International Journal of Plant and Animal Sciences Vol. 1 (2), pp. 030-036, April, 2013. Available online at thttp://internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Effect of partial mango pulp mixing in ration on behaviour and production of broiler

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Accepted 31 January, 2013

The present study was carried out to investigate the effect of various levels of mango pulp ration on the growth, carcass and behavior of broiler during the year 2010 to 11. The experiment enrolled 200 one day old chicks and randomly divided them into four groups i.e. A, B, C and D groups were fed during 1st, 2nd and 3rd weeks, later group A was not fed and kept as control beside others were fed a ration mixed with Mango pulp as supplement at the rate of 2, 3 and 4% per kg, respectively. Mango pulp contained DM 97.5% and CP 12, Fiber 3.5 and Ash 2.5 percent on DM basis. All feeds were iso-nitrogenous and iso-caloric offered twice a day and fresh water was made available over 24 hours thrice a day. At the end of the experiment, the average of the liver weight in B (51.98) was higher than C (45.03), D (43.58) and A (40.71) g/b ($P \leq 0.05$) and gizzard weight was higher in group A (36.2) than D (34.58), C (31.8) and B (29.97) g/b, ($P \leq 0.05$) but in the hearts weight were found not significant differences ($P \geq 0.05$) between group A (10.68), B (10.70), C (11.86) and D (10.16) g/b, ($P \geq 0.05$), respectively. RBC's (2.60, 3.13, 2.03 and 1.97, m/ cu.mm), WBC's (3933, 4500, 3450 and 3383, 000/ mm^3) and Haemoglobulin values (9.0, 10.7, 6.5 and 5.5 g) were not different for groups (A, B, C and D ($P \geq 0.05$), respectively. Feeding, drinking, standing/walking and lying/sleeping behavior were not significant differences ($P \geq 0.05$) between the groups for periods of brooding and growing ($P \geq 0.05$), respectively, but generally all these behaviors were higher at brooding than growing periods ($P \leq 0.05$), respectively. It was concluded that mango pulp at a level of 2 percent had a better impact on both broiler body and carcass weights and FCR with no health problem in broilers.

Key words: Broiler production, Mango pulp, Net profit.

INTRODUCTION

The standard daily per capita consumption of total protein is 102.7 g, availability of protein is 69.61g, out of which 27.0 g should be of animal origin; while at present local per capita consumption of animal protein is 17.0 g. Poultry culture in Pakistan is expanding rapidly and the rate of growth of commercial layer and broiler farms is phenomenal to meet the ever increasing demand for proteins through poultry meat and eggs. This sector generates employment for about 1.7 million people and poultry meat contributes 23.8 percent of the total meat production in the country. During the last three years, the poultry meat production in Pakistan was 601, 652 and 707 thousand tons, showing gradually an increasing trend GOP (2010). The dynamic growth and success of the poultry industry is based on a high degree of vertical integration, improved production efficiency standards (e.g. increased market values, reduced days-to market and improved feed conversion) and greatly automated processing combined with successful marketing (e.g. low fat, high-protein convenience products) and changed consumer habits e.g. health considerations (Sahito et al., 2012).

Mango, *(Mangier indica* L.) family: Anacardiaceae, is the second major fruit crop in Pakistan. At present it is grown on an area of 93.5 thousand per hectares. Pakistan is blessed with many important leading commercial varieties of mango such as Sindhri, Langra, Anwar Ratol, Summer Bisht, Fajri, Fazali, Zafran, Saroli, Dusheri, Gulab Khas, Swarnarica, Bagan Pali, Chuansa Black and White, and Neelum (Farag, 2001). Mango

