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The Influence of Dietary Probiotic (*Saccharomyces cerevisiae*) Supplementation and Different Slaughter Age on the Performance, Slaughter and Carcass Properties of Broilers

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Abstract: The present study was carried out to determine the influence of dietary probiotic (*115-Biogallinox*, containing *Saccharomyces cerevisiae* at 4×10^8 colony forming units/g) on growth, slaughter and carcass characteristics of broilers slaughtered at different ages (35, 42 and 49 days). Day-old male Ross-308 chicks ($n = 336$) were weighed and randomly assigned to three dietary treatment groups [P_0 (control): 0 g probiotic/kg; P_1 : 1 g probiotic and P_2 : 2 g probiotic/kg] as a 3×3 factorial arrangement. Each treatment group was replicated eight times as subgroups, comprising of 14 birds each. The broiler chickens were grown on starter (0 to 21 days) and finisher (to 35, 42 and 49 days) diets calculated to meet NRC recommendations. Body weight and feed consumption were determined weekly during the study. Means to slaughter age of body weight, daily weight gain, daily feed consumption, feed efficiency and mortality were 2524.5, 50.7, 94.4 g, 1.86 and 1.8% for P_0 group; 2559.1, 51.4, 94.8 g, 1.85 and 0.0% for P_1 group; 2548.3, 51.2, 95.9 g, 1.88 and 1.8% for P_2 group, respectively. None of the live performance variables investigated differed significantly between control and probiotic treatment. Similarly, 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. Means for these slaughter variables were 1543.8, 1521.3 g, 74.0, 73.4%, 31.0 g for P_0 group; 1561.1, 1539.4 g, 74.2, 73.6%, 30.2 g for P_1 group; 1558.7, 1535.2 g, 74.1, 73.5% and 31.0 g for P_2 group, respectively. However, slaughter age had a highly significant effect on the final body weight slaughter variables mentioned above. In this experiment probiotic supplementation of broilers, up to the level of 4×10^8 colony forming units/kg feed, did not significantly affect the live performance and slaughter variables investigated.

Key words: Broiler, probiotic, performance, slaughter age, carcass traits

Introduction

Soon after the introduction of antimicrobials into human chemotherapy in the 1940s they were also introduced into veterinary practice (Moore *et al.*, 1946). Chickens are consequently more susceptible to colonization by bacterial pathogens. It is known that microbes-microscopic organisms such as bacteria or fungi- are a major cause of disease. When livestock and poultry are fed low doses of antibiotics routinely, bacteria may develop that are resistant to the drugs (Collignon, 1999). Microbes play a key role in the digestive process. Netherwood *et al.* (1999) show that improving the balance of the healthy microbes in digestive tract of chickens can provide benefits ranging from stimulation of the immune system to reductions in the risk of certain illness. Normal gut microbiota in farm animals is important because of their effects on the production of livestock and the quality and safety of livestock products. During studies on the sterilization of the intestine of chickens with antibiotic feed supplements (sulfonamide and streptomycine) a growth promoting effect was observed and soon after this was confirmed in pigs (Moore *et al.*, 1946). By 1949, antibiotics had been approved for growth promotion in experimental, and

many different groups of antibacterial have subsequently been approved for on-farm use as growth promoters in many European countries and the United States of America (Inbarr, 2000). In the poultry industry, a 3-5% increase in growth and feed conversion efficiency is a typical effect of antibiotics used in feed at prophylactic levels (Thomke and Elwinger, 1998). However, some scientific findings (Manning *et al.*, 1994); suggested that antibacterials used for animal feeding becomes risky for human (Sahin, 2002); and animal health (Thorns, 2000) and the conclusions of scientific committee of the European Council have led to a ban on feeding antibiotic growth promotants (virginamycin, spiramycin, tylosin and zinc bacitracin), which are commonly used in feed around the world (Collignon, 1999). Increased public concern over the development and spread of antibiotic resistance in bacteria and the possible presence of antibiotic residuals in poultry products has led to search for alternatives to use of antibiotics in chicken diets (Gong *et al.*, 2002). Currently, many parts of the world are experimenting alternative feed additives that may be used to alleviate the problems associated with the withdrawal of antibiotics from feed. A popular alternative

