Productive Performance, Carcass Trait and Blood Parameters of Broiler Chickens Fed Different Levels of Dried Whey and Protexin Probiotic

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Abstract

This study was conducted to investigate the effects of different levels of dried whey and protexin probiotic on the productive performance, carcass trait and blood parameters of broiler chickens. In this study, 360, one-day old male and female commercial Ross 308 broiler chickens of mixed gender were used in a randomized design with four treatment (six replicated in each treatment and 15 birds/replicated) and reared on the floor pens for 42 days. The dietary treatments were: (1) control diet (no supplement), (2) basal diet supplemented with 40 g/kg dried whey powder (3) basal diet supplemented with 1g/kg protexin probiotic and (4) basal diet supplemented with 20 g/kg dried whey powder + 0.5 g/kg protexin probiotic. The results of this study indicated that diet supplementation with dried whey powder and protexin statistically increased chicks body weight at 42 days of age in comparison to the control chicks (p<0.05). The other results showed significant differences in feed intake among control and dried whey powder + protexin treatments. Broilers receiving different levels of dried whey powder and protexin had higher feed intake in compare to the control group. Furthermore, addition of different levels of dried whey and protexin probiotic decreased feed conversion ratio in comparison of control groups. Addition of different levels of dried whey and protexin probiotic increased gizzard, spleen and bursa of fabricius in compersion of control groups. Further result showed that birds received dried whey powder + protexin had lowest total cholesterol, HDL and LDL concentrations in compersion of control groups.

Keywords: Broiler, Blood Parameters, Carcass, Performance, Protexin Probiotic, Whey.
Introduction

Probiotics are live microbial food supplements that benefit the host animal by improving its intestinal microbial balance (Gomes & Malcata, 1999). Probiotics are increasingly being used as a tool to improve the health of farmed animals. This strategy is employed due to the observed effects of the gastrointestinal microbiota of broiler chickens on intestinal infections and the immune response, both of which are important in the prevention of infection by pathogenic bacteria in the gut (Lu et al., 2003). Whey or a liquid remaining from cheese or casein production is one of the most valuable sources of protein in human food chain. In spite of its balanced nutrients, liquid whey is disposed as a waste product. Liquid whey has a high biological oxygen demand so its disposal in rivers kills living organisms. Environmental pollution is also a concern in many countries (Thivend, 1977). In theory, whey protein content includes alpha and beta-lactalbumins and can be used a valuable source of protein to animals (Brunner, 1981).

Whey is considered an immune system enhancer, since its major protein fractions are α-lactoglobulin and β-lactalbumin. The yellow green color of whey is due to the presence of B-group vitamins, especially riboflavin. Rod-shaped lactic acid bacteria of the genus Lactobacillus are the most important type of bacteria found in the digestive tract of birds. So, it seems that acid whey may act as a natural probiotic in birds, enhancing their immunity, improving survival rates, and stimulating the growth of beneficial intestinal bacteria. It has been shown that dietary supplementation of whey powder linearly increases body weight gain and nitrogen retention in turkey and broiler chickens (Shariatmadari & Forbes, 2005).

Protexin is one of the commercial probiotics containing lactobacillus acidophilus and bifido bacterium. Each gram of protexin contained 0.1×10 CFU (EFSA, 2003). The manufactures of the product (Probiotics internationals limited, UK) claims that it exerts its beneficial effects on the performance of broilers. The results study by Khosravi et al (2008) showed that protexin probiotic can be a good alternative to antibiotic growth promoters. Zilkifli et al (2000) reported that dietary supplementation of probiotics improved body weight gain and feed intake significantly. Fallaha et al (2013) showed that mixture of Bioplus and Protexin probiotics had highest carcass weight, although, there had no significant difference between control and other chicks. These researchers showed that addition of probiotic to broiler diets, improved growth performance, better absorption of food materials in small intestinal and improved carcass characteristics of broiler chickens at 42 days of age. Toghyani et al (2011) reported that the effect of probiotics is decrease in abdominal fat of broiler chickens. Pish Jang (2011) found that the cholesterol level of serum significantly decreased in groups supplemented with probiotics in compared to control group. The purpose of this study was to investigate the productive performance, carcass trait, blood parameters of broiler chickens fed different levels of dried whey and protexin probiotic.

