Journal of Agricultural Science; Vol. 7, No. 8; 2015
ISSN 1916-9752 E-ISSN 1916-9760
Published by Canadian Center of Science and Education

Effect of Milk Powder Supplementation on Growth Performance of Broilers

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Received: April 25, 2015 Accepted: May 25, 2015 Online Published: July 15, 2015

doi:10.5539/jas.v7n8p111 URL: http://dx.doi.org/10.5539/jas.v7n8p111

Abstract

The aim of this study was to investigate the effect of adding milk powder on the growth performance of broilers. Two hundred Lohman broiler males were purchased and reared for 35 days. Chicks were randomly divided into two groups, each group assigned to 10 experimental units and reared in 10 identical pens (10 birds/m^2). After a week from purchasing, birds were weighed and assigned to two diets, the control diet (0% milk powder) and the experimental diet (0.5% milk powder). Feed intake and body weight gain were recorded weekly, while feed conversion ratio was calculated. It was noted that body weight gain was improved at week four and five of the experimental period for birds fed rations supplemented with 0.5% of milk powder compared with birds fed the diet contains 0% milk powder with an average body weight gain of 1.20 and 1.92 kg for birds fed 0.5% milk powder diet, and 1.11 kg 1.71 kg for birds fed 0% milk powder diet. A significant difference ($p < 0.05$) was shown in feed conversion ratio for the birds fed 0.5% of milk powder diet from week two till five with 1.39, 0.89, 0.84, and 0.59 respectively, compared with birds fed the 0% milk powder diet with 1.55, 0.99, 0.97, and 0.69 respectively. Therefore, feeding broilers rations supplemented with 0.5% milk powder significantly ($p < 0.05$) increased weight gain and feed conversion ratio compared to birds fed 0% milk powder diet, which indicate that milk powder supplementation might be effective and improved growth performance.

Keywords: body weight gain, broilers, feed intake, feed conversion ratio, growth performance, milk powder

1. Introduction

Poultry sub-sector considered one of the major sectors in agriculture due to its high contribution in Jordanian economics (MOA, 2014). Broiler production as a meat source developed in the last decades and this development combined to the development of other industries like feed industry (Al-Masad, 2012). The amount of broiler meat production in Jordan reached 182,264 ton last year (DOS, 2013).

Offering a high quality feed to broilers depends on the availability of raw materials that can provide main nutrient requirements (Gakuya et al., 2014). A great concern in poultry enterprise is to lower feed cost and consumption while increasing feed efficiency of birds at the same time (Kamran et al., 2004). Improving profitability of producers which reached by decreasing prices at the retail level may enhance broiler production in developing countries (Maqbool et al., 2005).

Improving feed quality by increasing protein level in rations may enhance growth performance and increase muscle growth in broilers (Firman & Boling, 1998). Many studies showed that using different protein sources as supplements in broiler rations increased performance and meat production (Aftahi et al., 2006; Kermanshahi & Rostami, 2006).

Protein supplements in poultry feed can be divided to proteins from animal sources and proteins from plant sources (Abro et al., 2012). The main sources of plant proteins used in broiler feed are soybean meal, and cottonseed (Anwar et al., 2008; Park et al., 2002), while the most sources of animal proteins used in broiler feeds are fish meal, and bone meal (Dat & Yu, 2003). Animal protein is a rich source of energy, and it is useful in the growth of animal body, animal protein is a complete protein that includes essential amino acids compared to plant protein (Olomu, 1995).

Milk replacers is a dried milk powder which is high in protein level and high amino acid profile that used in calves feed during the growing phase (Hill et al., 2008). The chemical composition of milk replacer is 20-24%

protein, 15-20% fat, and less than 0.1% fiber (Moran, 2012). Milk powder contains a special type of proteins named casein which was used as a source of protein supplement in broilers feed (Kabuage et al., 2002).

Many forms of animal protein supplements used in broiler rations were studied; however, there are no publications on using milk powder as a source of animal protein in poultry diets. Therefore, this study was designed to evaluate the effect of milk powder supplementation on the growth performance of broilers by which it's expected to improve feed efficiency and growth rate of broiler birds.

2. Materials and Methods

2.1 Experimental Birds

One day old of two hundred Lohman broiler males were obtained from a local hatchery and reared for 6 weeks (1 week for adaptation, and another 5 weeks as an experimental period) during the period from 31 October to 10 December, 2014 in a controlled environmental poultry house at the research station of the Faculty of Agriculture at Jerash University. Chicks were divided into two groups, each group assigned to 10 experimental units and reared in 10 identical pens (10 birds/m^2). Each pen was provided with an adequate number of thermostatically controlled heaters and an electric fan for air circulation and distribution. A thermometer was used to monitor temperature and the ambient temperature was controlled to the accuracy of ± 2 ºC.

2.2 Management Practices

Birds were offered *ad libitum* feed and water. Ambient temperature was decreased gradually during the experimental period from 32 ºC at one day old to reach 22 ºC at the end of the experiment. After a week from purchasing the birds, they were weighed and randomly assigned to the different treatments.

