Journal of Novel Applied Sciences
Available online at www.jnasci.org
©2017 JNAS Journal-2017-6-1/1-6
ISSN 2322-5149 ©2017 JNAS

Evaluation the effect of feeding method (dry-wet) on Japanese quail performance

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ABSTRACT: This study was conducted to investigate the effect of feeding method (wet and dry) on the performance of meat quail chicks. This experiment was carried out with 160 one days old quail chicks in completely randomized design, 2 treatments included 4 replicates (20 quail chicks in each replicate) and conducted for a 35 day period. Measured traits, were included performance parameters, carcass characteristics, and meat quality items. Diets were based on corn-soybeans and wheat. Using wet feeding resulted in a significant difference in performance parameters quail chicks. The results of this experiment showed that for entire period (0–35d), the wet feeding significantly improved body weight gain, daily feed intake and feed conversion ratio in compared with control group ($P < 0.05$). Also the wet feeing significantly decreased the length of cecaeum, pH of gizzard content and increased the population of lactic acid bacteria in compared to dry feeding. Meat quality items were not affected by feeding methods. In conclusion, the results of this experiment showed that wet feeding of chick quail improved the growth performance, and profit microbial population ofsmall intestine.

***Keywords*:** quail, wet feeding, performance.

INTRODUCTION

Quail with the most favorable characteristics such as small size, fast growth, resistance to many common diseases of broiler chicks, high quality of meat, high price of the products, low cost of food and treatment and rapid return of investment and is recognized as a valuable and economical bird and is now cultivated in many countries around the world. Quail reaches 20 times its original weight in 2 months, while the chicken reaches 14 times its birth weight in this period (Nasiri, M. 1997).Wet feeding involves the addition of water to dry poultry mash before feeding. Earlier comparison between the use of dry and wet mash showed significant increase in feed intake, body weight gain and feed efficiency of birds when the feed was mixed with up to twice the weight of water to give a porridge-like consistency(Yalda and Forbes, 1995; Kutlu et al., 1997). Studies by Awojobi and Meshioye (2001) and Ogbonna et al. (2001) showed that wet mash was more beneficial than dry mash in poultry feeding. Similar observations have been reported in growing pigs (Brooks and Carpenter, 1990; Rayner and Miller, 1990).The results of these experiment show that growth and efficiency are improved when the feed is given in the wet form.The improvement in growth due to wet feeding was accompanied by reduced digesta viscosity, previously associated with a reduction in the anti-nutritional effects of non-starch polysaccharides present in cereal based diets (e.g. Philip et al., 1995). One possible mode of action was reported by Yasar and Forbes (1999) who noted that a significant reduction in crypt cell proliferation rate (CCPR) paralleled a similar decline in digesta viscosity, representing a saving in terms of bird maintenance and therefore increasing the efficiency of food utilisation(9, 10) However, there is still little of information on the feeding value of wet feed to quail chicks.

The present study was therefore embarked upon to evaluate the performance of quail chicks fed wet and dry commercial quail chicks feed...

Materials and methods

A total of 160 one-d-old quail chicks were housed in floor pens covered with wood shavings and fed on experimental treatments to 35 d of age. At 1 d of age, chicks were individually weighed and assigned to 8floor pens (20 birds per pen) in an environmentally controlled room with continuous fluorescent lighting. Each of the 2 dietary treatments was randomly assigned to 4 pens. Room temperature was maintained at 36ºC during the first week and gradually decreased to 24ºC by the end of the third week. The starter (0-21 d) and finisher (22-35 d) basal diets were based on corn- wheat and soybean meal (Table 1). The experimental treatments were as follows: Treatment 1, dry; Treatment 2, wet (1.2 g water/g dry feed). Provision of each of these 2 diets was as described by Afsharmanesh et al. (2010). Briefly, an ample allotment of daily dry feed was mixed by hand with 1.2 parts water, allowed to stabilise for 15 min and then divided into plasticlined feeders identical to those used for feeding dry diets. The wet feed and feeder were weighed, presented to the broilers for a 24-h period and re-weighed, with the difference used to determine intake expressed on a dry weight basis. Any feed remaining after 24 h was discarded. Daily feed intake for each pen was recorded. The average body weight (BW) gain and feed intake adjusted for mortality to 21 and 35d of age were used to calculate the feed conversion ratio (FCR).

