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Full Length Research Paper

Carcass and commercial cuts yield in broilers of different ages fed diets supplemented with probiotics

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Abstract

In this study, the carcass and commercial cuts weights and yields in broilers of different ages fed diets supplemented with probiotics were determined. A total of 336 male broiler chicks (*Ross-308*) were randomly allocated into three treatment groups (P_0, P_1 and P_2). A basal diet (P_0), basal diet plus 0.01% (P_1) and 0.02% (P_2) probiotic (*Saccharomyces cerevisiae*, $4x10^8$ cfu g^{-1}) were offered to experimental groups. At the end of the trial, all chicks were slaughtered and stored at 3 °C for 24 hours. The cold carcass weights were determined, and then the carcasses were dissected into neck, whole wing, wing drumette, winglet, wing tip, whole breast, breast fillet, breast skin, front back, thigh, drumstick, hind back and tail as cuts up. All cuts up were weighed and their yields were calculated. The use of probiotic in broiler diet had significant effects on whole breast ($p<0.05$), breast fillets ($p<0.01$) and front back ($p<0.01$) weights. The weightiest breast fillet was in P_1 as compared with control and P_2 groups ($p<0.05$). The slaughter age, as expected, affected all parameters investigated ($p<0.01$) in point of weight of carcasses and cuts up, and the highest values were obtained at 49 days. On the other hand, the effect of treatment x slaughter age interaction on front back weight of broiler carcass was significant ($p<0.05$).

Keywords: broiler, probiotic, slaughter age, carcass, commercial cuts yield.

INTRODUCTION

In the recent past, the poultry industry products were generally marketed on whole carcass. However, today there is need for separate carcass offer or partial carcass parts. Therefore, major changes have occurred in poultry meat marketed. Some researchers reported that the accent of broiler production is putting on the quality and yield of the major carcass parts. Depending on market demand, poultry can be sold as a whole, ready-to-cook bird, split into two halves, separated into different parts such as wings, whole breast, deboned fillets, drumstick, thigh, whole leg, etc. On the other hand, it is determined that some factors such as line, sex, age, health, nutrition, body weight, fattening period before slaughtering influenced these carcass parts (Barbut, 2002; Nikolova and Pavlovski, 2009). Different feeding regimes, feeding periods and slaughter age have an effect on the broiler performance, carcass traits and its cuts up (Bilgili et al., 1992; Fletcher and Carpenter, 1993; Karaoglu et al., 2006). Nikolova and Pavloski (2009) defined that influence of age was significant the chicken at age of 49th day had a lot bigger mass and proportion of breasts, thighs an drumsticks than chicken at age of 42nd and 35th day. However, Leeson et al. (2000) and Young et al. (2001) determined that there was a growing trend in the broiler industry to produce weightier chickens for further processing.

Probiotics used instead of antibiotics improved the performance of broilers (Jernigan, 1985; Dawson, 1993; Karaoğlu and Durdağ, 2005). Supplementing broilers with microbial cultures provides beneficial bacteria to aid in nutrient absorption normalize gut activity by enhancing the microbial balance in the avian digestive tract (Erdogan, 1989; Kutlu and Görgülü, 2001). On the other hand, the use of probiotics in broiler diets improved meat quality (Karaoglu et al., 2004; 2005) and chemical and microbiological stability of drumstick and breast meats during storage (Aksu et al., 2005). Although the probiotic use has a positive effect on the meat quality and performance of broiler chickens, there is no information if probiotic use affected the carcass parts of broilers at different slaughter ages. So, the aim of the present study was to determine whether and how probiotic levels and different slaughter ages affected the parts of broilers carcasses and yields.

