A comparison between the effects of a probiotic and an antibiotic on the performance of *Desi* chickens

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Received: 22-09-2011, Accepted: 02-10-2011, Published Online: 12-12-2011
doi: 10.5455/vetworld.2012.160-165

Abstract

A study was conducted to compare probiotic with antibiotic, using drinking water supplemented with Biovet and TNF-60. The 8-days old *Desi* chicks were randomly divided into 9 separate floor pens each comprising 75 birds and three pens (replicates) per treatment group following completely randomized design. At the end of 6 weeks trial, body weight (BW) and feed to gain ratio (FCR) were determined. At the end of experiment, serum cholesterol was determined. The BW of birds given antibiotic and probiotic was significantly greater than control. Similarly, better FCR was observed in birds those given drinking water with antibiotic and probiotic. There was less mortality recorded with probiotic treatment. Cholesterol contents were reduced significantly in probiotic supplemented group as compared to antibiotic and control groups. It may be concluded that performance in *Desi* birds could be maintained when supplementing probiotic incorporated in broiler's drinking water. The supplementation of probiotic may lead to the development of low-cholesterol chicken meat as demanded by health-conscious consumers. Probiotic may be replaced with the antibiotic to avoid its residual effects on birds as well as human health.

Key words: *Desi* chickens, antibiotic, probiotic, body weight gain, cholesterol

To cite this article :
Amer MY, Khan SH (2012) A comparison between the effects of a probiotic and an antibiotic on the performance of *Desi* chickens, *Vet. World.* 5(3):160-165, doi: 10.5455/vetworld.2012.160-165.

Introduction

In view of the severe restriction or total ban on the use of antibiotics as growth promoters in poultry production, probiotics have been suggested as an alternative to antibiotics. The gastrointestinal tract in chicks is sterile at hatching, and immediately bacteria from the environment or the diet colonize it. After this first colonization, new bacterial species have more difficulties to establish themselves. A wide range of dietary factors affect the composition of the microflora. This leads to new micro-ecological conditions that allow a better colonization of some species due to improved adhesion or growth rate. Ingested bacterial species could colonize the gastrointestinal tract, and this is the case when probiotic micro-organisms are administered to the chickens (Fuller, 1989).

Using probiotic microorganisms shorten the period needed to stabilize the microflora. This microflora regulation may serve to improve feed conversion, weight gain and also improve the intestinal health and immune competence of the chickens (Panda *et al*., 2000). However, results under field conditions have generally been inconsistent (Stavric *et al*., 1992). Results from trials conducted with broiler fed various probiotics were inconsistent. Some researchers reported positive responses of weight gain and feed conversion ratio in chickens due to consumption of probiotics (Kumprecht and Zobac, 1998; Fritts *et al*., 2000), while others reported no beneficial effects (Panda *et al*., 1999; Kahraman *et al*., 2000). The most common routes of administrating probiotic preparations are in feed and drinking water (Tortuero, 1973; Watkins and Kratzer, 1984).

Biovet (as effective microorganisms) is a probiotic has recently been introduced in market. It consists of lactic acid bacteria, yeast,

actinomycetes, fermenting fungi and antioxidants extracted from fruits and vegetables. It is added to the drinking water for poultry and claims to enhance the growth, remarkable improvement in health and quality of meat in poultry. However, there is lacking of information regarding the efficacy and beneficial effects of biovet in poultry. There is a paucity of literature concerning the effects of probiotic on the performance of *Desi* chickens and need to explore the benefits of it as probiotic in the local chickens. The objective of this study was to evaluate the effect of biovet as probiotic on the performance characteristics and cholesterol concentration in *Desi* chickens.

Materials and methods

Experimental birds: A total of 675 (8 days old) unsexed *desi* chicks with initial weights of 27± 1 g were reared at experimental sheds of Breeding and Incubation section, Poultry Research Institute, Rawalpindi. The chicks were randomly divided into 9 separate floor pens (each 10x15 feet) each comprising 75 birds and three pens (replicates) per treatment group following completely randomized design. Each pen contained 1 tube-type feeder and 1 bell-type water fount. Birds were provided with *ad libitum* access to feed and water. The experimental house was thoroughly cleaned and disinfected before the start of experiment. The experiment was planned with the permission of Animal Ethics Committee of the institute. The duration of experiment was 6 weeks.

Birds diet**:** A basal diet was formulated to meet or exceed NRC (1994) recommendations for essential amino acids in feeding periods. A diet was analyzed as described methods in AOAC (2000) for proximate composition at feed testing laboratory of Poultry Research Institute, Rawalpindi. All analyses and determinations were done in triplicate. The composition and calculated nutrient contents of a basal diet for *desi* chickens were given in Table 1.

