differences were non-significant (P> 0.05) (Table 3). These results indicate that feeding mulberry leaf meal up to 9 percent level had no adverse effect on external and internal qualities of eggs. However, egg shell weight (gm) decreased slightly after supplementation of 3-9% mulberry leaf meal. Egg shell thickness slightly improved at the level of 6 percent mulberry leaf meal. Albumin weight decreased in the dietary treatments 3 and 6% but a little bit increased in dietary treatment 9% from those of control groups. Albumin index improved

slightly after inclusion of mulberry leaf meal in comparison to control. Moreover, Yolk weight and yolk index slightly decreased after the inclusion of 3-9% mulberry leaf meal but yolk index slightly improved at 6 percent level of mulberry leaf meal. Haugh unit decreased at 6 percent levels but, improved at 9 percent mulberry leaf meal. Similar results have been obtained by Tateno *et al.* (1999) and Sudo *et al*. (2000) who did not found any significant differences in the external and internal qualities of eggs up to 9 percent level of mulberry leaf meal.

Blood cholesterol: The effects of dietary mulberry leaves on plasma cholesterol and triglyceride are given in table 4. Total cholesterol and triglyceride content were lower significantly different ($P < 0.05$) for groups fed mulberry leaves diets compared to the control. This is perhaps because of its crude fiber content. Tasi *et al.* reported serum cholesterol levels in rats decreased as dietary fiber content increased. Similar results were observed in laying hens. Similarly, Kawrhung 1996 reported that rabbits fed a high cholesterol diet and mulberry leaves at 2.5 %, showed a decrease in the levels of cholesterol in their blood by a half during 10 weeks.

Table 2: Effect of mulberry leaf meal (*Morus alba*) on laying performance

Parameters	Mulberry leaf supplementation (%)				Level of significance
	T_1 0% (Control)	T_2 3 % MLM	T_3 6 % MLM	T_4 9 % MLM	
Body weight (gm)	1745 ± 23.4	1730 ± 18.3	1754 ± 15.8	1742 ± 20.1	NS
Egg production (%)	88.48 ± 0.70	88.53± 0.67	88.78 ± 0.59	88.32 ± 0.45	NS
Feed intake (gm/hen/d)	112.8 ± 2.45	112.3 ± 2.08	111.8 ± 2.03	112.2 ± 2.31	NS
Egg weight (gm/egg)	63.40 ± 0.53	63.33 ± 0.51	62.84 ± 0.44	63.36 ± 0.41	NS
Egg mass (gm/hen/d)	56.84 ± 1.72	56.92 ± 2.10	56.86 ± 1.56	56.31 ± 1.60	NS
Feed conversion ratio (gm feed /gm egg)	1.98 ± 0.07	1.97 ± 0.05	1.95 ± 0.04	1.96 ± 0.08	NS

Values are expressed as mean ± standard error of means. NS: Statistically not significant (P > 0.05). Means represent four replicates, three birds per replicate. MLM= Mulberry Leaf Meal.

Table 3: Effect of mulberry leaf meal (*Morus alba*) on quality characteristics of egg

Parameters	**Mulberry leaf supplementation (%)**				**Level of significance**
	T_1 0% (Control)	**T_2 3 % MLM**	**T_3 6 % MLM**	**T_4 9 % MLM**	
Egg Shell weight (gm/egg)	6.56 ± 0.09	6.41 ± 0.12	6.53 ± 0.09	6.50 ± 0.11	NS
Shape index (%)	80.04 ± 0.67	80.54 ± 0.86	81.59 ± 0.64	79.93 ± 0.83	NS
Shell thickness (mm)	0.40 ± 0.02	0.40 ± 0.02	0.41 ± 0.00	0.40 ± 0.01	NS
Albumin weight (gm/egg)	37.06 ± 0.77	36.87 ± 0.67	36.87 ± 0.70	37.86 ± 0.67	NS
Albumin index (%)	8.35 ± 0.28	8.40 ± 0.32	8.55 ± 0.38	8.40 ± 0.30	NS
Yolk weight (gm/egg)	17.24 ± 0.09	17.09 ± 0.08	17.12 ± 0.1	17.15 ± 0.11	NS
Yolk index (%)	42.7 ± 0.42	42.5 ± 0.36	42.9 ± 0.39	41.3 ± 0.35	NS
Haugh unit (%)	89.07 ± 2.33	88.56 ± 1.92	88.85 ± 2.12	89.19 ± 2.30	NS

*Values are expressed as mean ± standard error of means. a, b, c Means within row with different superscripts are statistically different (P <0.05). NS: Statistically not significant (P> 0.05). * Statistically significant (P <0.05).Means represents four replicates, three birds per replicate. MLM= Mulberry Leaf Meal.*