MATERIAL AND METHODS

A total of 336 one-day-old male broiler chicks (*Ross-308*) obtained from a commercial broiler breeder flock (KÖY-TÜR) were used in the current study. The chicks were weighed and distributed randomly into three dietary treatment groups were replicated eight times per treatment, comprising of 14 birds each replicate. The probiotic was added and mixed to basal diets. The experimental groups consisting three dietary treatments were: P_0 fed basal broiler diet containing no probiotics (0 g/kg), P_1 fed basal diet plus 0.1% probiotic (1 g/kg) and P_2 fed basal diet plus 0.2 % probiotic (2 g/kg). Commercial probiotic source was *115-Biogallinox* (Techniques et Biochimie Appliquees, 116-118 Avenue Beaurepaire, 94100 Saint Maur des Fosses, France) containing *Saccharomyces cerevisiae* ($4x10^8$ CFU/g). All chicks were fed *ad libitum* in three dietary groups for 35, 42 or 49 days in the Application and Research Farm of the Agricultural Faculty, Ataturk University. Also, birds were fed a starter diet from day 1 to 21, and a finisher diet to 35, 42 or 49 days. The basal diet was formulated to meet the nutritional requirements of the broiler chicken (NCR, 1994). Feed composition used in trial is shown Table 1, and its composition was analyzed by the AOAC (1984).

All birds were individually weighed at the end of the experimental period (35, 42 and 49 days). Total 72 birds (P_0: 8, P_1: 8, P_2: 8, total 24 for the first slaughter; and P_0: 8, P_1: 8, P_2: 8 total 24 birds for the second slaughter; and P_0: 8, P_1: 8, P_2: 8 total 24 birds for the third slaughter) were selected for evaluation of carcasses by representing one bird randomly chosen for each subgroup Prior to slaughtering the birds were held without feed for 10 hours, electrically stunned, slaughtered by neck cut, bled for 120 s and semi-scalded 54 °C for 30 s before mechanical plucking in a rotary drum plucker. The birds were eviscerated manually, washed and allowed to drain 10 min. (Yalcın et al., 1995). After eviscerating, the carcasses were stored at 3 ± 0.5 ° C for 24 h. and then dissected according to Barbut (2002) and Mathes et al. (1997). All cut up pieces were shown in Table 2 as weight and percentage the basis of cold carcass weight (Aksu et al., 2007).

Weight and calculated data (percentage) were separately analyzed with SPSS a using the General Linear Models in the analysis of variance (SPSS, 1997) for the completely randomized experimental design, as a 3 x 3 factorial arrangement. The model included the rations (P_0, P_1 and P_2) and slaughter age (35, 42 and 49 days) as main effects, and all their interactions, but the only significant interaction was shown in Figure 1. Comparisons of mean values were made using the Duncan's multiple range test ($p<0.05$). The results of the statistical analysis are shown as mean values ± standard error in tables.

RESULTS AND DISCUSSION

The slaughter age significantly affected the cold carcass weight ($p<0.01$). As slaughter age goes on the weight of cold carcass increased ($p<0.05$). The probiotic and probiotic x slaughter age had no effect on the cold carcass weight ($p>0.05$). Although the effect of treatment had no significant, P_1 group has the highest CCW among treatment groups (Table 3). Karaoğlu and Durdağ (2005) reported that the use of probiotic in broiler diet did not affect the live performances, but slaughter age had significant effect on these parameters.

Although the slaughter age had significant effect on both of the weight ($p<0.01$) and percentage of neck ($p<0.05$), treatment and probiotic x slaughter age interaction did not affect (Table 3 and 4). Table 3 demonstrates that neck weight increased as slaughter age goes on, controversially percentage. Breke et al. (1993) found that the percentages for neck for 35, 42 and 49 days of broiler age were 4.6, 4.4 and 4.2 %, respectively. Cevger et al., (2003) determined that the neck of broiler carcasses have similar cold carcass weights changed 6.80-7.24%, and as CCW decreased the percentage of neck increased.