Antibiotic and Probiotic: TNF-60 as antibiotic was mixed in drinking water at the rate of 1g $4.5L^{-1}$ as recommended by company (considered as positive control group). TNF-60 is a commercial antibiotic product which was manufactured by Bermer-Germany and marketed by Vety-Care in Pakistan. Each kilogram powder of antibiotic (TNF-60) used in this study contained oxytetracycline (250g), Neomycine (100g), Furaltadone (250g) and Sodium Sulphate (60g).

Table-1:Major ingredients and nutrients (%) of diets fed to *Desi* chickens during experimental period

Item	Wk 1 to 8
Corn	35.60
Rice	23.00
Rice polish	10.00
Soyabean meal	10.00
Canola meal	8.00
Corn gluten meal (60%)	5.00
Fish meal	5.00
Lime stone	1.50
DCP	1.25
NaCl	0.33
Premix*	0.25
DL- Methionine	0.07
Total	100.00
Calculated Nutrients	
ME Kcal/kg	2800
CP	18.5
CF	3.80
EE	3.31
Ca	1.0
Available P	0.56
Lysine	1.00
Methionine	0.43

*Supplied per Kg of diet: vit. A, 12000 IU; vit. D3, 2200 IU; vit. E, 10mg; vit. K3 2mg vit.B1, 1mg; vit.B2, 5mg; vit. B6, 1.5mg; vit. B12, 0.01mg;Nicotinic acid, 30mg; ; Folic acid, 1mg; Pantothenic acid, 10mg; Biotin, 0.05mg; Choline chloride, 500mg; Copper, 10mg; Iron, 30mg; Manganese, 60mg; Zinc, 50mg; Iodine, 1mg; Selenium, 0.1mg and Cobalt, 0.1mg.

Biovet as probiotic was mixed in drinking water at the rate of 2 ml^{-1} as recommended by Asad *et al*. (2006). Biovet is a commercial probiotic in liquid form which is imported from Light Matrix Organics CO. Ltd. Switzerland and marketed in Pakistan by Nature Farming Research & Development Foundation. An analysis of the culture mix observed a minimum presence of 1.5 x 10^9cfu per mL (*Lactobacillus Acidophilus, Bacillus subtilis, Saccharomyces cerevisiae and Aspergillus oryzae*). The birds of control group were given drinking water without any supplementation.

Parameter measured: Pen body weights were obtained at weekly basis of experimental period. Feed consumption was determined for the same time periods. Birds were checked twice daily; weight of dead birds was used to adjust for feed

Table-2: Effect of antibiotic and probiotic treatments on body weight gain, feed intake, feed conversion, mortality and cholesterol contents in *Desi* chickens

Items	Treatments		
	Control	Antibiotic	Probiotic
Initial body weight (g)	27±0.63	27±0.60	28±0.58
Final body weight (g)	608±24.50	640±20.20	650±19.80
Body weight gain (g)	581±20.50^{b}	613±19.00^{a}	622±22.10^{a}
Feed Intake (g)	2061±140	2042±155	2048±145
Feed to gain ratio	3.39^{b}	3.19^{a}	3.15^{a}
Mortality (%)	3.30^{a}	2.00^{ab}	1.00^{b}
Cholesterol (mg/dl)	188.00^{a}±100	187.50^{a}±106	179.50^{b}±99

a-b Means with different letters differ significantly (P ≤ 0.05).

consumption. At the end of experiment, blood samples were collected from the bronchial vein of 3 chicks from each replicate to determine serum cholesterol. The blood was collected in a test tube to obtain serum. The collected blood samples were centrifuged at 3000×g for 10 min and the serum was decanted into aseptically treated vials and stored at -20ºC for total cholesterol. Serum cholesterol was measured by using diagnostic kits (RANDOX Diagnostics, Catalog No. CH 207, RANDOX Laboratories Ltd. Ardmore, Diamond Road, Crumlin, Co. Antrim, United Kingdom BT29 4QY) and spectrophotometer apparatus.

Statistical analysis: All data were determined by using the SPSS version 9.5 (SPSS, Cary, NC, USA) statistical analysis program. A p-value of <0.05 was considered a significant difference among groups and the comparison of means was made using Duncan's Multiple Range Test (Steel and Torrie, 1984).

Results

Supplementation of antibiotic and probiotic indicated significantly increased ($p< 0.05$) the body weight gain of *Desi* chickens after 6 weeks of experiment (Table 2). The feed to gain ratios were decreased by 0. 20 and 0.24 units ($p< 0.05$) for the birds with antibiotic and probiotic treatments, respectively (Table 2) compared to control. However, body weight gain and feed efficiency of birds within probiotic treatments was similar. There was significant ($p< 0.05$) effect on mortality during the study (Table 2). The mortality rate was lower for probiotic-supplemented group (1.0%) than control group (3.30%) at the end of experiment.

The effect of antibiotic and probiotics on serum cholesterol of *Desi* chickens is also presented in Tables 2. Serum cholesterol concentration decreased ($p<0.05$) with probiotic treatment. However, there was non-significant ($p>0.05$) difference between antibiotic and control groups.