to the use of antibiotics has been the use of probiotics, which have been used in poultry for "competitive exclusion" of bacterial pathogens (Barrow, 1992). The positive effects of probiotics on animals can result either from a direct nutritional effect of the probiotic, or a health effect, with probiotics acting as bioregulators of the intestinal microflora and reinforcing the host's natural defenses. There have been numerous studies in humans and animals on the ability of probiotics to change the types and numbers of gut microflora (Endo *et al.*, 1999). Gong *et al.* (2002) define probiotics as health-promoting bacteria inhabiting the gastrointestinal tract of humans and animals. Exactly how supplemental dietary microbial products function in the digestive system is not known, but some suggested mechanism are that they: 1) provide nutrients, 2) aid in digesting foods, and 3) inhibit harmful bacteria (Owings *et al.*, 1990).

Since Tortuero (1973) found that *Lactobacillus* cultures improve broiler growth, many investigations (Watkins and Kratzer, 1983; Watkins and Kratzer, 1984; Jernigan *et al.*, 1985; Dawson, 1993) have been conducted to determine the effects of probiotic bacteria, mainly the lactic acid bacteria (LAB), on the performance of domestic animals, especially poultry species. Studies mentioned above suggest that supplementing broilers with microbial cultures provides beneficial bacteria to aid in nutrient absorption and enhance the microbial balance in the avian digestive tract. Therefore, probiotics are used to get rid of stress-induced abnormalities in the gastrointestinal tract, thus normalizing gut activity (Kutlu and Görgülü, 2001). Some reports (Erdogan, 1999; Midilli and Tuncer, 2001) showed that additional benefits can be gained by supplementing broiler diets with probiotics as feed additives. Cavazzoni *et al.* (1998) found that feeding probiotic supplements based on *Bacillus coagulans* enhanced the growth rate of broilers. However, Jin *et al.* (1998) reported that although a significant improvement in feed conversion ratio (FCR) was observed in probiotic-supplemented broilers, the results from investigations related to the use of probiotics are inconsistent. Consequently, equivocal reports about the effectiveness of probiotics in broiler feeding characterize the literature, showing either significant improvements in performance or no benefit at all.

The objective of this study was to determine the effects *Saccharomyces cerevisiae* as a dietary probiotic source (4×10^8 colony forming units (cfu)/kg feed) on the growth, slaughter and carcass traits of broilers slaughtered after different feeding periods (at 35, 42 and 49 days of age).

Materials and Methods

A total of 336 Ross-308, day-old male broiler chicks, obtained from a commercial hatchery (KÖY-TÜR: Erzurum Integrated Poultry Co, 25700 Turkey) were

used. Chicks were housed in batteries from 1 to 21 days, and then in litter pens (1x1.5x1.5m) from 22 days of age to slaughter at 35, 42 and 49 days of age, respectively. The study was conducted at the Application and Research Farm of the Agricultural Faculty, Atatürk University (Erzurum: longitude: 41.3, latitude: 39.9, altitude: 1982m). The ambient temperature was thermostatically controlled. This temperature was set at 33°C for the first day of the experiment and was decreased by 1°C every third day thereafter for the duration of the experimental period. All chicks were weighed on Day 1, and distributed randomly into three dietary probiotic treatment groups. The experimental groups consisting three dietary treatments were: 1) P₀ fed basal broiler diet containing no probiotics (0 g probiotic/kg, acted as control), 2) P₁ fed basal diet plus 0.1% probiotic (1 g probiotic/kg), and 3) P₂ fed basal diet plus 0.2% probiotic (2 g probiotic/kg). Each probiotic treatment group of 112 chicks was randomly subdivided into eight subgroups (replicates), comprising of 14 birds each. Feed and water were offered *ad libitum*, and lighting was continuous throughout the experimental period. Birds were fed a starter diet from day 1 to 21, and a finisher diet from day 22 to slaughter at either 35, 42 or 49 days. Twenty four birds (P₀: 8, P₁: 8 and P₂: 8 = 24 bird) were slaughtered at 35 day of age of broiler to determine the traits of slaughter, and this process was repeated at 42 and 49 days of experiment. In this way total 72 birds were slaughtered to determine the properties of slaughter. Diets were formulated according to NRC (1984) recommendations. Composition of the basal starter and finisher diets used in trial is shown Table 1. Chemical composition of the feeds was analyzed according to the methods of the AOAC (1984). Broilers were fed the diets with different levels of supplemental probiotic for either 35, 42 or 49 day. A commercial probiotic source, *115-Biogallinox* (Techniques et Biochimie Appliquees, 116-118 Avenue Beaurepaire, 94100 Saint Maur des Fosses, France) was used, which contained *Saccharomyces cerevisiae* (labelled as 4×10^8 cfu/g). Broiler mortality was recorded as it occurred and percentage mortality was determined at the end of the study. During the experimental period, the weight of chickens and feed consumed were recorded weekly for each replicate pen (treatment subgroup of 14 birds; the experimental unit). The mortality was considered to calculate feed intake and feed conversion ratio.