Whole wing and wing parts (wing drumette, winglet and wing tip) were affected by slaughter age ($p<0.01$), and the highest values were determined at the 49-day of age. However, probiotic levels and probiotic x slaughter age did not affect the wings and wing parts (Table 3). As percentage for the wing drumette was taken into consideration, the adding of probiotic at increasing levels had significant effect ($p<0.05$) on this parameter. However, there was no difference among slaughter days in point of wing tips (Table 4). The percentages for the whole wings are in general agreement with those reported (10.87-12.30%) by Cevger et al., (2003). Generally, wings, especially the portion of winglet because of containing high fat level, are consumed in Turkey as grilled meat for brazier.

Breast fillets are very important for human nutrition because of high meat quality in broiler carcasses, such as breast fillets have providing high quality protein and lower collagen and fat contents. Lesiow and Xiong (2004) reported that broiler breast meats contain protein 22.8%, fat 1.58%, collagen 0.54% and cholesterol 47.42-mg/100

Table 1. Composition of basal diets (%)

	Starter diet	Finisher diet
Ingredients and composition (%)		
Ground corn	46.29	46.23
Soybean meal (48% CP)	22.14	21.00
Fullfatsoy	12.50	10.00
Ground wheat	10.00	10.00
Fish meal	4.00	2.50
DCP	1.67	1.73
Ground limestone	0.59	1.30
Salt (NaCl)	0.25	0.26
Soya oil	1.58	3.31
Poultry fat	-	1.50
Lysine	-	0.08
DL-methionine	0.24	0.25
Choline cloride	0.04	0.04
Trace mineral premix[1]	0.30	0.30
Vitamin premix[2]	0.50	0.50
Coccidiostat	0.10	0.10
Lasolocyde	-	0.10
Analysis (%)[3]		
Dry matter	94.00	93.00
Crude protein	22.00	20.00
ME kcal./kg	3000	3100

[1]: Trace mineral mixure provides in milligrams per kg of diet: Mn, 70; Zn, 50; Fe, 30; Cu, 5, Se, 0.3. [2]:Vitamin mixure provides per kg of diet: vitamin A 8000 IU; cholecalciferol 1000 IU; α-tocopheryl acetate 15 mg/kg; menadione 3 mg/kg; riboflavin 5 mg/kg; niacin 40 mg/kg; thiamin 2 mg/kg; folic acide 0.6 mg/kg; vitamin B_{12} 15 µg/kg;
[3]: Calculated by AOAC (1984)

Table 2. Description of the weights and calculated of cut up pieces of broiler carcass

Variable	Description (weight, g)	Description (%)
Cold carcass	Whole carcass weight stored 3±0.5ºC for 24h	100
Neck	Weight of front portion of front back	Neck weight / cold carcass weight x 100
Whole wing	Weight of both wings	Whole wing weight / cold carcass weight x 100
Wing drumette	Weight the proximal portion of the both wings	Wing drumette/ cold carcass weight x 100
Winglet	Weight of distal portion of both wings	Winglet/ cold carcass weight x 100
Wing tip	Weight of tip portion of both wings	Wing tip weight/ cold carcass weight x 100
Whole breast	Weight of whole breast	Whole breast weight/ cold carcass weight x 100
Breast fillet	Weight of breast fillets	Breast fillet weight/ cold carcass weight x 100
Breast skin	Weight of skin on breast fillets	Breast skin weight/ cold carcass weight x 100
Front back	Weight of upper portion with bone of breast fillets.	Front back weight/ cold carcass weight x 100
Thigh	Weight of the proximal portion of the both legs	Thigh weight/ cold carcass weight x 100
Drumstick	Weight of the distal portion of the both legs	Drumstick weight/ cold carcass weight x 100
Hind back	Weight of upper portion with bones of both legs	Hind back weight/ cold carcass weight x 100
Tail	Weight of tail with cartilage tissue	Tail weight/ cold carcass weight x 100

Table 3. Cut up pieces of broiler carcass as weight (g).

