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Carcass Characteristics of Commercial Broiler Chicks as Affected by the Supplementation of Probiotics

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ABSTRACTS

The objective of this study was to evaluate the influence of probiotic on carcass characteristics of commercial broiler chicks. Two probiotic levels (without and with probiotic supplementation) were considered for the study. The experiment consisted of two replicates for probiotic groups. The carcass characteristics and Conformation traits of broiler was evaluated at 6th week of age. Data were analyzed on survivor and equal number of bird's per subclass basis. Analysis of variance revealed that the difference between replicates were not significant for the different traits under study as such all subsequent analysis was performed on combined sex basis. Inclusion of probiotic showed the significant effect on males, females and on combined sex basis the results of present study on per cent shrinkage, per cent dressing, per cent giblet and on total per cent meat yield. Higher per cent yield was estimated for most of the carcass components in the control group than the diet supplemented with probiotic. The cut-up parts yield (leg, breast, back with neck & wings) more or less similar in control and probiotic supplemented dietary group and also the percentage was lower in probiotic supplemented diet than the control group. The proximate principles of the meat revealed that there was no effect of the treatments on moisture, fat and ash content. However, the protein content was reduced significantly in broilers diet containing Probiotics. The lactobacillus counts were recorded higher in probiotic fed groups than the control.

Keywords: Probiotic, cut-up parts, giblet, fat, ash

Certain microflora in the gut of birds is known to ameliorate the effects of stress factors using probiotics especially during period of stress. These microbes can enhance the development of favorable microflora in the gut of poultry.

Intensive rearing conditions contribute to the delay in development of normal intestinal flora. Probiotic feeding leads to the development of stable type of micro flora which helps the bird to resist infections noticeably in the intestinal tract. This phenomenon is referred to by many terms by various authors as bacterial antagonism, bacterial interference, barrier effect, colonization resistance and competitive exclusion. Under such circumstances antibiotics are often used to suppress or eliminate harmful organism in the intestine to improve growth and feed efficiency.

Probiotics have been introduced as an alternative to antibiotics. The use of antibiotics as routine feed additives has been banned in some countries because of public concern over possible antibiotic residual effects and the development of drug-resistant bacteria. The commercial use of probiotics in poultry industry is relatively new. Probiotic represents a single or mixed culture of live microorganisms which when applied to animals, affects the host beneficially by improving the properties of indigenous microflora. Probiotics come under the category of *as generally recognized as safe* (GRAS) ingredients classified by Food and Drug Administration (FDA). They have no side and residual effects. Probiotics regulate the microbial environment in the gut, reduce digestive upsets and prevent pathogenic gut bacteria, thereby improve live weight gain, improve feed conversion ratio, reduce mortality, increase feed conversion ratio in layers and increase egg production. Probiotics commercially available contain strains of genera *Lactobacillus* (mainly),

Bifidobacterium, Streptococcus, Bacillus, Bacteroides, Pediococcus, Leuconostoc, Propionibacterium, Saccharomyces cerevisiae and *Aspergillus oryzae*. *In vitro* and *in vivo* studies have demonstrated that lactic acid producing bacteria are able to inhibit the growth of poultry pathogen like *Salmonella* and *E. coli* by lowering the pH of the gut (Fuller, 1977).

MATERIALS AND METHODS

The experiment was conducted to study the influence of Probiotics (P) on the carcass characteristics of day old four hundred and eighty commercial broiler chicks. A group of twenty broilers (male and female) distributed in 12 treatments replicated twice. The chicks were reared in electric battery brooders under same environmental conditions. These chicks were allotted at random to each treatment.

The probiotic named "Bioboost – YC" each gram provides, Live Yeast Culture (Strain SC-47) will be used @ Culture 20 million CFU kg^{-1} .

Observations

Data pertaining to performance traits such as growth, feed efficiency, conformation traits and mortality%, body weights were recorded by weighing individual chicks at weekly interval up to 6 weeks of age. Chicks were fed experimental ration *ad-libitum*. Conformation traits like breast angle, shank length and keel length were measured of all the birds at 4^{th} and 6^{th} week's age. Four broilers of either sex from each replication were picked up randomly and slaughtered at 6^{th} weeks of age to study the carcass characteristics.