The birds were fasted for 10-12h prior to the determination of final body weight at slaughter. Each bird was weighed live, slaughtered by neck cut and allowed to bleed for 180 s (Yalçın *et al.*, 1999). The bird was then reweighed to calculate blood weight by difference, sub-scalded at 50-52°C for approximately 30 s, and placed in a rotary drum picker for 30 s to remove feathers. The featherless body was then weighed to calculate feather

weight by difference. The bird was then processed by removing the head, neck, shanks and feet, and eviscerated by cutting around the vent and carefully removing the viscera without disturbing the fat pad along the abdominal wall. The heart, liver and gizzard were dissected from the viscera, and the gizzard was cut open and rinsed of its content. All of the above components and the dressed carcass were weighed individually. The weight of the remaining gastrointestinal tract, including fat and mesentery, was determined by difference between the weight of the featherless body minus the combined weight of the various body components that were removed and the dressed carcass weight. The lungs were left in the eviscerated carcass. The carcass was immersed in water at 4°C and washed. Upon removal from water, the carcass was drained for 10 min, weighed for hot carcass weight and yield, bagged and stored at 3±0.5°C for 24h (Yalçin *et al.*, 1999). Upon removal from the bag, the fat pad lining the abdominal wall was removed from the carcass, and both fat pad and carcass were weighed individually to determine a cold carcass weight and yield. Carcass yield (“dressing percentage”) was obtained by expressing the dressed carcass weight (without giblets) as a percentage of live body weight. All of the evisceration steps, cutting procedures described above were performed according to the methods of Brake *et al.* (1993). In addition, visual assessment of carcasses in terms of subcutaneous fat accumulation was determined by two experienced people.

The data were subjected to statistical analysis, using a General Linear Model procedure of SAS (1996) for the completely randomized experimental design, as a 3x3 factorial arrangement. The model included slaughter (1, 2 and 3: 35, 42 and 49 days) and probiotic levels (P₀, P₁ and P₂) as main effects and all their interactions, but the only significant interactions were shown in figures. The mathematical model for the analyses of the effect of probiotic treatment on body weight and daily weight gain, daily feed consumption and FCR was: $y_{ij} = \mu + a_i + e_{ij}$; and the model to analyse the effects of probiotic treatment, slaughter age, and their interaction, on the slaughter and carcass properties (final body weights, blood, feather, edible and inedible organ weights, hot and cold carcass weights and yields) was: $y_{ijk} = \mu + a_i + b_j + (axb)_{ij} + e_{ijk}$. Where: y_{ij} and y_{ijk} : is the observation of *i*th probiotic treatment group and *k*th slaughter age; μ : is the population mean; a_i : is the *i*th treatment group (1, 2, 3: P₀, P₁, P₂); b_j : is the *j*th slaughter age (1st, 2nd and 3rd slaughter age: 35, 42 and 49 days); $(axb)_{ij}$: is the interaction of the *i*th treatment and *j*th slaughter age; e_{ij} and e_{ijk} : is the experimental error. Differences between means were determined by Duncan’s multiple range test at significance level of P<0.05.

Results and Discussion

Table 2 presents the live body weight and daily weight

Table 1: Composition (% as fed) of the basal diets

Ingredients and composition	Starter diet	Finisher diet
Ground corn	46.29	46.23
Soybean meal (48% CP)	22.14	21.00
Full fat soy (heat treated)	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
Soy oil	1.58	3.31
Poultry fat	-	1.50
L-Lysine	-	0.08
DL-methionine	0.24	0.25
Choline chloride	0.04	0.04
Trace mineral premix ¹	0.30	0.30
Vitamin premix ¹	0.50	0.50
Coccidiostat	0.10	0.10
Analysis (%) ²		
Dry matter	94.00	93.00
Crude protein*	22.00	20.00
Ash*	6.74	5.96
Ether extract*	4.40	4.99
Crude fiber *	7.46	6.05
N-free extracts*	57.00	56.00
ME MJ/kg (as DM)	12.56	12.97

¹: Premixes were formulated to meet recommended levels for minerals and vitamins (NRC, 1984).