When the broilers were 35d of age, 8 birds per treatment (two birds from each replicate pen) were randomly selected, BW was recorded and the birds were slaughtered. The gastrointestinal tract and organs were carefully excised. The pH of the freshly collected contents of proventriculus and gizzard were determined with a hand-held pH meter (Model 360i, Corning Inc., Science Product Division, Corning NY). The empty weight and length of proximal ileum (from the pancreatic loop to Meckel's diverticulum), distal ileum (from Meckel's diverticulum to the ileocaecal junction) and length of caeca (left and right) were recorded. Empty weights of the gizzard and the weights of the pancreas, heart, spleen and liver were also recorded. The relative organ weights (g/kg BW) and relative length (cm/kg BW) were calculated.

Enumeration of bacteria

After slaughter at 35 days of age, samples of the contents from the ileum were collected and transported to the laboratory for enumeration of microbial populations. Intestinal microflora including total bacteria, Lactobacillus , and coliform,were determined. Intestinal digesta samples (1 g) were diluted tenfold with sterile 0.9 % NaCl, and then a specific agar was used to culture bacteria as follows: nutrient agar medium was used to count total anaerobic bacteria (incubation for 24 h at 37 °C), MRS agar medium for Lactobacillus (72 h incubation at 37 °C), and MacConkey agar medium for coliform (24 h incubation at 37 °C). Finally, the number of bacterial colonieswas calculated, and results were expressed as logarithmic (log10) transformation per gram of intestinal digesta.

Meat quality tests

At day 35, two birds per replicate (eight birds per treatment) were slaughtered, and the whole thigh was removed. The thighswithoutskinwere then placed in plastic bags and frozen (−23 °C) for meat quality tests (2-thiobarbituric acid-reactive substances (TBARS), pH, water holding capacity (WHC), cooking loss, and dripping loss).

2-Thiobarbituric acid-reactive substances

Among all methods discussed for assessing malondialdehyde (MDA), TBARS is one of the most accurate for lipid oxidation in animal tissues. As a whole, TBARS content expresses MDA concentration, and it is a good index for oxidation. Tests of TBARS in muscle tissues were done following the method of Tarladgis et al. (1960). TBARS values were expressed as microgram MDA per gram tissue.

pH

The pH of the thigh meat was measured by homogenizing 5 g of raw meat with 25 ml of distilled water. The homogenates were filtered, and the pH of each sample was measured with a pH meter at room temperature (Jang et al. 2008). The pH meter was calibrated by measuring buffer solutions (pH=4 and pH=7) after every five observations.

Water holding capacity

Water holding capacity was determined by using the cooking method described above. WHC was estimated by centrifuging 1 g of themuscles placed on tissue paper inside a tube for4min at 1,500×g. The water remaining after centrifugation was quantified by drying the samples at 70 °C for 24 h (Castellini et al. 2002). WHC was calculated as ((weight after centrifugation− weight after drying)/initial weight)×100.

Cooking loss

For determination of cooking loss, a meat sample of 1 cm^3 was cut from each muscle sample and weighed. After weighing (weight 1), the sample was stored for 24 h at 4 °C and then cooked in a water bath at 85 °C for 10 min resulting in a core temperature of approximately 75 °C. Finally, the meat sample was lightly dabbed and reweighed (weight 2) (Bertrama et al. 2003). The cooking loss was calculated with the following equation:

Cooking loss =100×((Weight 1−Weight 2))/Weight 1)

Dripping loss

Each piece was weighed and put into a netmade of cotton, and both items were put into a plastic bag, which was carefully closed and placed in a chilling room at 4 °C for 24 h. It is important that the piece ofmeat does not touch the plastic bag. After 24 h, each piece of meat was gently dabbed with soft tissue, and a second weighing was carried out on the same calibrated scale. Dripping loss was calculated as the percentage of the weight loss over the initial sample weight (Christensen 2003).

Statistical analysis

The data were analyzed by one-way analysis of variance using the general linear model procedure of SAS Institute (1999) as a completely randomized design with pen means as the experimental unit for growth performance data and other parameters. Data analysis was performed using mixed model procedure ofSAS. Means were compared using Tukey multiple range test. Statements of statistical significance are based on ($p < 0.05$).