		CCW	Neck	Whole Wings	Wing Parts			Whole Breast	Breast Parts			Leg parts and hind back			Tail
					Wing drumette	Winglet	Wing tip		Fillets	Skin	Front Back	Thigh	Drumstick	Hind Back	
Probiotic Levels															
P_0		1518.29	79.50	171.00	84.71	65.33	20.71	628.08b	336.79b	36.75	252.83b	237.04	219.29	154.54	22.63
P_1		1534.21	73.71	167.38	80.25	66.38	19.96	662.83a	357.42a	41.29	247.75b	241.88	219.63	150.17	22.17
P_2		1530.63	76.71	169.58	82.63	65.08	20.50	632.21ab	328.83b	35.75	266.38a	247.50	218.96	159.54	21.83
SEM		15.28	1.96	1.90	1.32	0.78	0.45	10.97	6.92	1.81	3.76	3.99	3.29	3.17	0.98
Significance		Ns	Ns	Ns	Ns	Ns	Ns	*	**	Ns	**	Ns	Ns	Ns	Ns
Slaughter Age (days)															
35		1160.00c	61.83c	136.29c	68.42c	51.04c	15.25c	468.08c	245.88c	27.58c	194.08c	183.92c	166.13c	118.17c	19.38b
42		1562.54b	76.00b	166.75b	78.83b	67.17b	20.25b	678.42b	351.58b	38.88b	270.21b	244.75b	226.08b	156.17b	21.92b
49		1860.58a	92.28a	204.92a	100.93a	78.58a	25.67a	777.93a	425.98a	47.33a	302.67a	297.75a	265.67a	189.92a	25.63a
SEM		15.28	1.96	1.90	1.32	0.78	0.45	10.97	6.92	1.81	3.76	3.99	3.29	3.17	0.98
Significance		**	**	**	**	**	**	**	**	**	**	**	**	**	**
Probiotic x Slaughter Age (days)															
P_0	35	1143.25	63.75	132.75	66.88	50.25	15.13	459.13	244.75	25.88	188.75	182.13	165.88	115.88	16.13
	42	1564.38	79.00	171.25	82.75	67.00	21.00	662.00	348.38	37.13	273.25	237.75	222.75	162.50	23.25
	49	1847.25	95.75	209.00	104.50	78.75	26.00	763.13	417.25	47.25	296.50	291.25	269.25	185.25	28.50
P_1	35	1165.88	60.63	138.88	69.50	52.88	15.63	475.75	257.75	32.88	184.00	179.88	161.38	117.75	23.00
	42	1547.00	77.00	162.50	75.25	67.00	19.75	699.50	361.50	39.50	251.75	239.25	231.25	149.50	20.75
	49	1889.75	83.50	200.75	96.00	79.25	24.50	813.25	453.00	51.50	307.50	306.50	266.25	183.25	22.75
P_2	35	1170.88	61.13	137.25	68.88	50.00	15.00	469.38	235.13	24.00	209.50	189.75	171.13	120.88	19.00
	42	1576.25	72.00	166.50	78.50	67.50	20.00	673.75	344.88	40.00	285.63	257.25	224.25	156.50	21.75
	49	1844.75	97.00	205.00	100.50	77.75	26.50	753.50	406.50	43.25	304.00	295.50	261.50	201.25	24.75
SEM		26.47	3.40	3.29	2.29	1.35	0.77	18.99	11.99	3.13	6.51	6.91	5.71	5.49	1.70
Significance		Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	*	Ns	Ns	Ns	Ns

*: ($P<0.05$); **: ($P<0.01$); Ns: Non significant;
a-c: Means within a column and same section with no common superscripts differ significantly ($P<0.05$). CCW: Cold carcass weight.

Table 4. Cut up pieces of broiler carcass as percentage (%).