Methodology

Birds and housing

In this study, 360, one-day old male and female commercial Ross 308 broiler chickens of mixed gender were used in a randomized design with four treatment (six replicated in each treatment and 15 birds/replieated) and reared on the floor pens for 42 days. Feed and water were supplied ad libitum. Brooding temperature in the first week of life was 32°C and decreased to 25°C until the end of the experiment. During the first week, 23 h of light was provided with a reduction to 20 h afterward.

Dietary treatments

The dietary treatments were: (1) control diet (no supplement), (2) basal diet supplemented with 40 g/kg dried whey powder (3) basal diet supplemented with 1g/kg protexin probiotic and (4) basal diet supplemented with 20 g/kg dried whey powder+ 0.5 g/kg protexin probiotic. The chicks were fed with the starter diets from day 1 to 21 and grower feed from day 22 to 42 (Table 1). Diets formulated and considered as control according to the recommendation of National Research Council (NRC, 1994). Birds were vaccinated routinely against infectious Bronchitis, Newcastle and Gumboro diseases, but no medication was administered during the entire experimental period.

Management and data collection
The growth performance of broiler chickens were evaluated by recording body weight, feed intake, and feed conversion ratio. Individual live body weights of each bird were recorded at the beginning of the experiment and on a weekly basis thereafter. Feed intake was determined as the difference between the amount of feed given and the residual feed at the end of each experimental day. Feed conversion ratio was determined as the ratio between feed intake and body weight gain at each week of the experimental period.

**Carcass Characteristics**

At the end of 42 days of age, two birds (male and female) were taken randomly from each replicate. Chicks were killed and weights of internal organs like liver, heart, gizzard, spleen, Bursa of fabricius, proventriculus and abdominal fat were recorded as percent of live body weight. Slaughter procedure was approved by the Animal Ethics Committee of Mazandaran University.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Starter (1-21 days)</th>
<th>Grower (22-42 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>61</td>
<td>58.7</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>29</td>
<td>30</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Fish meal</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Soybean oil</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Oyster shell meal</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>DCP</td>
<td>1.07</td>
<td>1</td>
</tr>
<tr>
<td>Vitamin and mineral premix(^1)</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>DL-methionine</td>
<td>0.13</td>
<td>0.10</td>
</tr>
<tr>
<td>L-lysine</td>
<td>0.15</td>
<td>0.25</td>
</tr>
<tr>
<td>Salt</td>
<td>0.25</td>
<td>0.10</td>
</tr>
<tr>
<td>Coccidiostate</td>
<td>-</td>
<td>0.05</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

1-Vitamin and mineral provided per kilogram of diet: vitamin A, 3600 IU; vitamin D3, 800000 IU; vitamin E, 7200 IU; vitamin K3, 800 mg; vitamin B1, 720mg; vitamin B9, 400mg; vitamin biotin, 40mg; vitamin B2, 2640mg; vitamin B3, 400mg; vitamin B5, 12000mg; vitamin B6, 1200mg; vitamin B12, 6mg; choline chloride, 200000mg; Mn, 40000mg; Fe, 20000mg; Zn, 40000mg; Cu, 4000mg; I, 400mg, Se, 80mg.

**Blood biochemical parameters**

Two 42 day-old birds per replicate were randomly chosen, then slaughtered and blood samples were collected into vials containing the role of ethylenediamine tetra acetic acid (EDTA) (to avoid blood clot formation) and centrifuged for 20 min at 1500 rpm to separate the serum. The serum samples were stored at -20 °C for the analysis of serum glucose (Coles, 1986), total protein (Wotton, 1964), uric acid (Trinder, 1969), total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides (Franey & Elias, 1986).