Results and discussion

The average BWG, FI, and FCR during the periods of 0 to 21, 21 to 35 and 0 to 35 are presented in Table 2. BWG, FI and FCR were affected by experimental treatments. Birds on the wet treatment weighed more ($P<0.05$) than those on the dry treatment at 21 and 35 d. From 0-35 d, the feed intake of birds fed on the wet diets was higher ($P<0.05$)

Than that of birds fed on the dry diets. The FCR of birds that were receiving wet diets had been significantly decreased compared to the dry diets during the 0-21 and 0-35-day periods. According to our results, Yasar and Forbes (1999), concluded that the effect of wet feeding based on wheat, has been considerably significant on feed intake and final live weight gain of broiler chicks. Scott (2002) suggested that adding water to the diet before feeding the hydrated diet allowed digestion to begin immediately and the bird to eat more and grow more quickly. This and previous studies (Scott, 2002; Afsharmanesh et al., 2006) indicated that wet feeding wheat-based diets increases growth rateof broilers. These studies indicate that broilers cannot eat enough dry feed to attain their genetic potential for growth. One aim of the current study was to determine if variation in the feed intake of dry wheat-based diets could be related to differences in the time it takes for the diets to absorb water and be digested in the gut. Scott (2002) suggested that adding water to the diet before feeding the hydrated diet allowed digestion to begin immediately and the bird to eat more and grow more quickly.

Table 3 shows the effect of dietary treatments on gastrointestinal tract segment length and weight and also the internal organs weight cecum length was shorter in the group which was fed wet than the groups on dry treatment. The decrease in cecum length can be due to the decrease of bacterial harmful effects (Visek1978). Generally, increasing the number of beneficial bacteria and decreasing harmful ones can improve intestine morphology by causing intestinal epithelium and microvilli increment (Kalavathy et al. 2003).

The effect of the experimental treatment on the pH of gizzard and proventriculus, are respectively shown in Table 4. It is observed that the feeding method causes a significant difference in the pH of gizzard and proventriculus ($P<0.05$). So that the wet feeding caused a significant decrease in the pH of gizzard and proventriculus of quail chicks, in comparison to the dry feed. The findings of the present study are consistent with the findings of Lotfi (2011), which suggested that the wet feeding method causes the significant decrease in the pH of the gizzard. According to the data in Table 4, the wet feeding method causes a significant increasing in the number of Lactobacillus bacteria in comparison with the dry feeding method which indicates the positive effect of applying the wet feeding method on the microbial population of the small intestine ($P<0.05$). Also Scholten et al.(1999) reported that, the wet feed causes the production of lactic acid and the decrease in the pH of feed up to 3.5. This decreasing in pH causes a reduction in the production of overall shape bacteria in the digestive system (Scott, T. A. and F. G. S. 2003).

The effect of the experimental treatments on quality parameters of quail chick's meat, are provided in Table 5. The effect of feeding method did not cause a significant difference in any of the meat quality parameters. The pH of all treatments in a range and has been changing between $6 \leq pH > 7$, where this pH is the most suitable range for the meat. It has been determined that pH is an important indicator for the quality of meat, because the decrease in pH after slaughtering may lead to the denaturation of proteins. Which ultimately leads to reduced water holding capacity

(WHC) and the light color of the flesh (Mehdipour, Z., 2011). According to the data of the tables, the effect of feeding method on TBARS of meat which is in fact the index in this study, measuring the oxidation rate of the malonedealdehyde, Meat Acidity after the frozen period, it is observed that no significant difference has been created. That means that the application of the wet feeding method has no effect on the quality of lipid oxidation in quail chick's meat after the freezing period in compare to the control group (dry feed). Considering that one of the factors affecting meat TBA, is pH, and considering that meat pH was maintained in a proper range, these results were expected. Referring to the diet used in the present experiment, the diet for all groups was the same (especially in terms of fat), and the test is the same, insignificance of the TBA and other experiments related to meat quality, is justified for all experimental groups. The average obtained pH is also between 6 and 7 and this causes the control of lipid oxidation, therefore, average TBA among the experimental groups is almost the same and water-holding capacity are not changing through pH changes. It also prevents early spoilage of meat.

In the current experiment, feeding wet diet to quails decreased the count of coliform and increased lactobacillus population, so wet feeding treatment improved the intestinal microbial population. Also, dietary wet feeding method positively influenced the quail chicks performance to those of traditional feeding method or dry feeding.

