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Influence of *Eugenia jambolana* and *Psidium guajava* Leaf Meal Mixture Supplementation on Carcass Characteristics and Economics of Broiler Chickens

M.A. Zargar, A.K. Pathak*, R.K. Sharma and M.I. Daing

Division of Animal Nutrition, Faculty of Veterinary Sciences & A.H., Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, R.S. Pura, (J & K), INDIA

**Corresponding author: AK Pathak; E-mail: dranand_pathak@yahoo.com*

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ABSTRACT

Present study was conducted in 120 day-old unsexed broiler chicks. They were randomly distributed into 4 dietary treatments (T_1, T_2, T_3 and T_4) supplemented with leaf meal mixture (LMM) of *Eugenia jambolana* and *Psidium guajava*@ 0, 2.5, 5.0 and 7.5 % of diet, respectively of 30 birds per treatment, each having 3 replicates (10 chicks per replicate) in a complete randomized block design (CRD). Significantly ($P<0.05$) higher mean body weight was observed in T_1 as compared to T_2, T_3 and T_4 groups. Carcass yields viz. live weight, de-feathered weight, slaughtered weight and eviscerated weights (in gram and % LWt.) were statistically non significant ($P>0.05$) with and without LMM supplemented diets. However, weights of spleen and liver were significantly ($P<0.000$, $P<0.026$) higher in LMM supplemented groups as compared to un-supplemented control (T_1). Dietary supplementation significantly reduced abdominal fat content in T_4 compared to T_1, whereas, T_2 and T_3 have an intermediate values between T_1 and T_4 and increased the net profit, it ranged from ₹ 30.41 to 34.24 per bird.

Keywords: Broiler chickens, Carcass characteristics, Economics, LMM

Broiler chicken production plays a significant role in human nutrition and as income sources for improving livelihood security of rural poor families. Broiler chicken provides an immense supply of animal protein for the world's human population. It is one of the most profitable businesses in agriculture as it provides nutritious meat within a short period of time. However, prices of poultry feed ingredients have increased dramatically over the past decade. Much of this cost increase has resulted from the short supply as a result of industrial and human needs. With increasing prices, managing the cost of poultry feed is becoming more important. Nutritionists have emphasized the need for utilizing locally available alternative feed resources (Al-Ruqaie *et al*., 2011; Pathak *et al*., 2013; Shafey *et al*., 2011). Thus, there is a need to look inwards for other alternative cheap sources of feed ingredients, which are not consumed by humans for the formulation of balanced ration for broilers. One possible alternative source of cheap feedstuff is the LM of some trees. The LM and LMM of various trees have been incorporated in the diets of broiler as a means of reducing the high cost of conventional feed ingredients (Daing *et al*., 2017a,b; Pathak, 2017; Zargar *et al*., 2017). It was reported that LM not only serve as protein source but also provide some necessary vitamins, minerals, potent source of PSMs especially CT (Pathak *et al*., 2015) as natural antioxidants and natural compounds having potent anti-parasitic properties (Daing *et al*., 2017a,b; Pathak *et al*., 2013, 2017; Zargar *et al*., 2016, 2017).

Leaf meals have been incorporated in the diets of broilers as a means of reducing the high cost of conventional feed ingredients. Introducing unconventional feed ingredients as cheap alternatives appear a realistic step for poultry

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nutritionists. Keeping all these point in view, the present study was designed to evaluate the effect of graded level of *Eugenia jambolana* and *Psidium guajava* LMM supplementation as partial replacer of costlier maize on growth, carcass characteristics and economics of broiler chickens.

MATERIALS AND METHODS

Fresh leaves of *Eugenia jambolana* and *Psidium guajava* were harvested from Faculty premises and air-dried in the shed for 12-15 days. Dried leaves were milled through laboratory hammer mill. LMM and experimental broiler diets were analyzed for proximate composition as per standard protocol. Before arrival of chicks management of brooder and shed were followed as per standard protocol. Electric bulbs brooder and gas brooder were used as source of light and heat. After brooding, chicks were housed in 12 deep litter pens.

