Effect of whole wheat and wet feeding on growth performance and immunity of broiler chicks

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Journal of Livestock Science (ISSN online 2277-6214) 8:225-230
Received on 25/9/2017; Accepted on 16/12/2017

Abstract

The experiment was performed to assay the effect of wet feeding and whole wheat on performance and immunity parameters of broiler chickens. A total of 280-day-old (Ross 308) broiler chickens were allocated to 4 dietary treatments with 5 replicates of 14 chicks in factorial arrangement (2*2) in a completely randomized design. Experimental diets were included 2 forms of feeding (wet and dry, 1.5 kg added water to 1150 g diet) and whole and ground wheat was used. Performance parameters like body weight (BW), weight gain (WG), feed intake (FI) and feed conversion ratio (FCR) was calculated during 4-44 day of age. Antibody titer against Newcastle and influenza viruses and sheep red blood cell (SRBC) was determined to evaluate the immune responses. BW, WG and FI were numerically increased by wet feeding and FCR decreased (P>0.05), while these parameters increased by ground wheat and FCR decreased (P>0.05). None of the immune parameters were statistically affected by dietary treatments. It can be concluded that wet feeding and ground wheat would enhance performance of broiler chickens.

Keywords: Broiler; Wheat; Wet feeding; Performance; Immunity

Introduction

In Iran and some other countries around the world, wheat is the alternative of the corn as a source of energy (Nahas and Lefrancois, 2001; Engburg et al, 2004). Feeding poultry with whole grains is not a new concept. In recent years, feeding broilers with whole grain attracted attention in commercial poultry industry, and with this strategy, feed costs, transport and processing loses (Svihus, 2001). In addition to feed cost reduction by using whole grain, other beneficial effects of feeding whole grain included improvements inbroilers' performance, gut health and general flock health (Cummings, 1994; Forbes and Covasa, 1995). It has been clearly reported that whole grain increased gizzard development (Gabriel et al, 2003) and this gizzard development may prevent potentially pathogenic bacteria from entering the intestine (Engberg et al, 2004); so, bird performance and feed efficiency improved (Biggs and Parsons, 2009), also in other studies an increased development of the pancrease was observed (Engberg et al, 2004; Banfield et al, 2001); positive effects on morphology of gastrointestinal tract (GIT) increased peristaltic movement (Taylor and Jones, 2004). Gizzard development is associated to increasing grinding activity, increasing gut motility and cause to greater digestion of nutrients (Amerah et al, 2007).

Dry feeding in mash or pellet form is the widest and most accepted feeding practice around the world. However, wet feeding more readily accepted by broiler than dry feed (Mikkelsen and Jensen, 2001). It has been reported that wet feeding will stimulate dry matter intake, growth rate and feed conversion efficiency (Yalda and Forbes, 1995; Tadtiyanant et al, 1991; Awojobi and Meshioye, 2001; Awojobi et al, 2007; Awojobi et al, 2009). Also, it has been reported that wet fed broilers in hot tropic can reduces heat stress and improve feed intake (Dei and Bumbie, 2011). Also, there are some barriers to the commercial utilization of wet feeding, for instance lack of information as to whether newly hatched chicken fed with wet feed (Forbes et al, 2005).

However, in some literature reported that wet feeding had no effect on carcass weight and dry matter digestibility in broiler chicken, and effect of wet feeding on some characteristics of broilers such as gut morphology or immune responses is rare in literatures (Afsharmanesh et al, 2010). Thus, the present experiment was performed to evaluate the effect of whole wheat, wet feeding and their interaction on growth performance and immunity of broiler chicks.

Materials and methods

Birds and management

A total of 280 day old mixed sex broiler chicks (Ross 308) were purchased from a commercial hatchery, weighted on arrival time and allocated to 4 dietary treatments and 5 replicates of 14 birds with factorial (2*2) arrangement were formulated in a completely randomized design. The experiment was conducted in an experimental farm of Islamic Azad University, Isfahan(Khorasgan) Branch, Isfahan, Iran. During rearing period broilers were fed by diets based on wheat that presented in Table 1. The cultivar of consumed wheat was M18 that is a hybrid cultivar planted in Iran. The intact wheat was added to diets. Throughout the trials feed and water were provided *ad libitum*. The ambient temperature was 33^{oc} at the beginning of experiment and then gradually decreases to 25^{oc} on day 21 and then was kept constant. Wet feeding was provided through addition of 1.5 litter of water to 1150 g dry feed or no water addition (dry feeding).