		CCW[1]	Neck	Wing drumette	Winglet	Wing tip	Hind Back	Thigh	Drumstick	Front Back	Fillets	Skin	Tail
Probiotic Levels													
P_0		1518.29	5.28	5.60a	4.32	1.36	10.19	15.63	14.45	16.68b	22.07b	2.39	1.48
P_1		1534.21	4.86	5.30b	4.36	1.31	9.81	15.71	14.29	16.12b	23.13a	2.70	1.51
P_2		1530.63	5.03	5.43ab	4.26	1.33	10.39	16.17	14.33	17.52a	21.31b	2.31	1.45
SEM		15.28	0.12	0.08	0.05	0.03	0.18	0.18	0.16	0.22	0.31	0.11	0.06
Significance		Ns	Ns	*	Ns	Ns	Ns	Ns	Ns	**	**	Ns	Ns
Slaughter Age (days)													
35		1160.00c	5.34a	5.89a	4.40a	1.32	10.18	15.86	14.32	16.73ab	21.19b	2.37	1.67a
42		1562.54b	4.88b	5.04c	4.31ab	1.29	10.01	15.64	14.47	17.29a	22.48a	2.49	1.40b
49		1860.58a	4.95b	5.40b	4.23b	1.38	10.21	16.01	14.29	16.29b	22.83a	2.55	1.36b
SEM		15.28	0.12	0.08	0.05	0.03	0.18	0.18	0.16	0.22	0.31	0.11	0.06
Significance		**	*	**	*	Ns	Ns	Ns	Ns	**	**	Ns	**
Probiotic x Slaughter age (days)													
35	P_0	1143.250	5.58	5.85	4.39	1.32	10.13	15.93	14.52	16.52	21.39	2.27	1.41
	P_1	1165.875	5.20	5.97	4.54	1.34	10.08	15.44	13.84	15.78	22.10	2.82	1.99
	P_2	1170.875	5.24	5.87	4.27	1.28	10.33	16.22	14.60	17.88	20.09	2.04	1.62
42	P_0	1564.375	5.06	5.29	4.29	1.34	10.40	15.18	14.25	17.45	22.25	2.37	1.49
	P_1	1547.000	4.98	4.87	4.33	1.28	9.66	15.46	14.94	16.29	23.34	2.56	1.34
	P_2	1576.250	4.59	4.96	4.29	1.27	9.96	16.28	14.21	18.15	21.87	2.53	1.38
49	P_0	1847.250	5.19	5.66	4.26	1.41	10.03	15.76	14.57	16.05	22.59	2.56	1.54
	P_1	1889.750	4.41	5.08	4.19	1.29	9.69	16.23	14.11	16.28	23.94	2.73	1.20
	P_2	1844.750	5.25	5.47	4.22	1.44	10.89	16.02	14.18	16.54	21.97	2.35	1.34
SEM		26.47	0.21	0.13	0.08	0.05	0.31	0.32	0.28	0.38	0.54	0.19	0.440
Significance		Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns

*: ($P<0.05$); **: ($P<0.01$); Ns: Non significant;a-c: Means within a column with no common superscripts differ significantly ($P<0.05$).
[1]CCW: Cold carcass weight. BF/CCW:Breast Fillets / Cold Carcass Weight

g. Thus, breast fillets are the most economically important part of the carcass. In the present study, the whole breast ($p<0.05$), fillets ($p<0.01$) and front back ($p<0.01$) weights and percentages were significantly different by probiotic levels. Whole breast and fillet weights or as percentage of carcass were significantly greater for P_1 group than any of the other two groups ($p<0.05$). The increased breast meat portion would also result in a decrease in the other part on a relative basis (Table 3 and 4). In some researches related to breast fillets and carcasses of broilers (Aksu et al.,

