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Full Length Research Paper

Effect of probiotics on broiler meat quality

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The study was carried out on "Hubbard Isa Starbo" broilers to evaluate the raw meat quality of both probiotics and conventional fed broilers in pre-freezing condition and post freezing storage. 80 day old broiler chicks were divided into 4 groups of equal numbers as group A (probitotics fed group vaccinated), B (probiotics fed group nonvaccinated), C (conventional fed group vaccinated) and D (conventional fed group nonvaccinated). The groups C and D were taken as control birds and were fed with commercial ration and the groups A and B as experimental birds which were fed with commercial ration plus 2 g probiotics (Protexin® Boost)/10 L drinking water up to 6th week of age. At the end of the 6 week feeding trial, the birds were slaughtered and dressed and subjected to organoleptic examination at 0, 7, 14 and 21 days of frozen storage. The increased panel scores were substantially obtained by all absorbent paper (AP) packed meat samples of probiotics fed group as compared to aluminium foil (AF) packed samples kept at frozen storage for 7, 14 and 21 days. The presence of high number of pathogenic *Staphylococci* and *Escherichia coli* encountered in meat from conventional fed broilers is alarming. The presence of these organisms in meat foods should receive particular attention, because their presence indicate public health hazard and give warning signal for the possible occurrence of food borne intoxication. The results of the study evidenced that supplementation of probiotics in broiler ration improved the meat quality both in prefreezing and postfreezing storage.

Key words: Probiotics, meat, sensory characteristics, broilers.

INTRODUCTION

There is currently a world trend to reduce the use of antibiotics in animal food due to the contamination of meat products with antibiotic residues (Menten, 2001), as well as the concern that some therapeutic treatments for human diseases might be jeopardized due to the appearance of resistant bacteria (Dale, 1992). Recently, alternatives for substituting these traditional growth promoters have been evaluated and probiotics have been the most studied. It is well recognized by this time that the probiotics are live microorganisms and when administered through the digestive tract, cause a positive impact on the host's health. Studies on the beneficial impact on poultry performance have indicated that probiotic supplementation can have positive effects. Kabir et al. (2004), for example, conducted a 6 week growth performance study with broilers and found that live weight gain and carcass yields were significantly higher in broilers fed probiotic supplementation. Probiotics are reported to prevent colonization gut by pathogens like *Escherichia coli* and *Salmonella*. They also prevent contamination of carcasses by intestinal pathogens during processing and promote higher growth rate and feed conversion efficiency in growing chickens (Hose and Sozzi, 1991; Juven et al., 1991). The use of probiotics for meat and carcass quality improvement has been questioned and many unclear results have been shown. Some authors reported advantages of probiotic administration (Burkett et al., 1977; Jensen and Jensen, 1992; Maruta, 1993; Corrêa et al., 2000; Vargas et al., 2002), whereas others did not ob-serve improvement when probiotics were used (Owings et al., 1990; Quadros et al., 2001). Therefore, this study was undertaken to know the effect of probiotics feeding on meat quality of broilers both in prefreezing condition and post freezing storage.

MATERIALS AND METHODS

A total of 80 day old broiler chicks of "Hubbard Isa Starbo" strain

were purchased from Kazi Farms Ltd., Dhaka, Bangladesh. The birds were randomly assigned to four groups as A (Probiotics fed group vaccinated), B (Probiotics fed group nonvaccinated), C (Conventional fed group vaccinated) and D (Conventional fed group nonvaccinated), each consisting of 5 chickens and were reared in well partitioned area in a room under strict hygienic condition in the experimental poultry shed of the Department of Microbiology and Hygiene, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh, Bangladesh. The groups C and D were taken as control birds and were fed with commercial ration and the groups A and B as experimental birds which were fed with commercial ration plus 2 g probiotics (Protexin® Boost, Novertis (Bangladesh) Ltd.)/10 L drinking water up to 6th week of age. Vaccination schedule for newcastle and gumboro diseases was maintained properly.