Discussions

It is clear from this study that the administration of antibiotic and probiotic via the drinking water had beneficial effects on *Desi* performance. The improvement in live weight in chickens of antibiotic group than control is attributable to better feed conversion due to antibiotic. An antibiotic (Avilamycin) has been reported to improve live weight by 3% and feed conversion efficiency by 2% in broiler chickens when given during first 3 weeks of life (Jamroz et al., 1995; Loddi *et al*., 2000). In the present study, live weight improved by 5% and feed conversion efficiency by 6% in *Desi* chickens when antibiotic (TNF-60) given for 6 weeks. Similarly, Avoparcin increased live weight in broilers when given at 7.5, 10 and 15 mg/kg diet fed for 70 days (Krinke and Jamroz, 1996). Administration of antibiotics from hatching to 53 days age has been reported to increase body weight, lower feed intake and improved feed conversion index (Fabris *et al*., 1997).

Overall, the beneficial effects of probiotic treatment on performance parameters are in line with some number of other research studies using

probiotics in broilers (Kabir *et al*., 2004; Gil de los Santos *et al*., 2005) compared with studies lacking positive effects (Watkins and Kratzer, 1984; Priyankarage *et al*., 2003). However, it is difficult to directly assess different studies using probiotics, because the efficacy of a probiotic application depends on many factors (Patterson and Burkholder, 2003) such as species composition and viability, administration level, application method (e.g., spraying, feed, or water), frequency of application (e.g., once, intermittent, or continuous), overall diet, bird age, overall farm hygiene, and environmental stress factors (e.g., temperature, stocking density).

Studies on the beneficial impact on *Desi* chickens performance have indicated that probiotic supplementation can have positive effects. It is clearly evident from the result of Kabir *et al*.(2004) that the live weight gains were significantly ($P<0.01$) higher in experimental birds as compared to control ones during the period of 2nd, 4th, 5th and 6th weeks of age, both in vaccinated and non-vaccinated birds. In addition, Torres-Rodriguez *et al*. (2007) reported that administration of the selected probiotic (FM-B11) to turkeys increased the average daily gain and market body weight (BW), representing an economic alternative to improve turkey production.

The improvements in BW and feed to gain ratio of broilers fed probiotic supplement in the current study were probably due to the *Lactobacillus spp*., *Saccharomyces cerevisiae /Aspergillus oryzae* and other bacterial spp. used in the supplements. It has been suggested that to obtain the best effects from *Lactobacillus* as a growth promoting, the bacteria used must be able to survive and later colonize the gastrointestinal tract so that their beneficial functions could be performed. The *Lactobacillus spp*. in the probiotics have a strong ability to attach to the intestinal epithelium of chicken (Jin *et al*., 1996a), are resistant to the bile and acidic conditions and are able to antagonize and competitively exclude some pathogenic bacteria *in vitro* (Jin *et al*., 1996b). Mechanisms by which probiotics improve feed conversion efficiency include alteration in intestinal flora, enhancement of growth of nonpathogenic facultative anaerobic and gram positive bacteria forming lactic acid and hydrogen peroxide, suppression of growth of intestinal pathogens, and enhancement of digestion and utilization of nutrients (Yeo and Kim, 1997).

The mortality losses in chickens attributable to various known and unknown factors accounted for a great loss annually. In this study, 1.0% mortality was recorded in probiotic-supplemented group but 3.30% mortality was recorded in birds on control group throughout the experiment. There were no disease or pathological lesions recorded in the organs of slaughtered birds. Furthermore, no medication was required for the *Desi* chickens during the experimental period. This may be due to the fact that continuous feeding of probiotic might have suppressed the undesirable microorganisms that lead to improved health status (build-up resistance) and ultimately improved growth and overall performance. Patterson and Burkholder (2003) explained the mechanism of probiotics to pathogen inhibition by competition for nutrients, production of toxic condition and compounds (volatile fatty acids, low pH, and bacteriocins), competition for binding sites on the intestinal epithelium and stimulation of the immune system.

Desi chickens given water supplemented with probiotic had lower levels of serum cholesterol than the control. These results lend support to the finding of the previous experiments (Yusrizal and Chen, 2003; Kannan *et al.*, 2005). They suggested that the cholesterol-lowering effect of probiotics could be obtained through retarded cholesterol synthesis and increased degradation of cholesterol.

Conclusion

Based on the results, it may be concluded that performance could be maintained when supplementing probiotic incorporated in bird's drinking water. The supplementation of probiotic may lead to the development of low-cholesterol chicken meat as demanded by health-conscious consumers. Probiotic may also be replaced with

the antibiotic to avoid its residual effects in birds as well as human health.

Acknowledgements

The authors are grateful to the Livestock and Dairy Development Department, Punjab, Pakistan for its help and financial assistance.

Conflict of interest

Authors declare that they have no conflict of interest.

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