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waste and Fruit byproducts, which would otherwise, can be used as an alternative feed resource in animal feeds, pose a disposal problem leading to environmental pollution. Mango, apple, pineapple, citrus and tomato were the main fruits used for processing in most of the Asian countries (Kumar et al., 2007) and the fruit waste is incorporated in poultry diets as dry product. Besides the above fruits, papaya and guava fruits, which were produced in 1.3 and 1.5 million metric tones per year, respectively in India, are being extracted and 25-35 per cent of the processed fruits were left as wastes and all made available for feeding livestock (Bansal, 1998). Mango seed kernels and peels are commonly used in poultry/livestock rations but the fiber for waste from mango fruit pulp is comparatively a new by product now available for incorporation in poultry diets. An attempt would be made in the present study to evaluate the effect of partial mango pulp mixing in ration on the production and behaviour of broiler. Carson (2000) investigated various uses of mango seed kernels and reported that mango seed kernel is an effective ingredient of poultry feed. The addition of mango seed kernel improves immunity and reduces mortality as compared to normal commercial ration. Mhazo et al., (2003) evaluated the possibilities of using fruits and vegetable wastes for production of poultry feed and concluded from some experimental studies that mango and citrus wastes can be a most planting and effective feed ingredient for poultry production. Shah (2005) conducted comprehensive studies on utilization of fruit wastes (mango pulp and mango seed kernel) in poultry feed production. It was found that the mango stone was used as a non-conventional source of protein and a stone of four local mango varieties was analyzed. Chapman, (2006) concluded that the poultry feed diet composition of poultry on a balanced feed composition plus a mango pulp supplement, said feed supplement being particles of a substance untreated mango byproduct of dried mango pulp from mango. Chicken food consists of cereals, plants, animal, agro-based industrial, maize, sorghum, rice, fish meal, meat meal, cotton seed meal, gluten meal and minerals (Sahito et al., 2012).

The economic analysis of poultry production indicates that the feed is a major expense in poultry production amounting to about 70 to 75 percent of the total cost. The ration should suit the objective like using laying ration for egg production, broiler ration for the production of broilers (Sahito et al., 2012). Considering the importance of alternate sources of vegetable protein in the production of broiler, the present investigation has been planned to examine the effect of various levels of mango pulp in broiler ration on the growth, carcass and feed efficiency of broilers.

MATERIALS AND METHODS

In order to ascertain the effect of various levels of Mango pulp as a supplement in poultry ration, the study was conducted during December 2010 to January 2011 at the Poultry Experiment Station, Department of Poultry Husbandry, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University Tandojam, Sindh-Pakistan. One day-old about (200) broilers were purchased from Hyderabad market and separately weighted then randomly divided into A, B, C, and D groups, every single group had 50 chicks. Broilers of group A kept as control where the groups B, C and D were offered a mixed ration with mango pulp at the rate of 2, 3 and 4 percent on fresh bases / as fed basis in finisher ration. This kind of diet was offered by partially mixing in start condition during 4^{th} week as adaptation period, later full supplement was offered during 5^{th} and 6^{th} weeks. Feed was given *ad Libitum* and the feed refusal was collected and that was weighted at morning on daily basis which was offered for 24 hours to each group of broilers as to record daily feed intake. Like this similar technique was also used for water supply in each group. After that the shed was washed and cleaned with pressure water with potassium permanganate on diluted Formalin and shed kept to dry for 24 hours. Finally limestone was used on floor with wooden dust and chick-paper (Horka-200) provided to comfort chicks during first week of the brooding at 90-95^{o}F for first week latter it was reduced by 5^{o}F in every week finally maintained at 70^{o}F. Where the relative humidity 60% was maintained and the light was provided 24 hours by fixing fluorescent tube light (40 Walt) fitted with roof at the height of 8 feet level. Both the temperature and relative humidity was recorded by using of thermometer and Hygrometer. Vaccination processes were carried out during early morning and late evening/night hours. All the behaviors were visually observed in all groups with in the one minute interval guided by stop watch by using Time Sampling Technique (Rind, 1995) where the weight was obtained on weekly basis for (42 days). Vaccination schedule for broiler was adopted as; N.D= New Castle, I.B= Infectious Bronchitis, I.B.D= Infectious Bursal Disease, H.P.S= Hydro Pericardium Syndrome for precautions to safe the shed.