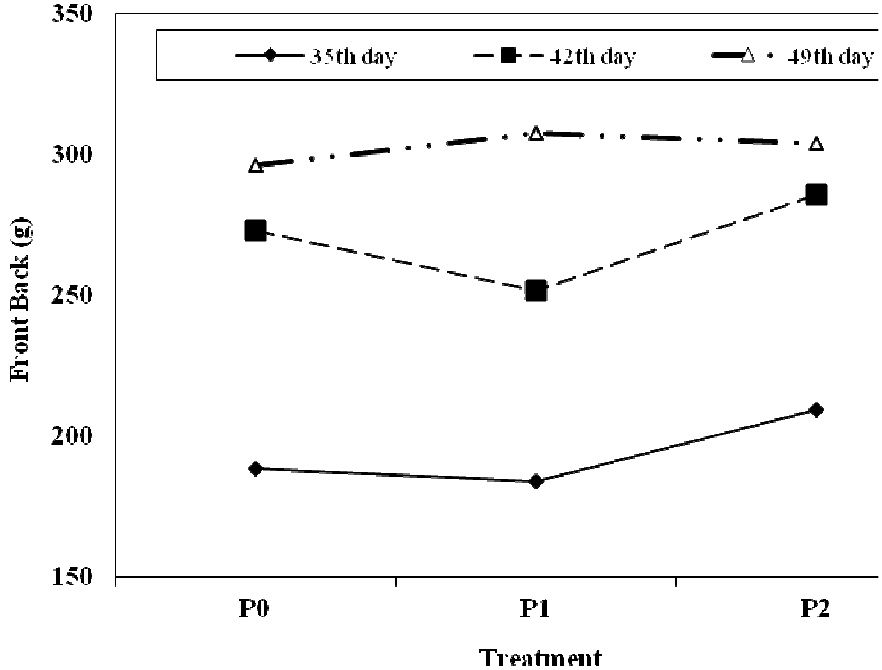

Figure 1. The effect of treatment x slaughter age on front back weight of broiler carcass.

2005; Karaoglu et al., 2005) it was determined that the use of probiotic in broiler diets positively affected the breast fillets and carcass quality such as TBARS, pH, color and microbiological properties for 24 h and 12-day storage. On the other hand, slaughter age had a significant effect on whole breast and breast fillets ($p<0.01$). As expected, whole breast and breast fillets weights increased depending on slaughter age goes on (Table 3). Nikolova and Pavlovski (2009) also determined that weight of breast for 35, 42 and 49 day was 291.57g, 399.82g, and 515.83g, respectively. Age impact was statistically significant, so the chicken at age of 49th day had a lot bigger mass and proportion of breasts than chicken at age of 42nd and 35th day, as the chicken at age of 42nd days had significantly larger mass and major carcass parts proportion than chicken at age of 35th day. Meanwhile, the breast fillets have the highest percentage (21.31-23.94%) for cold carcass weight as compared with the other cuts up (Table 4). The results of these studies agree with previous reports indicating that breast fillets have highest portion among cuts up of broiler carcass (Cevger et al., 2003; Smith, 1993). In this study, whole breast was taken up three parts as fillet, skin of fillet and front back, as mentioned in Table 2. Front back weight was affected by treatment ($p<0.01$), slaughter age ($p<0.01$) and their interaction ($p<0.05$). The weightiest front back was obtained from P_2 group among treatment groups (Table 3), and 49 days among slaughter ages (Table 4). Figure 1 depicts that the weightiest front back was observed in P_2 group for 35 and 42 days, while P_1 had highest front back weigh for 49 days.

The more important portion of carcass is leg with its parts following breast fillet in point of meat proportion. Thigh and drumstick meats are the most popular to grill in Turkey. As shown in Table 2, the whole leg was dissected into three parts as thigh, drumstick and hind back. While treatment and slaughter age x treatment interaction did not affect the leg part weights, slaughter age significantly did ($p<0.01$; Table 3). There were no effects of all variation sources on these parameters, as percentage (Table 4). When legs were taken into consideration as a whole (percentage) the weights of leg are very near to the findings of Barbut (2002), Brake et al., (1993) and Cevger et al., (2003). The result related to leg, drumstick and thigh weights of this research were higher than those of Smith (1993).

CONCLUSION

In this research, although the inclusion of probiotic into diets of broiler did not affect the cold carcass weight, the supplement of 0.1% probiotic increased the weights of whole breast, breast fillets and front back as compared with the other groups. Therefore, it is recommendable to add probiotics to broiler diets to obtain the weightier cuts up such as breast fillets, which are very important for marketing and meat production.

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