Feeding and experimental design

One hundred and twenty day-old unsexed broiler chicks were randomly distributed into four dietary treatments of thirty birds per group. Each group was sub-divided into three replicates of ten chicks per replicate in a complete randomized block design (CRD). Water and respective diets were supplied *ad libitum*. Chicks in T_1 group were given control diet (0% LMM), while the chicks in groups T_2, T_3 and T_4 were given LMM supplemented diets @ 2.5, 5.0 and 7.5 percent, respectively. Weighed amount of experimental feeds were offered to chicks of respective replicate and determined feed intake, body weight gain and feed conversion ratio and economics of LMM supplemented chicks.

Carcass Parameters

Carcass evaluation was done at the end of feeding trial of 42 days. Two birds from each replicate were randomly selected for carcass evaluation. Birds were starved overnight to empty the crop and were put in slaughtering trough and the head cut. Carcass analysis viz. live weight, slaughtered weight, de-feathered weight, eviscerated weight, shank, head, neck, heart, liver, lungs, empty gizzard, thymus, bursa, spleen and empty intestine weights were taken in grams and as percent of the live weight of the bird.

Statistical Analysis

Results obtained were processed and analysed using SPSS 16.0 software. Significance was declared at P<0.05 unless otherwise stated. All the statistical procedures were done as per Snedecor and Cochran (2004).

RESULTS AND DISCUSSION

Nutrient and chemical composition of experimental diets

The ingredients (g/kg) and chemical composition (g/kg DM) of experimental diets of broiler starter and finisher chicks have been presented in the table 1.

Table 1: Ingredients and chemical composition of experimental broiler diets

Attributes	Experimental diets							
	Broiler starter				Broiler finisher			
	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4
Ingredient composition (g/kg)								
Crushed maize	510	485	460	435	570	545	520	495
Rice polish	37.5	37.5	37.5	37.5	65	65	65	65
Soybean meal	350	350	350	350	275	275	275	275
Meat cum bone meal	50	50	50	50	40	40	40	40
Soybean oil	17.5	17.5	17.5	17.5	20	20	20	20
Di-calcium phosphate	11.6	11.6	11.6	11.6	10	10	10	10
Lime stone powder	10	10	10	10	7	7	7	7
Salt	4	4	4	4	4	4	4	4
Premix	4.7	4.7	4.7	4.7	4.5	4.5	4.5	4.5
Lysine	3.1	3.1	3.1	3.1	3	3	3	3
Methionine	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5
LMM	0	25	50	75	0	25	50	75
Chemical composition (g/kg on DM basis)								
Crude protein	229.3	228.3	229.7	230.7	200.1	201.3	198.1	198
Ether extract	44.5	44	42.3	46.4	50.4	51.2	52.2	50.7
Curde fibre	44.2	45.3	46.9	48.2	46.3	43.8	47.2	48.3
Calcium	16.7	16.4	17.7	18.3	17.3	15.6	18.3	17.7
Phosphorus	7.6	7.7	7.3	7	6.9	6.7	6.3	6.1
Metabolizable energy	2818	2790	2762	2734	2925	2897	2869	2841

Various feed ingredients except LMM were purchased from local market for formulation of broiler starter and finisher diets as per BIS (1992). The LMM of *E. jambolana* and *P. guajava* was added in the experimental diets @ 0, 2.5, 5.0 and 7.5 % in T_1, T_2, T_3 and T_4 diets, respectively by replacing maize so as to maintain iso-nitrogenous diets of both broiler starter and finisher. Every other ingredient remained constant throughout the experimental period. The average body weight (g) of entire growth trial at weekly interval in T_1, T_2, T_3 and T_4 groups is depicted in the figure 1. Significantly ($P<0.05$) higher body weight (g) was observed in T_1 as compared to T_2, T_3 and T_4 groups. As the time period of experimental study increased, mean body weights of broiler chicks increased significantly ($P<0.05$) at weekly intervals.