Performance and Immunity

Performance parameters such as body weight (BW), weight gain (WG), feed intake (FI), feed conversion ratio (FCR) were determined throughout the experiment (4-44 day). Two birds per pen at 42 days of age were randomly selected and their blood samples were taken from brachial vein and centrifuged to obtain serum. Antibody titer against Newcastle and Influenza (H2N9) viruses were measured using hemagglutination inhibition test. At day 24 of age, two birds from each pen were randomly selected and via brachial vein inoculated with 1 ml of 1% sheep red blood cells (SRBC) suspension. At day 6 after inoculation, blood samples were taken from brachial vein and SRBC antibody titers were measured by microtiter procedure of Wegmann and Smithies (1966). SRBC titers were stated as the log2 of the reciprocal of the highest dilution giving the visible hemagglutination.

Statistical analysis

Data were exposed to ANOVA using the general linear model procedure of SAS institute (2008) with the main effects of wheat form (whole or ground) and feed form (wet or dry) and the interaction of them. Means were compared using Tukey's test and were considered to be significant different at $P<0.05$.

Table 1. Ingredients and composition of the diet

Diet Composition	Starter (4-15 d)	Grower (15-29 d)	Finisher (29-44)
Wheat (10.4% CP[a])	20	40	60
Corn	33.83	15.7	-
Soybean Meal (42% CP)	39.19	37	32
Soybean Oil	2.5	3.7	4.5
Calcium Carbonate	1.7	1.45	1.37
Mono calcium phosphate	1.43	1.13	1.02
DL- Methionine	0.33	0.22	0.18
L- Lysine	0.17	0.01	-
Salt	0.35	0.3	0.3
Vitamin premix[b]	0.25	0.25	0.25
Mineral premix[c]	0.25	0.25	0.25
Calculated composition			
Metabolozable energy (kcal/kg)	2860	2950	3000
Crude Protein (%)	21.30	21	20
Lysine (%)	1.34	1.17	1.07
Methionine+cysteine (%)	1.02	0.89	0.82
Calcium (%)	0.99	0.86	0.8
Available phosphorous (%)	0.49	0.425	0.4

[a]Crude Protein. [b] Vitamin premix provided per kg of diet: vitamin A (retinol) 2.7 mg; vitamin D3 (cholecalcifrol) 0.05 mg; vitamin E (tocopherylacetate) 18 mg; vitamin k3, 2 mg; thiamine 1.8 mg; riboflavin 6.6 mg; pantothenic acid 10 mg; pyridoxine 3 mg; cyanocobalamin 0.015 mg; niacin 30 mg; biotin 0.1 mg; folic acid 1 mg; choline chloride 250 mg; antioxidant 100 mg. [c] Mineral premix provided per kg of diet: Fe ($FeSo_4.7\ H_2O$, 20.09% Fe), 50 mg; Mn ($MnSO_4.H_2O$, 32.49% Mn), 100 mg; Zn (ZnO, 80.35% Zn), 100 mg; Cu ($CuSo_4.5H_2O$), 10 mg; I (KI, 58% I), 1 mg; Se ($NaSeO_3$, 45.56% Se), 0.2 mg

Results

Performance parameters

Regarding Table 2, no significant effect of feeding method (dry or wet) and wheat form (whole and ground) was observable in the whole period performance of broiler chickens (4-44 day), except of body weight that significantly affected by wheat form (P<0.001). Nevertheless, an increasing trend in wet feeding compare to dry feeding, ground wheat compare to whole wheat in BW, WG and FI of chicks was observed (P>0.05). FCR in wet feeding and ground wheat was insignificanlty lower than other treatments (P>0.05).

Table. 2 Effect of whole and ground wheat and wet feeding on whole- period performance of broiler chickens.

	FM			WF			Source of variation (Significance)		
Performance	Dry	Wet	SEM	Whole wheat	Ground wheat	SEM	FM	WF	FM×WF
Body weight (g) 4-44	2251.00	2318.20	35.4	2181.6	2384.1	27.5	NS	***	NS
Weight gain (g/d) 4-44	54.50	56.20	0.88	52.80	57.80	0.69	NS	NS	NS
Feed intake (g/d)	98.00	98.80	1.40	95.10	102	1.2	NS	NS	NS
FCR (g:g) 4-44	1.83	1.78	0.02	1.81	1.80	0.02	NS	NS	NS

FCR: feed conversion ratio; FM: feeding method; WF: wheat form; NS: not significant; * P<0.05; **P<0.01, ***P<0.001.

Immunity response

Table 3 lists the effect of feeding method (dry or wet) and wheat form (whole or ground) on humoral immunity indices of broiler chicks. Experimental diets failed to significantly influence antibody titer against Newcastle, influenza and SRBC (P>0.05).