²: Analyzed according to AOAC (1984) based on Dry Matter.

gain and percentages of mortality of broilers during the experiment. Body weight was not affected by probiotic treatment, except 14, 21 and 28 days of age, where body weight of probiotic supplemented birds were either significantly higher (P<0.05), or tended to be higher, than that of the control birds. Also, there was no difference in average daily weight gain during the experimental period (1-49 days), between control and probiotic-treated groups (P>0.05).

However, Table 2 depicts that the heavier body weight and daily weight gain was found in P₁ group as compared with P₀ and P₂ groups, at the end of the trial (49 days). Generally, there was no significant improvement in parameters investigated as probiotic level increased in diet. Body weight means recorded in this study were higher than those of Yalçin *et al.* (1999) and Erdogan (1999), which ranged from 1629 to 2410g. Karaoglu *et al.* (unpublished) reported that the final body weight of birds fed with supplemental ram horn hydrolysate at different levels were 2524, 2601, 2442 and 2425 g for all groups (H₀, H₁, H₂ and H₃ groups) respectively. While some recent field reports (Richter *et al.*, 2000; Pradhan *et al.*, 1998; Cmiljanic *et al.*, 2001; Banday and Risam, 2002) have suggested that probiotic supplementation improved performance of broilers, the results of the present study agreed with contrary findings

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Table 2: Means (\pm S.E) for live body weight and daily weight gains of three diets differing in probiotic at different ages of broilers

Treatment	Body weight (g/b)									
	Age (days)									
	n	(1)	(7)	(14)	(21)	(28)	(35)	(42)	(49)	Mortality (%)
P ₀	8	41.8	132.3	339.7 ^b	657.7 ^b	1042.7 ^b	1603.9	2134.9	2524.9	1.8
P ₁	8	40.9	134.8	365.4 ^a	681.6 ^a	1067.0 ^b	1596.7	2146.3	2559.2	0.0
P ₂	8	41.9	135.5	361.3 ^a	665.2 ^{ab}	1084.6 ^a	1620.7	2196.0	2548.3	1.8
SEM		\pm 0.4	\pm 1.7	\pm 6.5	\pm 6.4	\pm 9.9	\pm 15.0	\pm 27.3	\pm 24.4	
Significance		Ns	Ns	**	**	**	Ns	Ns	Ns	
Daily weight gain (g/b) during different periods										
	n	(1-7d)	(8-14d)	(15-21d)	(22-28d)	(29-35d)	(36-42d)	(43-49d)	(1-49d)	Total gain
P ₀	8	12.9	29.6 ^b	45.4	55.0 ^b	80.2	75.9	55.7	50.7	2483.0
P ₁	8	13.3	33.0 ^a	45.2	55.0 ^b	75.7	78.5	59.0	51.4	2518.0
P ₂	8	13.4	32.3 ^{ab}	43.4	59.9 ^a	76.6	82.2	50.3	51.2	2502.0
SEM		\pm 0.2	\pm 0.9	\pm 0.9	\pm 1.5	\pm 1.6	\pm 3.6	\pm 4.3	\pm 0.5	\pm 24.5
Significance		Ns	*	Ns	*	Ns	Ns	Ns	Ns	Ns

**:(P<0.01); *:(P<0.05); Ns: Non significant. ^{a,b}: Means within a column with no common superscripts differ significantly (P<0.05)

Table 3: Means (\pm S.E.) of feed intake and feed efficiency (based on as fed) of different treatment groups during experimental period