Carcass characteristics

Data on carcass characteristics and organ weights are presented in the table 2. Carcass yields viz. live weight, de-feathered weight, slaughtered weight and eviscerated weights in gram and as percent of live weight of experimental broiler chicks were not statistically ($P>0.05$) influenced by graded level of LMM. Similarly, live weight of different body organs and body parts viz. feather, shank, head, neck, heart, intestine, drumstick and wings did not differ significantly ($P>0.05$) irrespective of groups. It clearly indicated that dietary supplementation of LMM from 2.5 to 7.5% did not exert any adverse effect on these organs and body parts. Present findings are in line with the results of Mulla *et al*. (2003), they conducted experimental study on broiler chicks fed 2 % dried leaves of Subabul, Mulbery, Stylozanthus and observed non-significant difference in carcass characteristics except weight of lungs.

Table 2: Carcass characteristics of broiler chicken fed tanniferous LMM containing diets

Particulars	Groups				SEM	P Value
	T_1	T_2	T_3	T_4		
Live weight (g)	1640.83	1660.17	1730.50	1519.83	43.10	0.397
Slaughtered weight (g)	1566.83	1583.50	1648.33	1446.83	42.47	0.423
% Live weight	95.41	95.42	95.27	95.05	0.30	0.974
De-feathered weight (g)	1252.67	1265.50	1330.33	1153.00	33.97	0.338
% Live weight	76.42	76.23	76.84	75.75	0.24	0.465
Eviscerated weight (g)	1073.33	1087.00	1156.67	985.17	31.75	0.310
% Live weight	65.50	65.51	66.76	64.46	0.48	0.439
Neck weight (g)	51.50	53.83	55.17	47.83	1.48	0.334
% Live weight	3.16	3.24	3.19	3.19	0.06	0.982
Abdominal fat (g)	10.33	8.67	7.00	6.17	0.63	0.078
% Live weight	0.67^{b}	0.51^{ab}	0.43^{a}	0.37^{a}	0.04	0.023
Gizzard weight (g)	29.67	35.17	34.33	35.00	1.09	0.240
% Live weight	1.81^{a}	2.11^{bc}	1.99^{ab}	2.32^{c}	0.06	0.007
Heart weight (g)	6.33	8.17	8.50	8.17	0.55	0.517
% Live weight	0.38	0.49	0.48	0.53	0.03	0.285
Spleen weight (g)	3.50^{a}	5.33^{b}	5.33^{b}	6.67^{c}	0.30	0.000
% Live weight	0.22^{a}	0.33^{b}	0.32^{b}	0.45^{c}	0.02	0.001
Liver weight (g)	23.67^{a}	26.83^{ab}	30.00^{b}	28.67^{b}	0.82	0.026
% Live weight	1.46	1.63	1.75	1.93	0.07	0.070
Intestine weight (g)	56.67	61.67	66.00	62.33	2.10	0.500
% Live weight	3.47	3.70	3.84	4.15	0.12	0.229
Thigh Weight (g)	82.33	81.00	82.83	68.00	2.66	0.147
% Live weight	5.02^{b}	4.91^{ab}	4.77^{ab}	4.44^{a}	0.09	0.087
Drumstick weight (g)	77.50	78.83	81.50	66.17	2.64	0.177
% Live weight	4.72	4.77	4.71	4.32	0.09	0.215
Breast weight (g)	416.33	412.83	444.17	353.17	13.55	0.103
% Live weight	25.38^{ab}	24.84^{ab}	25.61^{b}	23.15^{a}	0.34	0.033
Wings weight (g)	56.00	52.83	53.50	44.00	2.15	0.220
% Live weight	3.41	3.16	3.09	2.86	0.08	0.920

[abc]Means with different superscripts within a row differ significantly ($P<0.05$)

However, weights of spleen and liver were significantly ($P<0.000$, $P<0.026$) higher in LMM supplemented groups as compared to un-supplemented T_1 group. Spleen weight was found to be highest in T_4 followed by T_2, T_3 and least spleen weight in T_1 group. Liver weights (g) were significantly higher in T_3, T_4 compared to T_1. Significantly higher weights as well size of spleen and liver (gram and %) were observed in T_2, T_3 and T_4 groups as compared to T_1 group because CT having immune stimulating property which might be provoke the size as well as weights of these lymphoid organs.