Mango was collected from the local market and removed the peels, dried in sun light approximately one week and then whole pulp was put in the grinder for making powder in manual grinder and finally chemical analysis was done. Mango pulp was analyzed for dry matter, crude protein, crud fiber and ash, total solid, crude protein, crude fiber, Ash according the AOAC, (2000) 5 gm sample was digested using micro-kjeldhal in the presence of catalyst (0.2 gm copper sulfate and 2 gm sodium sulfate) where sulfuric acid (20-30 ml) was used as an oxidizing agent. While, protein percentage was determined by conversion of nitrogen percentage to protein, assuming that all the nitrogen in mango dried pulp powder was present as protein i.e. Protein percentage = N% × Conversion factor. Where conversion factor = 100 / N% x 6.25 in protein of mango dried pulp powder (James, 1995). The blood was collected from 10 birds of each group for haematology

Table 1. Average feed intake of broiler gallon per broiler.

Weeks	Groups				Probability value of different weeks
	a	b	c	d	
W_1	165	129	111	141	
W_2	283	282	274	320	
W_3	477	454	467	476	
W_4	721	712	738	695	(P≥0.001)
W_5	982	987	1023	988	
W_6	1218	1204	1198	1206	
Total	3846	3768	3811	3826	
Probability value of different groups	(P≥0.811)				

Note: Interaction between both groups and weeks at (P≥0.898) found non significant.

Table 2. Average water intake of broiler in ml per broiler.

Weeks	Groups				Probability value of different weeks
	a	b	c	d	
W_1	360	361	344	361	
W_2	796	772	774	800	
W_3	1196	1235	1210	1221	
W_4	1786	1900	1937	1974	(P≥0.001)
W_5	3501	3610	3691	3735	
W_6	5787	5862	5992	6054	
Total	13426	13740	13948	14145	
Probability value of different groups	(P≥0.649)				

Note: Interaction between both groups and weeks at (P≥1.000) found non significant.

purpose. Each bird was handled and alcohol swab was used on wing vein as antiseptic. The syringe inserted in a wing vein of bird and 2 ml of blood was collected and put in test tube having EDTA anticoagulant. Hemoglobin examination was done by the Acid Heamatin Method, Sahil's instrument and took 0.1N Hcl in diluting tube of heamoglobinometer up-to the 20%. Red Blood cells were counted by haemocytometer consisted of counting chamber and two diluting pipettes. For the examination of Red blood cells the using high power 40x lenses. White Blood cells were counted by haemocytometer consisted of counting chamber and two diluting pipettes having a white bead and marking 11 above the bulb. Drew the whole Blood up-to 0.5 marks in a pipette. Wiped the blood from tip and drew Truck's solution (Diluting fluid) up-to 11 mark. Count in all the four corner squares making a total area of 4 sq. 10x lenses were used for the determination of WBC's.

Chemical analysis of dried Mango pulp initially and weekly live body weight, feed intake, water intake, mortal-

Table 3. Average live body weight of broiler in gram per broiler.

Week	Groups				Probability value of different weeks
	a	**b**	**c**	**d**	
W_O	42.5	42.4	40.6	41.9	
W_1	121.7	128.3	120.5	123.3	
W_2	410.1	418.3	418.5	397.3	
W_3	811.9	800.3	812.5	825.3	(P≥0.001)
W_4	1404.9	1406.3	1378.7	1357.3	
W_5	1714.3	1762.9	1706.5	1723.5	
W_6	2149.4	2254.3	2160.7	2151.3	
Probability value of different groups	(P≥0.001)				

Note: Interaction between both groups and weeks at (P≥0.001) found non significant.

Table 4. Average carcass weight, dressing rate and feed conversion ratio of broiler.

	Groups			
	a	**b**	**c**	**d**
Carcass weight (g/b)	1120.4	1311.8	1237.7	1208.8
Dressing (%)	50.71	58.19	57.14	56.17
Feed Conversion Ratio	1.79	1.67	1.76	1.78

Note: Interaction among carcass weight, dressing and feed conversion ratio (P≥0.002) found non significant.

ity, haematology, behaviors (Feeding, drinking, standing/walking, lying/sleeping), economics etc. At the end of experiment, ten broilers in each group were slaughtered to study the carcass weight, dressing rate and weight of giblets. The collected data initially tabulated in to computer subjected to Factorial analysis of variance (AOV) to see the overall significant differences, while comparison LSD was applied to see the significant differences within treatments. Statistics 8.1, A Computer Software package for student was used to perform statistical analysis (2005).