The birds were dissected at the end of the 6th week feeding trial according to the procedure of Jones (1984). After removing the skin, head and viscera, final processing was performed and the dressed broilers (mainly leg and breast) were kept in the refrigerator wrapping in aluminium foil (AF) or absorbent paper (AP). A total of 5 dressed broilers (mainly leg and breast) each of 0, 7, 14 and 21 days of freezing storage from each group were subjected to organoleptic quality determination. Several criteria such as color, odor, consistency, texture etc. were considered. They were scored in a 10 point hedonic scale for quality that is, excellent 10; good 8-9; fair 6-7; marginal acceptable 4-5; unacceptable 2-3; bad 0-1.

The quantitation of bacteria in meat samples was done according to the standard method (ICMSF, 1985) and ISO (995). The examination followed detail study of cultural characteristics including colony formation, staining reactions and biochemical properties. Different kinds of bacterial colonies were isolated in pure culture and identified as per instruction of Cowan (1985) to find out different types of microorganisms in meat samples.

RESULTS AND DISCUSSION

5 organoleptic quality characteristics were taken for the panel score and judgement for consumer's acceptance. For each of the characteristic, the maximum score given was 10 points. The total scores marked thus for 5 characteristic parameter become 50 points. The taste panel scores of meat of dressed probiotics and conventional fed broilers are presented in Tables 1a and 1b.

The present results demonstrated that the increased panel scores were substantially contributed by all absorbent paper (AP) packed meat samples of probiotics fed group as compared to aluminium foil (AF) packed samples kept at frozen storage for 7, 14 and 21 days. It is noteable from the present study that the taste panel scores of meat of dressed nonvaccinated probiotics fed broilers were higher than vaccinated probiotics fed broilers on the 0, 7 and 21 days of storage. The organoleptic qualities (whether desirable or undesirable) of meats from conventional fed or probiotics fed dressed broilers were marked evaluated by taste panel experts. It is revealed from the present study that meat cut up parts of conventional fed dressed broilers if defrosted before 7 days of storage did not exhibit any signs of undesirable attributes of changes in color or off flavor. Afterwards the meat seemed to be organoleptically downgraded and many of the desirable characteristics of acceptability was lacking. Such products could not be considered of good quality or desirable and sensitive consumers probably would reject. On the other hand, the organoleptic unacceptability of the product was perceptible after 14 days of storage in probiotics fed birds. To protect public health it is therefore advocated that there should be any incipient spoilage potentially appear in frozen foods on progression of storage. From the result of the findings obtained it could be consistently conferred upon that frozen dressed birds should not be allowed to sell after 14 days of storage in the refrigerated display cabinet of food shop. It is however notable that the long frozen storage of samples of both probiotics and conventional fed groups of broilers seemingly accounted for obtaining gradually lower scores as the storage continues. This ultimately resulted in unacceptability of product for consumption and ensuing of spoilage.

Mahajan et al. (2000) stated in their study that the scores for the sensory attributes of the meat balls; appearance, texture, juiciness and overall acceptability were significantly higher and those for flavour were lower in the probiotic (Lacto-Sacc) fed group. They also reported that aluminum foils + polyethylene (AP) samples showed significantly ($p < 0.05$) higher scores for all the organoleptic characters when compared to polyethylene packed samples. They also concluded that the meat balls from different groups were acceptable till 14 days, on the basis of organoleptic scores. In addition, Pelicano et al. (2003) evaluated the effect of different probiotics on carcass and meat quality of broilers and they reported that the concomitant use of probiotics in water and feed increased meat quality in relation to color, pH, tenderness and general aspect. On the other hand, Zhang et al. (2005) reported that meat tenderness could be improved by the whole yeast (WY) or *Saccharomyces cerevisiae* extract (YE). However, the present results differ from Loddi et al. (2000) who observed that neither probiotic nor antibiotic affected sensory characteristics (intensity of aroma, strange aroma, flavour, strange flavour, tenderness, juiciness, acceptability, characteristic colour and overall aspects) of breast and leg meats.