Treatment	Daily feed consumption during different periods (g/bird)									
	Age (days)									
	n	(1-7d)	(8-14d)	(15-21d)	(22-28d)	(29-35d)	(36-42d)	(43-49d)	(1-49d)	
P ₀	8	19.0	42.7 ^a	69.0	100.1 ^b	155.5	142.1	133.1	94.4	
P ₁	8	18.6	39.8 ^b	69.1	101.0 ^{ab}	154.5	146.4	134.2	94.8	
P ₂	8	18.7	39.1 ^b	69.0	103.9 ^a	157.9	145.3	138.0	95.9	
SEM		\pm 0.3	\pm 0.6	\pm 0.6	\pm 1.1	\pm 1.5	\pm 2.0	\pm 2.2	\pm 0.78	
Significance		Ns	**	Ns	**	Ns	Ns	Ns	Ns	
Feed efficiency (FCR, g feed consumption:g gain)										
	n	(1-7d)	(8-14d)	(15-21d)	(22-28d)	(29-35d)	(36-42d)	(43-49d)	(1-49d)	
P ₀	8	1.47 ^a	1.44 ^a	1.52	1.82	1.94	1.90	2.51	1.86	
P ₁	8	1.39 ^{ab}	1.20 ^b	1.53	1.84	2.05	1.90	2.34	1.84	
P ₂	8	1.36 ^b	1.21 ^b	1.58	1.74	2.06	1.78	2.57	1.87	
SEM		\pm 0.03	\pm 0.03	\pm 0.02	\pm 0.04	\pm 0.05	\pm 0.09	\pm 0.17	\pm 0.02	
Significance		**	**	Ns	Ns	Ns	Ns	Ns	Ns	

**:(P<0.01); Ns: Non significant.

^{a,b}: Means within a column with no common superscripts differ significantly (P<0.05).

of Mikulec *et al.* (1999); Ergün *et al.* (2001) and Ladukar *et al.* (2002) which have reported that probiotic supplementation had no effect on the growth performance of broilers.

There are many factors affecting the susceptibility of chickens to pathogenic microorganisms, include age, stress, genetics and feed additives. Mortality rates in this study (Table 2) illustrate low mortality (0 to 1.8%, compared to the range of 3.3 to 3.8% reported for probiotic-fed broilers by Jin *et al.* (1998). Barrow (1992) pointed to the considerable importance of the microbial flora in the avian gastro-intestinal tract for the performance and animal health. Also, Pascual *et al.*

(1999) reported that probiotics had a preventive effect against *Salmonella*

The data indicated that there was no significant difference (P>0.05) in daily feed consumption (except from 8 to 14 days, and from 22 to 28 days) and feed efficiency, (except during the first two weeks of feeding period. While the daily feed intake recorded in this study was lower than that of Erdogan (1999), it was higher than those of Isik (1997) and Midilli (1999). Results of the present study were similar to the findings of Ergün *et al.* (2001) and Karaoglu *et al.* (2005) reported that FCR values for ram horn hydrolysate- supplemented broiler diets ranged from 1.71 to 1.83.

Table 4: Mean of blood volume (as % of live weight at slaughter) and weights (g/bird) of non-carcass components in broilers as influenced by probiotic supplementation and different slaughter ages

Probiotic treatment	n	Offals	Feet	Head	Blood	Blood (%) ¹	Feather	Gizzard	Liver	Heart	
P ₀	24	99.2	88.6	65.8	68.2	3.2	104.4	37.8	41.8	10.2	
P ₁	24	103.4	89.1	67.1	68.1	3.2	106.8	36.9	41.9	10.1	
P ₂	24	102.0	88.5	68.3	69.7	3.3	102.0	38.3	42.4	9.9	
SEM		±2.3	±1.2	±1.4	±3.0	±0.1	±3.3	±0.8	±1.0	±0.3	
Significance		Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	
Slaughter age											
1 (35d)	24	86.5 ^b	69.8 ^c	52.0 ^c	38.4 ^c	2.4 ^c	95.2 ^b	33.0 ^c	36.4 ^c	10.1	
2 (42d)	24	109.0 ^a	88.8 ^b	68.0 ^b	84.7 ^a	3.9 ^a	99.4 ^b	37.7 ^b	97.0 ^a	9.9	
3 (49d)	24	109.1 ^a	107.7 ^a	82.18 ^a	82.9 ^a	3.3 ^b	118.6 ^a	42.3 ^a	43.8	10.2	
SEM		±2.3	±1.2	±1.4	±3.0	±0.1	±3.3	±0.8	±1.0	±0.3	
Significance		**	**	**	**	**	**	**	**	Ns	
Probioticx Slaughter age											
P ₀	1	8	86.5	70.4	51.0	38.5	2.4	99.8	3.8	36.0	9.5
	2	8	106.0	86.8	70.8	78.5	3.7	96.8	37.8	47.5	11.8
	3	8	105.0	108.8	75.8	87.5	3.5	116.8	42.8	42.3	10.3
P ₁	1	8	85.5	68.8	53.5	33.1	2.1	98.1	33.0	40.0	11.8
	2	8	112.0	92.3	64.5	92.3	4.3	105.3	35.0	46.5	8.8
	3	8	112.8	106.3	85.8	79.0	3.1	117.0	42.8	45.3	9.8
P ₂	1	8	87.5	60.3	51.5	43.6	2.7	87.8	33.1	33.4	9.0
	2	8	109.0	87.3	68.8	83.3	3.8	96.3	40.3	47.0	10.3
	3	8	109.5	108.0	84.8	82.3	3.3	122.0	41.5	43.8	10.5
SEM		±4.0	±2.1	±2.4	±5.1	±0.2	±5.8	±1.4	±1.8	±0.6	
Significance			Ns	Ns	**	Ns	*	*	Ns	Ns	