**Statistical analysis**

All data were analyzed using the one-way ANOVA procedure of SAS (2004) for analysis of variance. Differences between means were analyzed with Duncan's multiple range test. The significant difference statements were based on the probability of p<0.05, unless explained in another way.
Results

The results of adding different levels of dried whey powder and protexin on the growth performance of broiler chickens at 42 days of age are presented in Table 2. Diet supplementation with dried whey powder and protexin statistically increased chicks body weight at 42 days of age in comparison to the control chicks (p<0.05). Treatment with adding dried whey powder + protexin had the highest total body weight (2370), and the lowest total body weight was observed in the control groups (2240). The other results showed significant differences (p<0.05) in feed intake among control and dried whey powder + protexin treatments.

**Table 2. Effect of different levels of dried whey powder and protexin on the growth performance of broiler chickens at 42 (means± SEM).**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>Dried whey powder</th>
<th>Protenxin</th>
<th>Dried whey powder + Protenxin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final body weight (g)</td>
<td>2240±126.83&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2280±129.42&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2340±125.85&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2370±138.25&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Feed intake (g)</td>
<td>4220±352.75&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4280±348.29&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4360±353.49&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4380±358.36&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Feed conversion Ratio</td>
<td>1.88±0.05</td>
<td>1.87±0.04</td>
<td>1.86±0.02</td>
<td>1.84±0.03</td>
</tr>
</tbody>
</table>

<sup>abc</sup> means on the same row with different superscripts are significantly different (p<0.05), SEM: Standard Error Means.

Broilers receiving different levels of dried whey powder and protexin had higher feed intake in compare to the control group. Treatment with adding dried whey powder + protexin had the highest feed intake (4380), and the lowest feed intake was observed in the control groups (4220). Treatment with adding dried whey powder + protexin had the lowest FCR (1.84), and the highest FCR was observed in the dried whey powder and protexin groups (1.88). The further results showed no significant differences in FCR among control and other treatments.

The results of adding different levels of dried whey powder and protexin on internal organs mass of broiler chickens at 42 days of age are presented in Table 3. The results of this study showed no significant differences (p>0.05) in heart, liver, gizzard, spleen, bursa of fabric us and proventriculus relative weights among control and other treatments. Broilers receiving dried whey powder and protexin probiotic had higher spleen and bursa of fabric us relative weight compared to the control group. The highest relative weight of spleen was shown in group fed with dried whey powder + protexin in diet (0.19) and the lowest of these was shown in the control group (0.14).

**Table 3. Effect of different levels of dried whey powder and protexin on internal organs mass of broiler chickens at 42 (means± SEM) (% live weight).**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>Dried whey powder</th>
<th>Protenxin</th>
<th>Dried whey powder + Protenxin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart</td>
<td>0.59 ±0.015</td>
<td>0.57 ±0.017</td>
<td>0.62 ±0.016</td>
<td>0.58 ±0.015</td>
</tr>
<tr>
<td>Liver</td>
<td>3.82±0.012</td>
<td>3.65±0.015</td>
<td>3.57±0.013</td>
<td>3.88±0.018</td>
</tr>
<tr>
<td>Gizzard</td>
<td>3.28±0.016</td>
<td>3.42±0.018</td>
<td>3.53±0.017</td>
<td>3.82±0.019</td>
</tr>
<tr>
<td>Spleen</td>
<td>0.14±0.012</td>
<td>0.15±0.014</td>
<td>0.17±0.015</td>
<td>0.19±0.016</td>
</tr>
<tr>
<td>Bursa Fabricus</td>
<td>0.15±0.014</td>
<td>0.17±0.015</td>
<td>0.16±0.014</td>
<td>0.18±0.015</td>
</tr>
<tr>
<td>Proventriculus</td>
<td>0.32±0.015</td>
<td>0.34±0.016</td>
<td>0.35±0.016</td>
<td>0.34±0.018</td>
</tr>
<tr>
<td>Abdominal Fat</td>
<td>1.87±0.016&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.68±0.015&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.65±0.013&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.62±0.015&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>abc</sup> means on the same row with different superscripts are significantly different (p<0.05), SEM: Standard Error Means.