Traits measured: The following traits were measured for comparative evaluation and interaction effects of all treatments:

(A) Conformation traits: at 4^{th} and 6^{th} week of age

- ❒ Breast Angle (°)
- ❒ Keel length (cm)
- ❒ Shank length (cm)

(B) Carcass traits: at 6^{th} week of age

- ❒ Dressed weight (in per cent)
- ❒ Giblet weight (in per cent)
- ❒ Abdominal fat weight (in per cent)
- ❒ Cut-up parts weight (in per cent)

(C) Proximate composition of meat

- ❒ Moisture per cent
- ❒ Fat per cent
- ❒ Protein per cent
- ❒ Ash per cent

Proximate principle

Samples from raw meat were analyses for proximate principle (moisture, protein, fat and ash content) as per the methods described by AOAC (1984).

Moisture

Thirty gram minced meat samples were weighed accurately by difference in dried aluminum dishes and were kept in hot air oven with lid removed, at 100 ± 1°C for 18 hours. They were cooled in desiccators and weighed again.

Moisture percentage was calculated as under:

$$\% \text{ Dry Matter} = \frac{\text{Weight of dried sample}}{\text{Weight of sample before drying}} \times 100$$

% Moisture = 100 - % Dry matter

The dried samples were stored in desiccators for the estimation of protein, fat and ash content.

Ether extract (Fat)

About one gram of oven dried finely ground meat sample was weighed in a previously weighed extraction thimble (made up of Whatman Filter paper No. 1). Extraction of the sample was done in Soxhlet's extraction apparatus for 6-8 hours by using petroleum ether (boiling pint 60-80°C). The thimble after extraction was taken out, dried in open air and then in hot air oven at 100 ± 1°C for one hour. The loss in weight following extraction and drying was used to calculate per cent ether extract.

% Ether extract (fat) =

$$\frac{\text{Loss of wt. of sample after extraction}}{\text{Weight of sample before extraction}} \times 100$$

Crude protein

Nitrogen content was determined by Micro-kjeldhal's method which consists of three steps, i.e. digestion, distillation and titration. Crude protein was determined by multiplying the nitrogen by the factor 6.25.

One gram of finely powdered dried meat sample was taken in Kjeldhal's flask and digested with 25ml concentrated sulphuric acid with a pinch of digestion mixture (consisting of 10 parts potassium sulphate and one part copper sulphate). The digestion was considered complete on appearance of bluish color. Digested samples were then cooled and volume was made to 100ml with distilled water.

Five ml of this aliquot and 10ml of 40 per cent NaOH was taken in distillation apparatus and distilled. Ammonia thus liberated was collected in 10ml of 2 per cent boric acid solution containing Toshiro's indicator (Toshiro's indicator was prepared by mixing 80mg methyl red, 20mg bromocresol green and 100ml methyl alcohol. Then ten ml of this Toshiro's indicator was added to one litre of 2 per cent boric acid solution).

The distillate obtained was titrated against N/100 sulphuric acid till light pink color was obtained which was considered as the end point. Per cent crude protein was calculated as:

% Crude protein =

$$\frac{\text{Amount of acid consumed (N/100 } H_2SO_4) \times 0.00014 \times 100 \times 100 \times 6.25}{\text{Weight of sample} \times \text{ml of aliquot taken}}$$

Ash

About 1-2 grams of oven dried finely powdered meat sample was taken in a dried, weighed crucible. The samples were ignited on a burner till the smoke was removed and then kept in a muffle furnace at about 600 ± 2°C for 1 hour. The crucibles were removed, cooled in desiccators and weighed. The percentage of ash was calculated.

$$\% \text{ Ash} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

(D) Microbial counts of meat

- ❒ Standard plate count
- ❒ Coliforms count
- ❒ Lactobacilli count

Microbiological quality

Microbiological quality of the meat samples were assessed for standard plate count, coliforms count and lactobacilli count by using standard methods described by APHA (1984).

Samples in ten grams amount from both groups were taken and tenfold dilutions were made by using 0.1 per cent peptone water. The different types of cultural media, temperature and time of incubation followed for enumerating various organisms were as indicated in the Table 1. Plates containing 10-300 colonies were selected for counting.