RESULTS

Mango pulp was analyzed for dry meter 97.5%, crude protein 12%, fiber3.5% and ash 2.5% on diameter basis (A.O.A.C 2000). Average feed intake of broiler for A, B, C and D groups were 3846, 3768, 3811 and 3825 g/b (P> 0.05), respectively table-3. The differences between broiler groups feed intake was non significant (P> 0.05) are subject in under given table- 1.

Average water intake of broiler in table-2 of group A , B, C and D were 13426, 13740 and 13948 and 14145 ml/b, (P≤0.05), respectively. The interaction between groups and weeks (P≥0.05) were found non-significant in table-2.

Average live body weight of broiler table-5 of group A , B, C and D were 2149.4, 2254.3 and 2166.5 and 2166.5 g/b, (P≥0.05), respectively. Minimum live body weight was gain by the broilers in group A and maximum by group B, respectively. The interaction between groups and weeks (P≤0.05) were found significant in table-3.

Average carcass weight of the chicks in table-4 of group A (control), B, C and D were 1120.4, 1311.8, 1237.7 and 1208.8 g/b and its dressing percentage calculated was 50.71, 58.19, 57.14 and 56.17 percent respectively. Minimum dressing percentages were recorded from broilers group A and maximum from group B, respectively (P≤0.05). Average feed conversion ratio of the broiler table-6 of group A, B, C and D were 1.78, 1.72 and 1.79

Table 5. Average liver, heart, gizzard weights and mortality% of broilers.

Parameters	Groups				Probability value of liver, heart and gizzard
	a	b	c	d	
Liver	40.71	51.98	45.03	43.58	(P≥0.093)
Heart	10.68	10.70	11.86	10.16	(P≥0.078)
Gizzard	36.2	29.97	31.8	34.58	(P≥0.018)
Broiler in numbers	2	01	3	3	(P≥0.05)
Mortality (%)	4	02	6	6	

Table 6. Haemotology of broiler.

Particulars	Groups				Probability value of haemoglobin, RBC's and WBC's
	a	b	c	d	
Haemoglobin (g/dl)	9.00	10.73	6.53	6.47	(P≥0.243)
RBC's (m/cumm)	2.60	3.13	2.03	1.97	(P≥0.241)
WBC's (000/mm^3)	3933.3	4500.0	3450.0	3383.3	(P≥0.574)

Table 7. Average feeding and drinking behavior of broiler minimum per hour per broiler.

	Groups			
Period	**a**	**b**	**c**	**d**
Brooding	16.3	16.6	17.8	17.4
Growing	14.0	13.7	14.3	14.2
Probability value of different groups	(P≥0.959)			
Brooding	13.1	12.7	13.0	12.8
Growing	7.3	7.1	7.3	7.0
Probability value of different groups		(P≥0.999)		

and 1.84, respectively. It is obvious from the results that the minimum feed conversion ratio gained by the broilers in group D and maximum by group A, respectively.

Average liver weight of the broiler (edible parts weight) in table-5 of group A , B, C and D were 40.71, 51.98, 45.03 and 43.58 g/b, (P≤0.05), respectively. It is obvious from the results that the liver weight was higher for broilers of group B and lowest for group A, respectively (P≤0.05). Average heart weight of the broiler in groups A , B, C and D were 10.68, 10.70, 11.86 and 10.16 g/b, (P≥0.05) respectively. The minimum liver weights were gained by the broilers group A and maximum by group C, respecti-

Table 8. Average standing/walking and lying/sleeping behavior of broiler in minimum per hour per broiler.

	Groups			
Period	**a**	**b**	**c**	**d**
Brooding	10.4	9.8	10.1	9.9
Growing	11.6	12.3	12.0	13.2
Probability value of different groups	(P≥0.993)			
Brooding	20.2	20.9	19.1	19.8
Growing	27.3	25.9	26.4	25.6
Probability value of different groups		(P≥0.984)		

Table 9. Economics of broiler.