Table 1. Ingredient composition and calculated values (g/kg)
Of the basal diets (as fed basis)

ingredient	0 – 21 d (%)	21 – 35 d (%)
Corn	45.83	43.7
Soybean meal	37.42	29.1
Wheat	8	18.8
Dicalcium phosphate	1.2	1.02
Soybean oil	4.64	4.5
Limestone	0.31	0.31
DL-Methionine	0.17	0.09
Trace mineral–vitamin premix1	0.375	0.375
Multi enzyme2	+	+
Calculated values		
Metabolisable energy (MJ/kg)	3076	3076
Crude protein (%)	22	20.21
Lysine (%)	1.25	1.11
Methionine + cysteine (%)	0.9	0.73
Calcium	1	0.94
Available phosphorus	0.45	0.40

[1]***Supplied per kg of diet:*** vitamin A, 3,600,000 IU; vitamin B_{12}, 6 mg; vitamin B_1, 720 mg; 2640 mg vitamin B_2; 4000 mg nicotinic acid; 1200mg vitamin B_6; 400 mg folic acid; vitamin D_3 8000 IU; vitamin 7200 IU; 800 mg vitamin K_3; biotin 40 mg; antioxidant 100,000 mg; choline chloride 50000 mg; Mn 4000 mg; Zinc 33880 mg; Iron 20,000 mg; Cu, 4000 mg; I, 400 mg; 80mg, Se;
[2] **SAFIZYME® GP800 enzyme** (a multi-enzyme product) contents: 0.0 and 3g/kg. The added enzyme is a commercial product, Safizym GP 800 that has 3500 U ß –glucanase, 600 U xylanase and 10.2 U cellulase activity per g of product.

Table 2. The effect of feeding method (dry-weton body weight, feed intake and feed conversion ratio of meat quail fed on corn - wheat-soybean based diets 0—21 d, 21-35 d and 0-35 d[1]

Treatment	Body weight gain (g/b/d)			Daily Feed Intake (g/b/d)			Feed Conversion Ratio		
	(0 – 21)	(21 – 35)	(0 – 35)	(0 – 21)	(21 – 35)	(0 – 35)	(0 – 21)	(21 – 35)	(0 – 35)
Dry	3.86[b]	4.76	4.11[b]	9.24	16.13[b]	12.50[b]	2.39[a]	3.51	3.03[a]
Wet	4.34[a]	4.82	4.63[a]	9.05	18.38[a]	13.45[a]	2.08[b]	3.65	2.90[b]
SEM	0.06	0.099	0.09	0.08	0.25	0.26	0.02	0.19	0.03
Significance	*	NS	*	NS	*	NS	*	NS	*

[a,b,c] Means within column with no common superscript differ significantly (* P < 0.05), NS = non-significant.
[1]Data are means of 3 replicate pens of 20 birds each.

Table 3. The effect of feeding method (dry-wet) on relative weight (% of BW) gastrointestinal segments of meat quail at 35 d of age[1]

Treatment	Heart	Pancreas	proventriculus	Gizzard	Abdominal fat	Liver	Cecum Length	Small intestine weight	Small intestine Length	breast	leg
Dry	0.0085	0.0020	0.0040	0.029	0.0025	0.022	0.10[a]	0.051	0.37	0.23	0.14
Wet	0.0080	0.0022	0.0046	0.025	0.0031	0.021	0.09[b]	0.053	0.36	0.24	0.13
SEM	3×10^{-4}	2×10^{-4}	3×10^{-4}	18×10^{-4}	0.001	17×10^{-4}	0.003	37×10^{-4}	0.016	0.009	0.005
Significance	NS	NS	NS	NS	NS	NS	*	NS	NS	NS	NS

[a,b,c] Means within a column with no common superscript differ significantly (* P < 005), NS = non-significant.
[1]Each mean value represents an average of 3 replicate pens (two birds per pen).

Table 4. The effect of feeding method (dry-weton pH of Gizzard and proventriculus and population of bacteria in small intestine.1

	pH		(Log CFU/g)		
Treatment	Gizzard	proventriculus	Coli form bacteria	Lactic acid bacteria	Aerobic bacteria
Dry	4.46[a]	4.46[a]	6.11	6.03[b]	7.21
Wet	4.21[b]	4.21[b]	6.51	6.66[a]	7.69
SEM	0.07	0.11	0.11	0.14	0.13
Significance	*	*	NS	*	NS

[a,b,c] Means within a column with no common superscript differ significantly (* P < 005), NS = non-significant.
[1]Each mean value represents an average of 3 replicate pens (two birds per pen).

Table5. The effect of feeding method (dry-weton meat quality of meat quail on 35 d of age[1]

Treatment	TBA	pH	WHC	Drip loss	Cooking loss
	(gr/kg)		(%)		
Dry	0.15	6.28	61.66	12.90	24.78
Wet	0.14	6.18	64.67	14.46	24.96
SEM	0.019	0.077	1.90	0.90	1.05
Significance	NS	NS	NS	NS	NS

NS = non-significant.
[1]Each mean value represents an average of 3 replicate pens (two birds per pen)

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