The prevalence of bacterial isolates obtained from the stored meat samples of probiotics fed broilers are presented in Table 2. It has revealed the percentage as Staphylococci 80.65%, *Escherichia coli* 9.68%, Pseudomonas 6.45%, and others (unidentified) 3.23%. It is remarkable that Streptococci, Bacilli, Micrococci and Salmonella were not found from the stored meat samples of probiotics fed broilers. In this study Staphylococci occupied the highest percentage of occurrence. Next to Staphylococci, *Escherichia coli* secured the second position and Pseudomonas obtained the third position. These results support the findings of Caramori Jr. (2001) who demonstrated that the use of a product containing probiotics and prebiotics in contaminated flocks challenged with *Salmonella enteritidis* had significantly reduced carcass contamination with *Salmonella* spp. On the other hand, the

Table 1a. Sensory characteristics of meat of dressed probiotics fed broilers: Taste panel scores expressed in hedonic scales[a].

Characteristics	Packing conditions prior to storage		0 day		7 day		14 day		21 day	
			PFG		PFG		PFG		PFG	
			A	B	A	B	A	B	A	B
Appearance	Aluminium foil (AF) packed sample of	Leg	8	9	7	8	3	4	4	4
		Breast	8	9	7	8	4	4	4	4
	Absorbent paper (AP) packed sample of	Leg	8	8	8	7	5	5	4	4
		Breast	8	8	7	8	5	5	4	4
Color	Aluminium foil (AF) packed sample of	Leg	8	9	6	6	4	4	3	4
		Breast	8	8	6	7	5	5	3	4
	Absorbent paper (AP) packed sample of	Leg	8	8	7	7	5	5	4	4
		Breast	8	8	7	7	5	5	4	4
Odor	Aluminium foil (AF) packed sample of	Leg	8	9	6	7	4	4	3	4
		Breast	8	8	6	6	4	4	4	4
	Absorbent paper (AP) packed sample of	Leg	9	8	7	7	5	4	4	4
		Breast	8	9	7	7	5	5	4	4
Texture	Aluminium foil (AF) packed sample of	Leg	8	9	6	7	4	4	4	4
		Breast	8	9	6	7	4	4	4	4
	Absorbent paper (AP) packed sample of	Leg	8	9	7	7	5	5	4	4
		Breast	8	8	7	7	6	5	4	4
Overall characteristics	Aluminium foil (AF) packed sample of	Leg	8	8	6	6	5	5	4	4
		Breast	8	8	6	6	5	5	4	4
	Absorbent paper (AP) packed sample of	Leg	9	8	7	7	5	6	4	4
		Breast	8	9	7	7	6	5	4	4
Grand total score	Maximum score of 200 marks		162 (81%)	169 (84.5%)	133 (66.5%)	139 (69.5%)	94 (47%)	93 (46.5%)	77 (38.5%)	80 (40%)

[a]Sensory characteristics with hedonic scales: 10 = Excellent; 8 – 9 = good; 6 – 7 = fair; 4 – 5 = marginal acceptable; 2 – 3 = unacceptable; 0 – 1 = bad.
PFG: Probiotics fed group, A: Vaccinated birds, B: Nonvaccinated birds, %: Percentage.

prevalence of bacterial isolates obtained from the stored meat samples of conventional fed broilers are presented in Table 2 which revealed Staphylococci 48.91%, *Escherichia coli* 19.71%, Pseudomonas 11.68%, Streptococci 7.30%, Bacilli 5.84%, Micrococci 3.65%, Salmonella 1.46% and others 1.46%. Similar to the above result Staphylococci obtained the highest percentage of occurrence. Next to Staphylococci, *Escherichia coli* ranked the second position. The reports from Bhargava (1986) revealed that the emerging poultry borne pathogens were *Yersinia spp*., *Escherichia coli* 0157H7 (responsible for haemorrhagic colitis in man), *Aeromonas spp*. (present in fish and amphibia), *Listeria monocytogenes*, Salmonella and *Clostridium botulinum*. The presence of high number of pathogenic Staphylococci and *Escherichia coli* encountered in meat is alarming. The presence of all

Table 1b. Sensory characteristics of meat of dressed conventional fed broilers: Taste panel scores expressed in hedonic scales[a].