Table 1: Types of media, incubation temperature and time of microbial evaluation

Organisms	Media	Incubation temperature	Time
Total viable count	Standard plate count agar	35 ± 1°C	24-48 hours
Coliforms	Violet red bile glucose agar	35 ± 1°C	24-48 hours
Lactobacilli	M.R.S. Broth	35 ± 1°C	24-48 hours

Observation and sampling

The following recording and sampling procedures were adopted during the experimental period.

Carcass traits

Four birds selected at random from each group were sacrificed for carcass evaluation at the end of experiment

(6 weeks). The birds were kept off feed for over night prior to slaughter but were allowed to take fresh drinking water *ad -libitum* during that period.

Dressed weight

First of all live weights of birds were recorded. The birds were slaughtered by 'Modified Kosher' method, i.e., allowing them to bleed completely. The feathers were removed completely with hand picking, leaving the skin intact. The shanks were removed at hock joints and dressed weight recorded. The per cent dressed weight was calculated on the basis of live weight.

Dressed wt. = Live wt. – (blood wt. + skin wt. + Feather wt. + giblets + Visceral Content)

Eviscerated weight

Evisceration was done by removing crop, gullet, trachea and preens glands. A horizontal cut was made at the rear of the keel bone thereby the breast was a little upturned and pushed foreword, exposing the viscera along with the visceral organ which were then removed completely by pulling. The lungs were scrapped off and heart, liver and gizzard constituting giblet removed carefully from the viscera. The gizzard was then opened, the contents washed out and inner epithelial lining removed. The heart was made free from blood and adhering vessels. The eviscerated weight was recorded as the weight of carcass together with giblets.

$$\text{Eviscerated weight} = \frac{\text{Live wt.} - (\text{blood wt.} + \text{feather wt.} + \text{head} + \text{shank})}{\text{Live weight}} \times 100$$

Giblet weight

The heart, liver and gizzard were weighed jointly. The giblet were expressed as percentage of live weight.

$$\text{Abdominal fat weight (\%)} = \frac{\text{Abdominal fat weight}}{\text{Starved weight}} \times 100$$

$$\text{Cut-up parts weight (\%)} = \frac{\text{Weight of individual cut-up parts}}{\text{Dressed weight}} \times 100$$

Statistical analysis

The data collected under study were analyzed as 3x2x2 factorial completely randomized design according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Conformation traits

The overall means along with its standard error for conformation traits (shank length, keel bone length and breast angle) measured at 28 and 42 days of age are scheduled in the Table 1 for combined sex basis.

Breast angle

The commercial broiler chicks fed with probiotics supplemented diet recorded significantly wider breast angle measurement over the diet does not contain probiotics. Combined sex analysis also revealed the same trend at both the ages (28 and 42 days) of measurements. The combined sex averages at 28 and 42 days of age observed were 58.2°, 61.6° and 63.6°, 66.9° for P_0 and P respectively.

Some of the carcass parameters studied here (weight after de-feathering, feather weight, eviscerated weight, weight of giblets, weight of shank and dressing percentage) are in line with (Katoch *et al.,*1998; Mahajan *et al.*, 1999; Sayed *et al*., 2000; Banday and Risam. 2001). There are others who have concluded based on their studies that supplementation of probiotics in broilers diet does not affect the carcass characteristics (Takalikar *et al.,*1992 a, b; Fleroupaneri *et al.,* 1993; Baidya *et al.,* 1994; Durst *et al.,* 1995).

Keel bone length

The inclusion of probiotic showed highly significant effect on the keel bone length of the male at both ages of measurement. Whereas, in females and on combined sex

Table 2: Means for confirmation traits on pooled sex basis due to the probiotics effect at IVth and VIth weeks

	Shank length(cm)		Keel Length(cm)		Breast Angle(‘)	
FACTORS	**28 days**	**42 days**	**28 days**	**42 days**	**28 days**	**42 days**
Prob. P^0	5.69 [a]	7.28 [a]	6.45	7.48 [a]	58.23 [a]	63.57 [a]
P^1	5.85 [b]	7.82 [b]	6.41	8.31 [b]	61.63 [b]	66.97 [b]
SE Range	0.02-0.04	0.04-0.07	0.04-0.08	0.04-0.06	0.3-0.7	0.27-0.32

*Means having similar super-scripts do not differ significantly P^0 (daily diet Without Probiotic), P^1 (daily diet With Probiotic)

basis keel bone length was affected at 42 days of age. The males keel bone length are superior than the females at both the ages of recording and the diet supplemented with probiotic resulted significantly highest keel bone length than the diet not supplemented with probiotic.