Table 3. Effect of wet feeding and wheat form on antibody titer of broiler chickens

	FM			WF			Source of variation (Significance)		
Variable	Dry	Wet	SEM	Whole wheat	Ground wheat	SEM	FM	WF	FM×WF
Influenza (log_2)	2.800	2.900	0.210	2.900	2.900	0.210	NS	NS	NS
Newcastle (log_2)	5.700	5.600	0.300	5.400	5.800	0.290	NS	NS	NS
SRBC (log_2)	6.700	6.800	0.190	7.00	6.600	0.190	NS	NS	NS

Values in the same row not sharing a common superscript differ significantly (P<0.05).

FM: feeding method; WF: wheat form; NS: not significant; SRBC: sheep red blood cell.

Discussion

In the present study wet feeding had no significant effect on BW, WG and FI of broiler chickens, but slight enhancement was observed in wet feeding and ground wheat treatments compare to dry feeding and whole wheat treatments, respectively (P>0.05). Some researches (Yasar and Forbes 1999, 2000; Scott 2002) reported that FI is increased by wet feeding.

Increasing the passage rate of digesta in gastro-intestinal tract (GIT), palatability, enhanced nutrient utilization, and decreased digesta viscosity can account as a reasons of FI increase (Yasar and Forbes, 2000). Enhancement of digesta passing rate can be a main reason of more FI by wet feeding (Yasar and Forbes 2000; Scott 2002). Greater capacity of wheat type to hydration rate that used in present study may cause no significant effect on FI. According to Scott (2002) report, hydration rate of wheat is limiting factor in FI of broiler chickens that is differed between different types of water. Yasar and Forbes (2000) and Scott (2002) in their experiments concluded that increased FI against stable WG, increased FCR of wet fed chickens, but in present experiment the likely higher hydration of wheat type perhaps reduced passage rate of digesta compare to other experiments and simplify nutrient absorption, and little improved FCR of broiler chickens. The results of present experiment is opposite to Yalda and Forbes result's (1995, 1996). This is illustrated in Table 2 that whole and ground wheat did not significantly affect performance parameters of broiler chickens (P>0.05). Yuben and VelmuruguRavindran (2004), reported that whole wheat inclusion had no effect on weight gain of broiler chickens that agrees with obtained result in present study, but in contrast reduced feed intake and improved feed efficiency. Improvement in feed efficiency was because of whole wheat inclusion that largely reduced feed intake (Uddin et al, 1996; Hetland et al, 2002). In agreement with present study, Amerah et al (2011) observed that in whole 35 day of trial period, whole wheat inclusion had no effect on weight gain or feed intake, but tended to improve feed per gain. Contradictory literature on the effects of whole wheat inclusion in broiler diets have reported. Several studies have reported feed per gain improved when whole wheat has replaced with ground wheat (Plavnik et al, 2002; Wu et al, 2004; Wu and Ravindran, 2004; Ravindran et al, 2006). While, other researchers had not seen improvement in feed efficiency by including whole wheat in broiler chickens' diet (Preston et al, 2000; Banfield and Forbes, 2001; Svihus et al, 2004; Amerah and Ravindran, 2005).

Various factors may be contributing in these contradictory results, including different experimental protocols and methods (Wu and Ravindran, 2004), diets with different nutrient density (Plavnik et al, 2002), broad variation in nutrient composition (Inglett, 1974), metabolizable energy (Hughes and Choct, 1999) and nutrient digestibility (Ravindran et al, 2005; Carre et al, 2007) of wheat is known.

Williams et al (2008), after using whole wheat in broiler chickens' diet, observed lower weight gain which may have induced by lower feed intake. The feed intake reduction may be due to limited capacity for grinding whole wheat grains in the gizzard, and transit rate in the digestive tract will be slow. In agreement with present study, Williams et al (2008) reported that FCR was not affected during whole rearing period and this is in agreement with other studies (Hetland et al, 2002; Gabriel et al, 2003; Svihus et al, 2004). However, Plavnik et al (2002) and Wu et al (2004) have reported an improvement in FCR with inclusion 200 g/kg whole wheat.

As mentioned in advanced, immune parameters such as antibody titer against Newcastle, influenza and SRBC were not affected by experimental diets, and immunity parameters needs to do more researches about the effects of wet feeding and whole wheat on them.

Conclusion

Wet feeding insignificantly improved FI, BW, WG and FCR of broiler chickens. The effect of ground wheat on BW, WG and FI of broiler chickens was more than whole wheat. Also, the interaction of feeding method and wheat form was not significant.

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