2.3 Experimental Rations

Two different experimental diets were used to investigate the effect of milk powder supplement in broilers diets on their performance. At the first week of bird age, a commercial broiler starter diet was used for the two groups containing 2999 Kcal ME/kg and a 20.1% crude protein, after that one group were kept on the same diet for another 14 days and then fed a finisher diet to the end of the experiment period which contains 3048 Kcal ME/kg and 18.2% crude protein (Table 1). The other group of birds were offered the same diets but with the addition of milk powder.

2.4 Experimental Setting and Measurements

The aim of this project was to evaluate broilers growth performance fed milk powder supplemented to their rations. The experimental diets used in this experiment are shown in Table 1. Milk powder was supplemented to one group of birds by 0.5% from the total feed offered (5 kg of milk powder on each 1000 kg of the diet). The source of milk powder used in this experiment was a milk replacer for feeding calves. Milk powder chemical composition is shown in Table 2.

Birds were weighed from second week and repeated every week at the same time until the end of the experimental period. Feed intake and body weight gain were recorded weekly, while feed conversion ratio was calculated.

2.5 Statistical Analysis

Data were analyzed using PROC MIXED of SAS (version 9.1, SAS Institute, Inc. Cary, NC, USA) with bird considered the experimental unit for the treatment × week effects. The mean separation was performed using an F-protected t-test. Treatment means are reported as least square means by using Tukey test, and differences were referred to as tendencies are those having a $P \leq 0.05$.

Table 1. Ingredients and calculated composition for the starter and finisher broiler diets

Item	Starter (%)	Finisher (%)
Ingredients and composition		
Yellow corn	61.60	69.20
Soy-bean meal (44% CP)	34.50	27.00
Limestone	1.00	1.00
Dicalcium-phosphate	2.10	2.00
Premix*	0.30	0.30
DL-methionine	0.10	0.10
Choline	0.10	0.10
Salt	0.30	0.30
Coccidostats	0.05	0.05
*Nutrient chemical composition***		
ME (kcal kg^{-1})	2999.00	3048.00
Crude Protein, %	20.10	18.20
ME/CP	143.50	167.80
Crude Fat, %	2.70	3.03
Calcium (%)	0.96	0.94
Phosphorus (%)	0.76	0.73
Lysine (%)	1.26	0.99
Methionin (%)	0.48	0.41
Methionin and cystine (%)	0.89	0.39
Sustain (%)	0.40	0.34

Note. *: 1 kg of premix contains: 12000000 IU vitamin A, 2500000 IU vitamin D3, 10000 mg vitamin E, 2000 mg vitamin K3, 1000 mg Vitamin B1, 5000 mg vitamin B2, 10 mg vitamin B12, 30000 mg Nicotinic acid, 3000 mg Ca-pantothenate, 1000 mg folic acid, 50 mg biotin, 40000 mg Fe, 5000 mg CU, 60000 mg Mn, 100 mg I, 60000 mg Zn, 150 mg Co, 10000 mg B.H.T.

**: The chemical composition of nutrients for each feed ingredient was calculated using NRC tables (1994).

Table 2. Chemical composition for milk powder (Milk Replacer)

Chemical Analysis		Vitamins	
Crude protein	21.00%	A	44.300 I.U.
Crude Fat	20.00%	D3	< 25 µg
Crude Ash	7.84%	C	75 mg
Crude Fiber	0.73%	E	59 mg
Dry matter	96.97%	B1	3.4 mg
Ca	0.57%	B2	16.8 mg
P	0.70%	B3	18 mg
Mg	0.15%	Choline	1550 mg
K	1.00%	Panthotenic Acid	49 mg
Fe	78 mg	B6	4.9 mg
Co	0.1 mg	Folic Acid	964 µg
Se	0.13 mg	B12	25 µg
Cu	< 5 mg	Biotin	150 µg
Zn	62 mg	K1	30.6 µg
Mn	22 mg	K3	1.5 mg
Na	0.64%	A	44.300 I.U.
I	1.50 mg	D3	< 25 µg

Source: Milk replacer for young calves, a product manufactured in Holland (Krishnamoorthy & Moran, 2011).

3. Results and Discussion

Table 3 shows the effect of milk powder supplementation in broiler chickens rations on body weight gain (kg). The results showed that there was a significant difference ($p < 0.05$) between the two treatments during week four and five of the experimental period. Body weight gain was improved at week four for birds fed rations supplemented with 0.5% of milk powder more than birds fed the control diet (0% milk powder). The average body weight gain was 1.11 and 1.20 kg for 0% milk powder and 0.5% milk powder treatments, respectively. Moreover, at week five, the average body weight was increased for birds fed rations supplemented with 0.5% of milk powder with 1.92 kg compared with birds fed rations with 0% milk powder supplementation with 1.71 kg. The accumulative average body weight gain was significant ($p < 0.05$) for birds fed 0.5% milk powder and was 3.95 and 4.34 kg for 0% milk powder and 0.5% milk powder treatments, respectively. The results agree with Mahmmod et al. (2014) which found that body weight gain was increased with broiler birds fed rations supplemented with dried yogurt powder during the period of 22-35 days of the experimental period. The increase in body weight gain may be due to the higher digestibility of milk powder protein and an excellent amino acid balance profile found in it as shown by the study performed by Mansoub (2011).