Dietary supplementation significantly reduced abdominal fat content in T_4 compared to T_1, while, T_2 and T_3 have an intermediate values between T_1 and T_4 groups. Present results are in accordance with findings of Hafeni (2013), who also reported low abdominal fat content when fed *A. karroo* leaf meal diet containing 5 g/kg of CT in Cobb 500 broiler chickens. Thigh weight (g) showed statistically non-significant difference among all four groups but it was comparatively ($P<0.087$) higher in T_1 than that of T_4, while T_2 and T_3 have an intermediate position between T_1 and T_4 when expressed in percent of live weight. Breast weight in percent of live weight was significantly higher in T_3 as compared to T_4, whereas T_1 and T_2 have an intermediate values between T_3 and T_4. Similarly, Shafey *et al*. (2013) reported that the replacement of 15 and 30 g wheat bran/kg with Olive leaves, respectively in starter and finisher broiler diets produces no significant effect on the performance and carcass characteristics of broiler chickens. The replacement of higher levels of olive leaves reduced carcass eviscerated weight and increased intestinal weight and length.

The presence of CT has been associated with reduced carcass fat in ruminant animals (Purchase and Keogh, 1984; Terrill *et al*., 1992). A possible explanation for this reduction of fatness has been suggested by Barry *et al.* (1986) who found a lower level of growth hormone (GH) in lambs when diets were sprayed with Polyethylene glycol. Growth hormone increase N retention and reduce fat deposition, with an increase in fat turn over. The reason for the higher level in plasma GH has been explained with a possible inactivation of gut wall proteins by CT.

Economic of broiler chickens

The economics of broiler chicken fed with and without CT containing LMM supplemented diets has been presented in the table 3. At the end of feeding trial of 42 days, significantly ($P<0.05$) higher total body weight (kg) was observed in T_1 and T_2 groups as compared to T_4 group, while total body weight of T_3 group has an intermediate value between T_1, T_2 and T_4 groups. However, LMM supplementation significantly ($P<0.05$) reduced total feed intake (kg), feed cost (₹) per kg diet and total feed cost (Rs.) per bird in T_2, T_3 and T_4 group as compared to un-supplemented T_1 group. Present findings disagreed with the results of Esonu *et al*. (2003), but agree with the reports of Nworgu *et al*. (2003), who observed a decrease in feed intake when broiler finisher were fed diets containing graded levels of *Mimosa invisa* leaf meal. As the level of LMM supplementation increased the total feed intake, feed cost per kg diet and total feed cost per bird decreased significantly ($P<0.05$).

Table 3: Economics of broiler chicken fed with and without CT containing LMM supplemented diets

Particulars	Groups			
	T_1	T_2	T_3	T_4
Body weight of day old chick (g)	43.06	42.93	42.42	42.96
Total body weight (kg)	1.92^{b}	1.89^{b}	1.81^{ab}	1.74^{a}
Total feed intake (kg)	4.02^{c}	3.92^{b}	3.87^{b}	3.68^{a}
Feed cost (Rs.) / kg diet	28.82^{b}	28.42^{b}	28.02^{ab}	27.62^{a}
Total feed cost (Rs.)/ bird	115.86^{c}	111.41^{bc}	108.44^{b}	101.64^{a}
Cost of chicks (Rs.)	15.00	15.00	15.00	15.00
Bird selling rate (Rs.) / kg	85.00	85.00	85.00	85.00
Revenue Rs. / bird	163.2^{c}	160.65^{c}	153.85^{b}	147.90^{a}
Investment Rs. / bird	130.86^{c}	126.41^{bc}	123.44^{b}	116.64^{a}
Net return/ profit (Rs.) / bird	32.34^{ab}	34.24^{b}	30.41^{a}	31.26^{a}

[abc]Means with different superscripts within a row differ significantly ($P<0.05$).