Table 4: Effect of mulberry leaves supplementation on plasma cholesterol and triglyceride content

Parameters	Level of mulberry leaves (%)					
	0	3	6	9	C.V.	F-test
Cholesterol (mg/dl)	95.00^{a}	78.12^{b}	90.00^{ab}	72.50^{c}	1.23	*
Triglyceride (mg/dl)	862.36^{a}	745.00^{b}	810.53^{ab}	712.11^{c}	1.17	*

Different superscripts in the same row show significant differences at the 5 % level

From the above discussion, it is said that blood cholesterol was decreased significantly without affecting egg qualities with increased level of mulberry leaf meal supplementation. Mulberry leaves contain phytosterol that is responsible for lower absorption of cholesterol from the intestine.

Conclusion

Based on the results of present study it may be concluded that mulberry leaf is a good source of protein and it has significant effect on the blood cholesterol and triglyceride was found to decrease at higher levels of mulberry leaves inclusion without affecting the bird's feed intake, body weight and egg quality characteristics. The results of the study suggest that supplementation of mulberry leaf meal (*Morus alba*) up to my investigation level (9%) in diets has high potential as commercial applications for production of low-cholesterol containing eggs and healthy birds. Therefore, mulberry leaf meal may be used along with the other conventional feed ingredients.

References

Akande, T. O., Adeyeri, M.K. Longe, O. G., Odunsi, A. A. (2007). Response of laying chickens to graded levels of Tephrosia bracteolate leaf meal fed with soybean meal or full fat soybean meal. Livestock Research for Rural Development 19:108.

Duncan, D. B. (1955). Multiple Ranges and Multiple F test. Biometric, 11:5-42.

Dot, K., Kojima, T. and Fujimoto, Y. (2000). Mulberry leaf extract in habits the oxidative modification of rabbit and human low density lipoprotein. Biol. Pharm. Bull. 23, 1066-71.

Kawrhung, W. (1996). Utilization and Products of Mulberry, Mulberry and Silk Research Institute Department of Agriculture Minister of Agriculture and Cooperation, Bangkok, 24.

Limcangco-Lopez, P. D. (1989). The use of shrubs and tree fodders by non-ruminants. pp 61-73 in Proc. Workshop Shrubs and tree fodders for farm animals, Denpasar, Indonesia.

Lokaewmanee, K., Mompanuon, S., Khumpeerawat, P.; Yamauchi, K. (2009). Effects of dietary mulberry leaves (*Morus alba L.*) on egg yolk color, 46: 112-115.

Machii, H. (2000). Evaluation and utilization of mulberry for poultry production in Japan. In: Mulberry for Animal Production. FAO Anim. Prod. & Health Roma, Italy, 147: 241-248.

Odunsi A. A. (2003). Assessment of Lablab purpureus leaf meal as a feed ingredient and yolk coloring agent on the diet of layers. International Journal of Poultry Science, 2:71-74.

Ojewola, G. S., Okoye, F. C. and Ukoha, O. A. (2005). Comparative utilization of three animal protein sources by broiler chickens. Int. J. Poult. Sci., 4970: 462-467.

Ravindran, V., Kornegay, E. T., Rajaguru, A. S. B., Potter, L. M. and Cherry, J. A. (1986). Cassava leaf meal as a replacement for coconut oil meal in broiler diets. Poultry Science, 65:1720-1727.

Sarita, S., Rashmi, K., Anju, T. and Rajesh Prakash (2006). Nutritional quality of leaves of some genotypes of mulberry (*Morus alba*). Int. Journal of Food Science and Nutrition. 57(5/6): 305-313.

Steel, R. D. G. and Torrie, J. H. (1986). Principles and procedures of statistics. New York, McGraw-Hill, 137- 191: 236-372.

Suda, T. (1999). Inhibitory effect of mulberry leaves on ammonium emission from poultry excrement. Abstracts of Gunma Agriculture-related Experiment Stations Meeting, 7-8.

Sudo, M., Kuramoto, H. and Iso, M. (2000).Studies on functional poultry eggs. Effects of mulberry leaves on quantity & quality of eggs. Bull. Ibaraki Prefectural Poultry Experiment Station, 35 (in Japanese).

Tateno H., Yatabe, T. and Iso, M. (1999). Studies on foliage of unused resources. Effects of mulberry leaves on egg production as a poultry food. Bulletin of Ibaraki Prefectural Poultry Experiment Station, 33:15-20 (in Japanese)

Udedibie, A. B. I., Opara, C. C. (1998). Responses of growing broilers and laying hens to the dietary inclusion of leaf meal from Alchornia cordifolia. Anim. Feed. Science Technology, 71:157-164.