Shank length

The highly significant difference were observed due to probiotic- effect on the shank length in both males and females and on combined sex analysis at 28 days and 42 days of age. The diet having probiotic showed significantly longer shank length than the diet without probiotic.

Carcass characteristics

Four broilers of either sex from each replication were picked up randomly for slaughtered to study the carcass characteristics, proximate composition and Microbial counts of meat. The data were analyzed for each characteristic within and combined sex basis to study the Probiotic effect. On per cent weight basis of different carcass traits the overall means for carcass trait for 42 days of age due to main and interaction effects were tabulated in Table 3.

Hossain *et al.,* (2012) Indicated that had a positive effect on carcass composition. Paryad and Mahmoudi, (2008) concluded that supplementation of probiotics improve carcass characteristics of broiler chicks.

Dressing percentage

The supplementation of probiotic in the diet was found to have highly significant effect (P<0.01) on dressing per cent of males. Low per cent eviscerated yield was observed for the diet containing probiotic.

Giblet weight Per centage

The analysis of variance revealed highly significant effect of probiotic on per cent giblet weight of males, females and combined sexes. Higher per cent giblet weight was obtained in the diet not supplemented with probiotic, which was true for either and combined sexes.

Abdominal fat Percentage

Probiotic exerted significant only on per cent fat weight of females, but opposite to enzyme effect higher per cent abdominal fat was observed in probiotic supplemented diet. Kalavathy *et al.,* (2003) concluded that the supplementation of Lactobacillus culture in broiler diets improved the body weight gain and feed conversion rate from 1 to 42 days of age and was effective in reducing abdominal fat deposition but only after 28 days of age. Hossain *et al.,* (2012) Indicated that it had a positive effect on gizzard relative weight. It improved oxidative stability of both breast and thigh meats.

Kalavathy *et al.,* (2006) studied that LC reduces the fat content of the liver, muscle and carcass of broiler chickens, but it has very little potential to modify the fatty acid composition.

Table 3: Means for carcass characteristics due to the probiotics effects for pooled sexes (28 days)

Factors	Dressing percentage	Giblet weight percentage	Abdominal Fat percentage
P^0	64.57[b]	4.20b	0.65
P^1	63.05[a]	3.83[a]	0.70
SE Range	0.95-1.12	0.06-0.16	0.03-0.07

Per cent cut-up parts yield

The findings are in close agreement with Brozoska *et al.,* (1999a b). The probiotic was found to have significant effect only on per cent wing yield of males. Numerically higher values were recorded for back with neck per cent yield of both the sexes due to probiotic effect were tabulated in Table 4.

Inclusion of probiotic showed the significant effect on males, females and on combined sex basis the results of present study on per cent shrinkage, per cent dressing, per cent giblet and on total per cent meat yield. Higher per cent yield was estimated for most of the carcass components in the control group than the diet supplemented with probiotic. The cut-up parts yield (leg, breast, back with neck and wings) more or less similar in control and probiotic supplemented dietary group and also the percentage was lower in probiotic supplemented diet than the control group. Takalikar *et al.* (1992a, b) studied the effect of probiotic with and without 0.02 per cent probiotic and reported that carcass characteristics were more or less similar in control and probiotic supplemented dietary group. Kulkarni and Thakur (1992) also reported almost similar dressing percent into sexes and the yield of different carcass components did not differ significantly in control and probiotic treated groups (Takalikar *et al.,*1992 a, b; Fleroupaneri *et al.,*1993; Baidya *et al.,*1994; Singh *et al.,* 1999c; Eren *et al.,* 1999; durst *et al.,*1995; Biswal *et al.,* 2000; Sayed *et al.,* 2000; Talukder *et al.,* 2001; Pietras *et al.,* 2001; Mahajan *et al.,* 2000; Endo *et al.,*1999; Hossain *et al.,* 2012). The present study indicated nonsignificant differences for per cent total meat yield of females in control and probiotic supplemented dietary groups. Some of the carcass parameters studied here (weight of giblets, weight of shank and dressing percentage) are in line with (Katoch *et al.,*1998; Mahajan *et al.,* 1999; Sayed *et al*., 2000; Banday and Risam, 2001). The probiotic treatment had no effect on the hot and cold carcass weight, carcass yield and the weight of carcass cuts and the abdominal fat pad Karaoglu and Durdag (2005); Kalavathy *et al.* (2006).