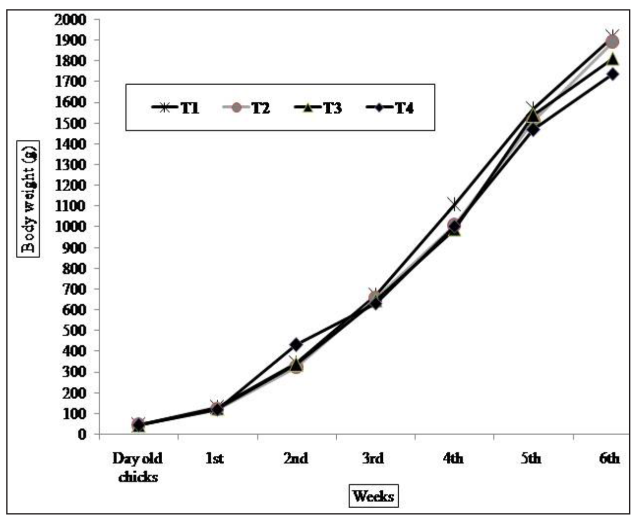

Fig. 1: Effect of tanniferous LMM supplementation on body weight changes of broiler chickens

The degree of reduction in the cost of total feed consumed at the end of feeding trial of 42 days was proportional to the amount of LMM in broiler diets. The price of day old chick was ₹ 15 per chick and the selling price of bird at the end of feeding trial of 42 days was ₹ 85 per kg bird. Furthermore, revenue generated in ₹ per bird as well as investment in ₹ per bird were significantly ($P<0.05$) lower in LMM supplemented (T_2, T_3 and T_4) groups than that of un-supplemented (T_1) group. However, the highest net return or profit (Rs.) per bird was recorded in the broilers fed 2.5% LMM supplemented diet (T_2 group), followed by those fed with un-supplemented control diet (0% LMM; T_1 group), while the least was on the birds fed with 5 and 7.5% LMM supplemented diets in T_3 and T_4 groups, respectively.

Present results are in line with the observations reported by Nworgu and Egbunike (2000). The net return or net profit made in the present study ranged from ₹ 30.41 to 34.24 per bird. The highest profit in 2.5 percent LMM supplemented T_2 group is an indication of good quality diet which led to improved productive performance of broiler chicken. The benefit cost ratio followed a similar trend among all groups, it varied from 1.25:1 in T_1 and T_3 groups fed 0 and 5 percent LMM supplemented diets to 1.27:1 in birds fed 2.5 and 7.5 percent LMM supplemented diets of T_2 and T_4 groups, respectively. Study indicated that LMM supplementation is cost effective in the replacement of maize in broiler feed without deleterious effect on performance.

CONCLUSION

It was concluded that broiler chickens consumed less feed supplemented with *E. jambolana* and *P. guajava* LMM. Hence, LMM utilization in broiler diet could be adopted when the motive is production of economically viable broiler meat with low abdominal fat deposit. Thus, LMM is cost effective, environment friendly, partial replacer of maize in broiler diets.

REFERENCES

Al-Ruqaie, I.M., Swillam, S.A., Al-Batshan, H.A. and Shafey, T.M. 2011. Performance, nutrient utilization and carcass characteristics and economic impact of broiler chickens fed extruded bakery waste. *J. Anim. Vet. Adv.,* **01**: 2061–2066.

Barry, T.N., Manley, R.T. and Duncan, S.J. 1986. The role of condensed tannins on the nutritional value of *Lotus peducculatus* for sheep. 4. Sites of carbohydrate and protein digestion as influenced by dietary reactive tannin concentration. *Br. J. Nutr.*, **55**: 123-137.

Bureau of Indian standards (BIS). 1992. Indian standard poultry feed specifications, 4th Rev. IS 1374, pp. 1-3.

Daing, M.I, Pathak, A.K.**,** Bhat, M.A. and Zargar, M.A. 2017a. Antioxidant and antibacterial potential of condensed tannins containing tree leaves extract. *Vet. Pract.,* **18**(1): 118-121.

Daing, M.I, Pathak, A.K., Bhat, M.A., Sharma, R.K. and Zargar, M.A. 2017b. *In vitro* antioxidant and antibacterial efficacy of condensed tannins containing tree leaves extract of Jammu Province. *J. Anim. Res.* **7**(1): 165-174.

Esonu B.O., Iheukwumere F., Iwuji T.C., Akanu N. and Nwugo O.H. 2003. Evaluation of micronutrients of puberula leaf as feed ingredient in broiler starter diets. *Nig. J. Anim. Prod.,* **30**(1): 3-8.