Treatment with adding dried whey powder + protexin had the lowest abdominal fat (1.62), and the highest of these was observed in the control groups (1.87). The highest relative weight of gizzard was shown in group fed with dried whey powder + protexin in diet (3.82) and the lowest of these was shown in the dried whey powder (3.12). Broilers receiving protexin probiotic had highest proventriculus relative weight compared to the control group (0.35) and the lowest of these was shown in the dried whey powder (0.32).

The results in Table 4 showed no significant differences in total protein, uric acid and triglycerides (p>0.05) among different treatments. Broilers receiving protexin probiotic had lowest glucose concentrations in comparing to other treatment groups (281.12) and the highest glucose concentrations was shown in control groups (328.28).
Further results showed that the highest total protein (8.23) was observed in birds received protexin probiotic and the lowest total protein (7.58) was observed in dried whey powder groups.

**Table 4.** Effect of different levels of dried whey powder and protexin on blood parameters of broiler chickens at 42 (means ± SEM).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>Dried whey powder</th>
<th>Protexin</th>
<th>Dried whey powder + Protexin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose (mg/dl)</td>
<td>328.28±16.45a</td>
<td>287.61±16.36b</td>
<td>281.12±17.85b</td>
<td>285.25±17.48b</td>
</tr>
<tr>
<td>Total protein (g/dl)</td>
<td>8.12 ± 0.15</td>
<td>7.58 ±012</td>
<td>8.23 ±0.15</td>
<td>7.67 ±0.16</td>
</tr>
<tr>
<td>Uric acid (mg/dl)</td>
<td>57.46 ± 2.84</td>
<td>54.75± 2.17</td>
<td>52.83 ±2.25</td>
<td>53.38± 2.79</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>162.48 ± 9.73a</td>
<td>132.58 ± 9.35b</td>
<td>138.31 ± 9.48b</td>
<td>135.58± 9.25b</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>67.28 ± 5.49a</td>
<td>58.47 ± 5.86b</td>
<td>53.42 ± 5.35b</td>
<td>51.22± 5.81b</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>38.28± 5.74a</td>
<td>31.53 ± 5.12b</td>
<td>33.74 ± 4.25b</td>
<td>32.19± 4.18b</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td>109.83 ± 18.35</td>
<td>109.37± 18.45</td>
<td>108.85 ± 17.45</td>
<td>107.57± 17.56</td>
</tr>
</tbody>
</table>

abc means on the same row with different superscripts are significantly different (p<0.05), SEM: Standard Error Means; HDL: high density lipoprotein; LDL: low density lipoprotein.

There was significant effect in total cholesterol, HDL and LDL concentrations between control and other groups. Further result showed that birds received dried whey powder + protexin had lowest total cholesterol, HDL and LDL concentrations and the highest of these were shown in control groups. The highest triglycerides were shown in control groups (162.48) and the lowest triglycerides were shown in dried whey powder groups (132.58).

**Discussion and Conclusion**

The results of this study indicate that the use of different levels of dried whey powder and protexin probiotic increased chicks body weight feed intake and improved FCR in comparison to control groups at 42 days of age. Al-Asadi et al (2008) reported that body weight gain of chicken received 2.5 and 5 % whey were improved at 46 days of age significantly, while 10% whey reduced body weight gain significantly compared with control group at 33-46 days of age. Kermanshahi and Rostami (2006) reported that broilers fed 1% whey in diet, had higher feed intake and body weight gain than the control group.