S. No.	**Economic Parameter**	**Groups**			
		a	**b**	**c**	**d**
1	Cost of day old chick in rupees per broiler	7.5	7.5	7.5	7.5
2	Total feed intake (kg/broiler)	3.846	3.768	3.811	3.826
3	Total cost of feed (Rs./broiler)	89.23	87.41	88.42	88.76
4	Cost of Mango pulp (Rs./broiler)	0	10	15	20
5	Miscellaneous expenditure (Rs./broiler)	15.00	15.00	15.00	15.00
6	Final live body weight (kg/broiler)	2.149	2.254	2.216	2.151
7	Total cost of Production (Rs./broiler) (1+3+4+5)	111.73	119.91	125.92	131.26
8	Broiler sale rate (Rs. /kg)	105	105	105	105
9	Total income (Rs./broiler) (6x8)	225.64	236.67	232.67	225.85
10	Net profit (Rs./broiler) (9-7)	113.91	116.75	106.75	94.59

vely (P≥0.05). Average gizzard weight of the broiler in groups A , B, C and D were 36.2, 29.97, 31.8 and 34.58 g/b, (P≤0.05), was found separately. The maximum gizzard weight was gained by the broilers in group A and minimum by group B, respectively. The differences between broiler groups means were found non-significant (P≤0.05). Mortality denotes to the number of broiler died from group of trial. The results showed that mortality tended to be higher in group B followed by C, D and A (P≤0.05), which indicated as 12, 6, 6 and 4%, respectively. The most broiler mortality recorded in earlier rearing weeks.

Haemoglobin analysis shows that means were 9.00, 10.73, 6.53, and 6.47 (g) for group A, B, C and D (P≥0.05). However its ranges were 6.00 to 13.20 (A), 9.20 to 13.20 (B), 4.40 to 9.20 (C) and 4.40 to 9.00g (D), respectively. RBC's analysis shows that means were 2.60, 3.13, 2.03 and 1.97 million/mm^3 for group A, B, C and D (P≥0.05). However, its ranges were 1.80 to 3.80 (A), 2.70 to 3.80(B), 1.50 to 2.70 (C) and 1.50 to 2.50 million/mm^3 (D), respectively. WBC's analysis shows that means were 39.33, 45.00, 34.50 and 33.83 000/mm^3 in groups A B, C and D (P≥0.05), respectively. However, its ranges were 31.00 to 48.00 (A), 43.00 to 48.00 (B), 28.00

to 43.00 (C) and 28.00 to 41.00 000/mm^3 (D), respectively (table-6).

Feeding behavior of broiler during brooding period table-7 in group A, B, C and D were 16.3, 16.6, 17.8 and 17.4 min/hr/b, while during growing period 14.0, 13.7, 14.3 and 14.2 min/hr/b, respectively. Drinking behavior of broiler in group A, B, C and D was 13.1, 12.7, 13.0 and 12.8 min/hr/b during brooding period, while during growing period 7.3, 7.1, 7.3 and 7.0 min/hr/b, respectively.

Standing/walking behavior of broiler (table-8) in group A, B, C and D was 10.4, 9.8, 10.1 and 9.9 min/hr/b during brooding period, while during growing period 11.6, 12.3, 12.0 and 13.2 min/hr/b, respectively. Lying/sleeping behavior of broiler in group A, B, C and D was 20.2, 20.9, 19.1 and 19.8 min/hr/b during brooding period, while during growing period 27.3, 25.9, 26.4 and 25.6 min/hr/b, respectively.

After covering all the production aspects of broiler, the economics of the ration were also worked to ascertain the effect of different levels of mango pulp. The results in (table-9) indicated that group B proved to be most economical where the birds were fed on ration containing mango waste at the rate of 2% feed where the net profit per broiler was taken. However, the groups A, B, C and D were recorded net profit of Rs. 113.91, Rs.116.75, 106.75 and Rs.94.59, respectively in Pakistani rupees at market value.