Hafeni, S. 2013. Performance of broiler chickens fed pearl millet as an energy source and Acacia karroo leaf meal as an additives. MSc Thesis submitted to the University of Namibia.

Mulla, J., Shivakuma, M. C. and Naik, D. G. 2003. Effect of feeding different leaf meal on performance and carcass characteristics of broiler. *Karnataka J. Agri. Sci.,* **16**(2): 288-290.

Nworgu F.C. and Egbunike G.N. 2000. Performance and nitrogen utilization of broiler chicks fed full fat extruded soybean meal and full fat soybean *Trop. Anim. Prod. Invest. J.*, **3**: 47-54.

Nworgu, F.C., Egbunike, G.N., Ononogbu, C.E., Fapohunda, J.B. and Ogbonna, J. U. 2003. Effect of Mimosa (*Mimosa invisa*) leaf meal supplements on broiler finisher performance. *Proc of 8th Ann Conf. of ASAN* held at Fed. Univ., of Tech., Minna, Niger State on Sept., 16th-18th.

Pathak, A.K. 2017. Nutritional bases to control gastrointestinal parasites of livestock. *J. Dairy Vet. Sci.*, **4**(2): 555632.

Pathak, A.K., Dutta, N., Banerjee, P.S., Pattanaik, A.K. and Sharma, K. 2013. Influence of dietary supplementation of condensed tannins through leaf meal mixture on nutrient intake, utilization and performance of *Haemonchus contortus* infected sheep. *Asian-Aust. J. Anim. Sci.,* **26**(10): 1446-1458.

Pathak, A.K., Dutta, N., Pattanaik, A.K., Sharma, K., Banerjee, P.S. and Goswami, T.K. 2017. Effect of condensed tannins supplementation through *Ficus infectoria* and *Psidium guajava* leaf meal mixture on erythrocytic antioxidant status, immune response and gastrointestinal nematodes in lambs (*Ovis aries*). *Vet. Arhiv.,* **87**(2): 139-156.

Pathak, A.K., Dutta, N., Pattanaik, A.K., Singh, A., Narang, A. and Sharma, K. 2015. Effect of condensed tannins supplementation from tanniferous tree leaves on methane production and efficiency of microbial biomass production *in vitro*. *Anim Nutr. Feed Technol.,* **15**(1): 91-100.

Purchase, R., and Keogh, R. 1984. Fatness of lambs on grassland Maku'lotus and grassland Huia' white clover. *Proc. N. Z. Soc. Anim. Prod.*, **44**: 219-221.

Shafey, T.M., Almufarij, S.I. and Albatshan, S.I. 2013. Effect of feeding olive leaves on the performance, intestinal and carcass characteristics of broiler chickens. *Int. J. Agri. Biol.*, **15**: 585–589.

Shafey, T.M., M.A. Alodan, H.A. Al-Batshan, M.A. Abouheif, M.S. Alamri and I.M. Al-Ruqaie, 2011. Performance, Egg Characteristics and Economic Impact of Laying Hens Fed Extruded Bakery Waste. *J. Anim. Vet. Adv.,* **10**: 2248–2252.

Snedecor, G.W. and Cochran, W.G. 2004. *Statistical methods*. 8th Edn., East West Press Pvt. Ltd., New Delhi.

Terrill, T.H., Douglas, G.B., Foote, A.G., Purchas, R.W., Wilson, G.F. and Barry, T.N. 1992. Effect of condensed tannins upon body growth, wool growth and rumen metabolism in sheep grazing sulla (*Hedysarum cornarium*) and perennial pasture. *J. Agri. Sci. Camb.*, **119**: 265-273.

Zargar M.A., Pathak, A.K. and Daing, M.I. 2017. Screening and evaluation of antioxidants and anticoccidial properties of condensed tannins containing tree leaves of Jammu province. *Indian J. Anim. Res.,* **51**(6): 1105-1112.

Zargar, M.A., Pathak, A.K., Sharma, R.K. and Daing, M.I. 2016. Antioxidants and Anticoccidial potential of aqueous extract from various tree leaves containing condensed tannins. *J. Anim. Res.,* **6**(4): 563-570.