Table 3. The effect of adding milk powder to broiler rations on average weekly weight gain (kg)

Period (days)	0% milk powder	0.5% milk powder	Sig
1-7	0.14 a	0.15 a	**N.S.**
8-14	0.30 a	0.34 a	**N.S.**
15-21	0.69 a	0.73 a	**N.S.**
22-28	1.11 b	1.20 a	*
29-35	1.71 b	1.92 a	*
1-35	3.95 b	4.34 a	*

Note. * Means with different superscripts in the same row are significantly different at ($p < 0.05$); N.S.: not significant.

Table 4 presents the effect of milk powder supplementation in broiler chickens rations on feed intake (kg). The

results showed that there was no significant ($p > 0.05$) difference between the different treatments (0%, and 0.5% milk powder supplementation) on broiler birds feed intake, although there was a slightly increase in feed intake for birds during the five weeks of experimental period. The accumulative feed intake was not significant ($p > 0.05$) for birds fed different treatments and it was 3.58 and 3.49 kg for 0% milk powder and 0.5% milk powder treatments, respectively. The reason for the increase in feed intake may be due to the increase of birds' appetite for the different diets (Aftahi et al., 2006). The results agree with Kermanshahi and Rostami (2006) whom found that there was no significant difference in feed intake for birds fed rations supplemented with dried milk whey powder. Feed conversion ratio was affected and significantly increased for birds fed different diets (Table 5) although the slightly changes found with birds feed intake, which indicates that the efficiency of feed conversion was increased due to the increase of feed ingredients and elements absorption.

Table 4. The effect of adding milk powder to broiler rations on average weekly feed intake (kg)

Period (days)	0% milk powder	0.5% milk powder	Sig
1-7	0.17 a	0.19 a	**N.S.**
8-14	0.46 a	0.49 a	**N.S.**
15-21	0.69 a	0.65 a	**N.S.**
22-28	1.08 a	1.02 a	**N.S.**
29-35	1.18 a	1.14 a	**N.S.**
1-35	3.58 a	3.49 a	**N.S.**

Note. N.S.: not significant.

Table 5 presents the effect of milk powder supplementation in broiler chickens rations on feed conversion ratio (kg). The results showed that there was no significant difference ($p > 0.05$) in feed conversion ratio for birds fed the different diets during the first week of the experimental period. On the other hand, from week two to the end of week five of the experiment, a significant difference ($p < 0.05$) was shown in birds fed the diet supplemented with 0.5% of milk powder from week two till five with 1.39, 0.89, 0.84, and 0.59 respectively, compared with birds fed the control diet (0% milk powder supplementation) with 1.55, 0.99, 0.97, and 0.69 respectively. The accumulative feed conversion ratio was significant ($p < 0.05$) for birds fed 0.5% milk powder treatments and it was 5.47 and 4.97 kg for 0% milk powder and 0.5% milk powder treatments, respectively This result agree with Ferguson et al. (1998) that studied the effect of feeding high crude protein and amino acid profile diets on broilers feed conversion ratio and found an enhancement in those ratios. Moreover, these results are more explained by the results of Nawar and El-Sayed (2003). They found that live weight gain and feed conversion efficiency were higher in chickens fed on animal protein.

However, the results of this study did not agree with the study performed by Kamran et al. (2004) that showed that the reduction in crude protein percentage in the diet enhanced feed conversion ratios of broilers fed this diet. Moreover, the results of this study disagree with the results found by Kabuage et al. (2002) whom found that the addition of casein (milk protein) to the diets fed to broilers did not affect the feed conversion rations. Casein generally increased the amino acid concentrations such as methionine and isoleucine of the diets which might have enhanced their utilization.

Table 5. The effect of adding milk powder to broiler rations on average weekly feed conversion ratio (kg)

Period (days)	0% milk powder	0.5% milk powder	Sig
1-7	1.27 a	1.26 a	**N.S.**
8-14	1.55 b	1.39 a	*
15-21	0.99 b	0.89 a	*
22-28	0.97 b	0.84 a	*
29-35	0.69 b	0.59 a	*
1-35	5.47 b	4.97 a	*

Note. * Means with different superscripts in the same row are significantly different $p < 0.05$; N.S.: not significant.

5. Conclusion

Experimental birds fed diets supplemented with 0.5% milk powder gained significantly ($p < 0.05$) higher weight and had an increased feed conversion ratio compared to birds fed the control diet (0% milk powder), which indicate that milk powder supplementation might be effective and improved growth performance. Furthermore, the experimental diets did not affect feed intake which indicate that bird's appetite was not improved by using milk powder as a supplement. However, further investigations with more different levels of milk powder supplement to broiler diets needed to confirm and support the results.

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