Ns: 1: as percentage of live weight; **: (P<0.01); *: (P<0.05); Ns: Non significant
a-c: Means within a column with no common superscripts differ significantly (P<0.05)

Table 4 shows the slaughter traits. In the poultry industry, one of the major concerns is to obtain a higher percentage yield of saleable products, and consequently, to increase the edible portions. In this study, some organ weights such as offals, head, feet and shanks, blood, feather and gizzard, liver and heart were determined. No significant differences were observed in non-carcass component weights between control and treated groups. but the age of slaughter significantly affected the parameters mentioned above (P<0.01).

Fontana *et al.* (1993) found that the liver and gizzard weights of broilers were 2.50 and 1.28 as percentage of carcass weight, respectively. Dickens and Lyon (1993) noted that blood loss were 2.64 and 2.86% of live weight. It was around 3.2% in our study, and P₂ had the highest blood volume as compared with control and the P₁ treatment groups. Brake *et al.* (1993) reported that the weights of body, blood, feathers, head, feet, gastrointestinal tract were 2547.4, 98.1, 108.1, 61.0, 114.3, 170.8 g, and heart, liver, gizzard, hot and cold carcass weights were 13.3, 42.3, 40.4, 1789.3 and 1771.6 g. The comparative findings of the present study were lower than those reported by Brake *et al.* (1993). The data on the body weights (before and after slaughter and after plucking), hot and cold carcass weights (HCW

and CCW), hot and cold carcass yields (HCY and CCY) and abdominal fat pad weights (AFW) are shown in Table 5.

As shown in Table 5 the probiotic treatment and probiotic treatment x slaughter age interaction had no effect on the weights and yields at slaughter (P>0.05), but the slaughter age had highly significant effect on these variables. Probiotic-treated groups had lower cold carcass yields than control group at 42 day of experimental period.

Based on subjective visual assessment, the use of probiotics in broiler diets appeared to decrease subcutaneous and intermuscular fat accumulation. However, abdominal fat pad weight which is an objective indicator of carcass fatness in broilers (Yalçın *et al.*,1999) was unaffected by probiotic supplementation, but slaughter age had an effect on this property (P<0.01). Fontana *et al.* (1993) found that the abdominal fat pad weight was 2.39% of carcass weight. Brake *et al.* (1993) determined that abdominal fat weight of broilers were 35.0 g (at 42 day of age) and it was higher than the result of the present study.

Conclusion: The use of probiotic at different levels did not significantly affect the performance of broilers. Although it was not statistically significant, the lower level

Table 5: Means of final body weights and carcass weights and yields (g and %), showing the influence of probiotic supplementation and different slaughter ages, and their interaction