Characteristics	Packing conditions prior to storage		0 day		7 day		14 day		21 day	
			CFG		CFG		CFG		CFG	
			C	D	C	D	C	D	C	D
Appearance	Aluminium foil (AF) packed sample of	Leg	7	7	6	6	3	3	3	2
		Breast	7	7	5	6	3	3	2	3
	Absorbent paper (AP) packed sample of	Leg	7	7	6	6	4	4	3	3
		Breast	7	8	6	6	4	4	2	2
Color	Aluminium foil (AF) packed sample of	Leg	6	7	5	5	4	4	3	3
		Breast	7	8	6	5	4	4	3	3
	Absorbent paper (AP) packed sample of	Leg	7	7	6	6	4	4	3	2
		Breast	7	7	6	6	4	4	2	2
Odor	Aluminium foil (AF) packed sample of	Leg	7	8	6	6	3	3	3	3
		Breast	7	7	6	6	3	3	3	3
	Absorbent paper (AP) packed sample of	Leg	7	8	6	6	3	3	3	2
		Breast	8	7	6	6	3	4	2	2
Texture	Aluminium foil (AF) packed sample of	Leg	7	7	6	6	4	3	2	2
		Breast	7	7	6	6	3	3	3	2
	Absorbent paper (AP) packed sample of	Leg	7	7	6	6	4	4	2	3
		Breast	8	7	6	6	4	4	3	2
Overall characteristics	Aluminium foil (AF) packed sample of	Leg	7	8	6	5	4	4	3	2
		Breast	7	7	6	6	4	4	3	3
	Absorbent paper (AP) packed sample of	Leg	7	7	6	6	4	4	2	3
		Breast	6	7	6	6	4	4	2	3
Grand total score	Maximum score of 200 marks		140 (70%)	145 (72.5%)	118 (59%)	117 (58.5%)	73 (36.5%)	73 (36.5%)	52 (26%)	50 (25%)

[a]Sensory characteristics with hedonic scales: 10 = Excellent; 8 – 9 = good; 6 – 7 = fair; 4 – 5 = marginal acceptable; 2 – 3 = unacceptable; 0 – 1 = bad.
CFG: Conventional fed group, C: Vaccinated birds, D: Nonvaccinated birds, %: Percentage.

these organisms in meat foods should receive particular attention, because their presence indicate public health hazard and give warning signal for the possible occurrence of food borne intoxication.

Conclusions

Probiotics may help in minimizing stress and improving meat quality regimen of broilers. The present study has provided evidences that supplementation of probiotics in broiler ration improved the meat quality both at prefreezing and post-freezing storage.

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Table 2. Prevalence of bacterial isolates obtained from stored meat samples.

Groups	Name of isolates	Number of isolates (%)
Probiotics fed group (Both vaccinated and nonvaccinated)	*Escherichia coli*	3 (9.68)
	Salmonella spp.	0 (0.00)
	Staphylococcus spp.	25 (80.65)
	Pseudomonas spp.	2 (6.45)
	Streptococcus spp.	0 (0.00)
	Bacillus spp.	0 (0.00)
	Micrococcus spp.	0 (0.00)
	Others (Unidentified)	1 (3.23)
Conventional fed group (Both vaccinated and nonvaccinated)	*Escherichia coli*	27 (19.71)
	Salmonella spp.	2 (1.46)
	Staphylococcus spp.	67 (48.91)
	Pseudomonas spp.	16 (11.68)
	Streptococcus spp.	10 (7.30)
	Bacillus spp.	8 (5.84)
	Micrococcus spp.	5 (3.65)
	Others (Unidentified)	2 (1.46)

encouragements throughout the period of this study.

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