Proximate composition

Four broilers of either sex from each replication were picked up randomly for slaughtered to study the proximate composition of meat. The data were analyzed for each proximate composition within and combined sex basis to study the Probiotic effect. On per cent basis of different proximate composition the overall means for proximate composition due to main and interaction effects were

Table 4: Means of cut-up parts due to the probiotics effects for males, females and on pooled sex basis

Factors	Males				Females				Pooled			
	Leg%	Wings %	Back & Neck%	Breast%	Leg%	Wings %	Back & Neck%	Breast%	Leg%	Wings %	Back & Neck%	Breast%
Prob. P^0	31.98	17.12[b]	24.47	26.32	31.73	16.81	24.46	26.61	31.85	16.97	24.64	26.47
P^1	31.92	16.83[a]	24.79	26.44	32.36	16.98	24.78	26.42	32.14	16.9	24.6	26.43
SE Range	0.22 - 0.33	0.11- 0.19	0.13- 0.27	0.14 - 0.22	0.22- 0.33	0.01- 0.18	0.14- 0.29	0.14 - 0.23	0.22 - 0.34	0.11- 0.19	0.15- 0.30	0.15 - 0.27

*Means having similar super-scripts do not differ significantly

Table 5: Means of Proximate principles due to main and interaction effects for males, females and on pooled sex basis

	Males				Females				Pooled			
Factors	Moisture%	Fat%	Protein%	Ash%	Moisture%	Fat%	Protein%	Ash%	Moisture%	Fat%	Protein%	Ash%
Prob. P^0	70.60	5.20	18.10	0.86	71.20	5.30	17.90	0.84	70.90	5.25	18.00	0.85
P^1	70.00	5.30	18.50	0.90	70.90	5.50	18.20	0.88	70.45	5.40	18.35	0.89
SE Range	.09-.1	1.1- 1.2	.02-.04	.01-.02	.08-.11	1.2- 1.4	.02-.04	.01-.02	.08-.1	1.1- 1.3	.02-.04	.01-.02

*Means having similar super-scripts do not differ significantly

Table: 6: Means of Microbial counts due to main and interaction effects for males, females and on pooled sex basis

	Males			Females			Pooled		
	standard	Coliforms	Lactobaci-	standard	Coliforms	Lactobaci-	standard	Coliforms	Lactobaci-
Factors	platecount	count	lli count	platecount	count	lli count	platecount	count	lli count
Prob. P^0	4.2	2.7	4.0	4.1	2.7	3.5	4.2	2.7	3.8
P^1	4.0	2.5	4.2	3.9	2.6	4.0	4.0	2.6	4.1
SE Range	.07-.09	.06-.08	.05-.07	.02-.03	.03-.04	.01-.02	.04-.07	.04-.05	.03-.04

*Means having similar super-scripts do not differ significantly

tabulated in Table 5. The proximate principles of the meat revealed that there was no effect of the treatments on moisture, fat and ash content. However, the protein content was reduced significantly in broilers diet containing Probiotics. Similar findings were noted by the Brozoska *el al.* (1999a, b) could not found any difference due to probiotic supplementation in broiler diet. Further it was also noted that the percent fat content was lower in carcass of probiotic fed groups than control. It was in compliance with the observations of (Endo *et al*., 1999; Pietras, 2001; Hossain *et al.,* 2012) also indicated that it had a positive effect on fatty acid composition.

Microbial counts

Four broilers of either sex from each replication were picked up randomly for slaughtered to study the microbial counts of meat. The data were analyzed for each microbial counts within and combined sex basis to study the probiotic effect. On log *cfu* per gram basis of different Microbial counts the overall means for Microbial counts due to main and interaction effects were tabulated in Table 6. Microbial counts of broiler were not within the safe limits. The *Lactobacillus* counts were recorded higher in probiotic fed groups than the control. The lactobacillus count was increased due to P fed groups. Our finding are in agreement with that of Sinol *et al*. (2012) they indicated that *B. subtilis* LS 1-2 can improve intestinal microbial balance and gut health of broilers. As well as Mahajan *et al.* (2000) they found that standard plate count significantly reduced due to probiotic feeding.

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