DISCUSSION

Live body weight of broiler increased significantly with the introduction of Mango pulp along with its increase in offered percentage in finisher diets. Chemical analysis was recorded as D.M. 97.5% and C. P 12, C. F 3.5 and ash 2.5 % on D.M basis of Mango pulp. Results showed significant differences ($P \leq 0.05$) in live body weight and these results are in some arrangement with the results of Chapman (2006); Elegbed and Richard, (2007). Who reported that mango pulp/waste can be used for improvement in broiler growth rate. Significant change was achieved for both carcass weight and recovery percentage ($P<0.05$) in group B, C and D respectively. However the control group A was showed an increase in trend B, C, D and A. Rabayaa et al., (2001) observed the same trends in broiler feed intake and FCR. Water intake and behavior (feeding, drinking, standing/walking and lying/sleeping) were found non-significant and blood haematology was non-significant and these results are in agreement with the results of Diarra and Usman, (2008); Sahito et al. (2012) reported the most economical group is B, where the broiler were fed on ration containing mango pulp at the rate of 2% feed with the net profit Rs. 116. 32/broiler. These results are in agreement with the study of Siegal et al. (1992) who noticed that mango kernel can attributed to increased growth, which enable broilers to reach market condition at an earlier age. Oluremi et al., (2007) reported that fresh mango pulp at the rates of 2.5 and 5.0 percent was supplemented in the commercial broiler ration. Before supplementation, the mango pulp was determined. Mango pulp was sun dried, milled using hammer mill machine and analyzed in the laboratory to determine yield, proximate composition and crude fiber fractions. Besides, Nazare (2005) reported that the fruits can be used for a variety of purposes. Besides its vital use of human consumption, the fruit wastes were effectively processed for livestock feed production.

Influence of various levels of mango pulp mixed in finisher ration on behaviour and production of broiler at P.E.S. Mango pulp mixed with the feed at rate of 2, 3 and 4 percent / 100kg for B, C and D group as supplement, while group A was controlled with no supplement, respectively. Whereas, Rabayaa et al., (2001) investigated the effects of different levels of olive pulp on body weight gain, feed intake and feed conversion efficiency of broiler chicks. Few studies were concluded by FAO (2001) that farmers attempt to produce least cost rations by including fruit and vegetable processing waste (citrus waste, mango waste, tomato, pineapple waste, tea leaves, etc.), depending upon their cost, availability and nutritive value. The use of mango waste/pulp was most beneficial and economical in poultry production, when the weight gain and feed efficiency was better. Rabayaa et al. (2001) investigated the effects of different levels of olive pulp on body weight gain, feed intake and feed conversion efficiency of broiler chicks. Larrauri et al., (2002) studied the isolation and characterization of Mango peel dietary fiber. Fresh mango peels, obtained as a byproduct of syrup production, were successively wet-milled, washed with water and dried.

Both feed and water intake of broiler were non-significant for all groups. While, feed intake was maximum (3826 g/b) in group D and minimum (3768 g/b) in group B. Water intake was maximum (14145 ml/b) in the group D and minimum (13426 ml/b) in A (control). Live body weight was maximum (2254.3 g/b) in group B and minimum (2149.4 g/b) was recorded in group A. Results showed significant differences ($P \leq 0.05$) for interaction between treatment and weeks for live body weight. Zafar et al. (2005) studied that the feed of group A contained maize in addition to other ingredients, whereas the feed of group B substituted maize with apple by-products. Feed consumed, water intake, weight gained, Feed Conversion Ration (FCR) and mortality was recorded daily. In our studies, FCR was improved (1.67) in group B and found poor in group A (1.79). Dressing percentage was higher (58.19%) in group B and lowest (50.71%) in group A. Both liver and heart weights were not different for groups of broiler. Gizzard weight was higher in group A than D, C and B groups. Mortality was higher (6%) in both groups of C and D than A (4%) and B (2%). RBC's and WBC's count and Haemotological values of broiler were not different significantly between the groups. The results are agreed

with Gary, et al. 2002; Sahito, et al. (2012) who reported that the mortality was average in broiler group receiving high dietary fat level. Body temperature of broiler increased with increasing dietary fat levels and was satisfactory and blood cholesterol level was increased but within the range and fat% in meat of broilers was also increased with increasing dietary fat levels but it was also satisfactory. Feeding, drinking, standing / walking and lying /sleeping behaviour of broiler were significantly higher in brooding period than the growing period while its treatments were not different significantly further results are agreed with Rind, (1995). It was concluded that Mango pulp mixed with finisher feed as a supplement has positive effects on broiler live body weight, carcass weight and carcass rate of recovery. Mango pulp supplement at 2% rate may be mixed in broiler ration for the improvement in FCR and net returns per broiler. It is suggested that broiler in their later age may be fed supplemented feed with 2 percent Mango pulp to improve feed efficiency and net return per broiler.

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