Gulsen et al (2002) reported that the improvement observed in broilers fed with lactose during the starter period, could be attributed to an increase in intestinal villi length which was assumed to improve nutrient absorption and bird performance. Omara (2012) observed that FCR improved significantly (P<0.05) with 1% whey diet compared with the control. Also, Al-Asadi et al (2008) reported that adding whey to water lead to improved feed conversion ratio during 20-46 days of age and improved significantly (P<0.05). The result of an investigation showed that poultry could not digest whey powder and using 8% whey powder caused increasing osmotic pressure and diarrhea (Kermanshahi & Rostami, 2006).

Ghafoouri et al (2013), investigated the effects of whey levels in the water on the broiler performance, and the results of this study showed the lowest FCR is related to the treatment with 10% whey. Results of a research showed the diet with 4% whey powder has significant effect on FCR and fed broiler with this diet had significant FCR than the control (Mehri et al., 2004) that is consistent with this study results. Results of another research showed using 4% whey in the broiler diet during 11-24 days caused improving FCR (Zanganeh et al., 2012). The results are similar with the findings by Mohan et al (1996) and Hamid et al (1994). They found that broiler fed different level of *L. acidophilus* culture as probiotic up to 35 days of age, improved FCR in birds fed 5.0g probiotic per liter of water. The higher body weight gain in probiotic group might be due to better digestive or microbial enzymatic activity (Jin et al., 1998), while the results contradict with the findings of Hossain (2004), Kwon et al (2002) and Priyankarage et al (2003). They found no significant effect of probiotic on body weight gain of broiler chickens. The possible variation might be due to sex effect, weather condition, infectious diseases, etc. The significant effects of probiotic on feed intake were observed by Kim et al (1988); Erdogan (1999) and Haq et al (1997). However, Hossain (2004) found no significant effect of probiotic on feed intake of broiler chickens at 42 days of age.
The results of this study showed that the treatments with addition of dried whey powder and protexin probiotic improved carcass characteristics compared with control group. An experiment was conducted to investigate the effects of using the whey in the drinking water of the broiler on the carcass traits of them (Adnan et al., 2008). Other investigation showed that use of whey in diet of broilers, increased liver weight percentage and decreased heart, abdominal fat, and gizzard weight percentage (Majewska et al., 2009). Al-Asadi et al (2008) found that the carcass weight in broilers received 2.5 and 5 percent whey was maximum (P<0.05) at 46 days of age compared with control group. Also, Kermanshahi and Rostami (2006) reported that carcass weight in chickens received 2 and 4 % of dried whey was maximum (P<0.05) at 49 days of age. Further results of this study indicate that the use of different levels of of dried whey powder and protexin probiotic decreased glucose, cholesterol, HDL, LDL and triglycerides concentrations of broiler chickens at 42 days of age.

Previous studies indicated that dietary supplementation of probiotics and prebiotics may have the potential to lower serum cholesterol levels (Salma et al., 2007; Velasco et al., 2010). Ooi and Liong (2010) found that the lowering effect of prebiotics on the serum cholesterol level would likely be through reducing lipid absorption in the intestine by binding bile acids, which results in increased cholesterol elimination and hepatic synthesis of new bile acid. Szczurek et al (2013) found that the concentration of total protein in serum of blood collected on day 21 was greater (P<0.05) for dried whey-fed birds compared with the control group.

Other investigations showed that serum triglycerides and cholesterol levels were significantly lower in the birds fed diets supplemented with probiotics and prebiotics than in birds fed the control diet (Ghasemi et al., 2014). The most important mechanism by which probiotics reduce serum cholesterol possibly is through interfering with cholesterol absorption in the gut by DE conjugating bile salts or by directly cholesterol absorption (Ooi & Liong, 2010).

The results of the present study indicate that addition of different levels of dried whey and protexin probiotic increased body weight, feed intake and improved FCR in broiler chickens at 42 days of age. Furthermore addition of dried whey and protexin probiotic improved carcass characteristics and decreased cholesterol, HDL and LDL and triglycerides concentrations of broiler chickens at 42 days of age.

Conflict of interest
The author declare no conflict of interest

References