Probiotic treatment	n	FBW	BWBS	BWAS	BWAP	HCW	CCW	HCY	CCY	AFW	
P ₀	24	2129.9	2067.3	1999.2	1894.8	1543.8	1521.3	72.7	71.3	31.0	
P ₁	24	2151.5	2091.0	2022.8	1916.0	1561.1	1539.4	72.7	71.6	30.2	
P ₂	24	2160.7	2089.0	2019.3	1917.3	1558.7	1535.2	72.5	71.5	31.4	
SEM		±18.9	±18.6	±18.0	±17.06	±15.5	±15.3	±0.3	±0.3	±1.5	
Significance		Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	
Slaughter age											
1 (35d)	24	1645.0 ^c	1596.4 ^c	1558.0 ^c	1462.89 ^c	1189.0 ^c	1172.8 ^c	72.3 ^b	71.3 ^b	24.2 ^c	
2 (42d)	24	2213.1 ^b	2154.0 ^b	2068.8 ^b	1969.4 ^b	1591.3 ^b	1532.5 ^b	71.9 ^c	70.6 ^c	30.4 ^b	
3 (49d)	24	2497.3 ^a	2497.3 ^a	2414.4 ^a	2295.8 ^a	1883.3 ^a	1860.6 ^a	73.7 ^a	72.5 ^a	37.7 ^a	
SEM		±18.9	±18.6	±18.0	±17.1	±15.5	±15.3	±0.3	±0.3	±1.5	
Significance		**	**	**	**	**	**	**	**	**	
Probiotic x Slaughter age											
P ₀	1	8	1639.4	1588.0	1549.5	1449.8	1165.1	1152.4	71.1	70.3	24.9
	2	8	2196.6	2142.0	2063.0	1966.6	1592.3	1564.4	72.5	71.2	32.8
	3	8	2554.1	2473.0	2385.0	2268.6	1904.5	1847.3	74.6	72.3	35.5
P ₁	1	8	1629.1	1595.4	1562.3	1464.3	1198.0	1181.5	73.5	72.5	25.4
	2	8	2208.0	2152.0	2059.3	1954.0	1577.0	1547.0	71.4	70.1	29.0
	3	8	2614.9	2526.0	2447.0	2330.0	1908.3	1889.8	73.0	72.3	36.3
P ₂	1	8	1666.4	1605.9	1562.3	1474.5	1204.0	1184.5	72.3	71.1	22.3
	2	8	2236.0	2168.0	2084.3	1988.0	1604.5	1576.3	71.77	70.5	29.5
	3	8	2580.1	2493.5	2411.2	2289.3	1897.5	1884.8	73.6	73.0	41.4
SEM			±32.7	±32.2	±31.2	±29.6	±26.9	±26.5	±0.4	±0.5	±2.6
Significance			Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns

** (P<0.01); Ns: Non significant; ^{a,c}: Means within a column with no common superscripts differ significantly (P<0.05). FBW: Final body weight, BWBS: Body weight before slaughter, BWAS: Body weight after slaughter, BWAP: Body weight after plucking, AFW: Abdominal fat weight, HCW and HCY: Hot carcass weight and yield, CCW and CCY: Cold carcass weight and yield.

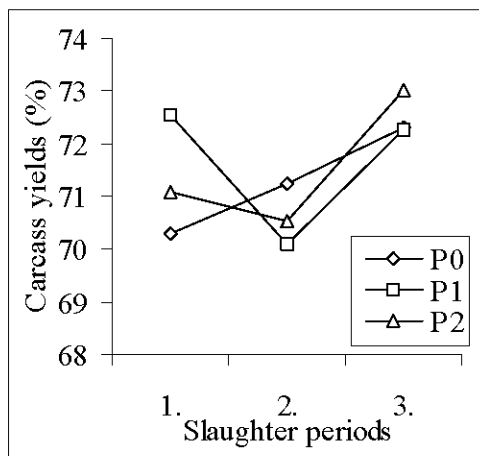


Fig. 1: Cold carcass yields of treatments at different slaughter periods (%).

of probiotic supplementation (4×10^8 cfu/kg feed) in particular did show a tendency to improve certain live performance traits (notably slaughter weight, daily gain and FCR) when compared to the unsupplemented control. Also, the use of probiotic in the broiler diet reduced or prevented the mortality. Low mortalities in this trial probably reflected low stress/challenge levels. Probiotic supplementation of broilers may be more helpful during periods of nutritional and other stress, but under normal environmental and management

conditions it seems to have minimal influence on performance and carcass traits. On the other hand, it was observed that 49-d-slaughter of broiler resulted optimum carcass weight and yields. Also, further research is required to determine the most effective source of probiotic and its dose.

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