

GUT CHARACTERISTICS AND ILEA DIGESTIBILITY OF BROILERS FED PELLET AND MASH FEED FORMS

Akande T.O., Olakanmi O. F., Okunlola P.F. and Owolabi E.O.

Obafemi Awolowo University, Ile-Ife, Osun State

yakandetaiwo@yahoo.com

ABSTRACT

A study was conducted to evaluate performance, gut characteristics and nutrient digestibility of broilers fed pellet and mash feed forms. 100 Cobb-500 one-day old broilers used were randomly grouped into two treatments of five replicates and 10 birds per replicate in a deep litter system. The birds were fed with 2mm and 4mm die size pelletized feed at the starter and finisher phase respectively while commercial mash feed grade was applied at starter and finisher phase. The experiment lasted 7 weeks. Five days to the end of the experiment, two birds per replicate were separated into metabolic compartment for ilea digestibility trial and they were offered feed treated with chromic oxide at 0.2% for the five days. On the 6th day, the birds were slaughtered and the ilea content of the gut was collected for the proximate and chromic content determination. The morphometric measurement of the internal organs and intestinal components of the birds were taken and sample collected for histological assessment. The result showed significant difference ($p < 0.05$) in the performance parameters measured with the birds fed pellet having higher feed intake, body weight gained and superior feed conversion ratio. There was no significant difference ($p > 0.05$) in the length of the duodenum, jejunum and ileum and weight of the heart and liver between the two treatments while the gizzard weight was higher ($P < 0.05$) in birds fed mash feed form. Ileal nutrient digestibility for ether extract was higher in birds on pellet. It was deduced from the result of the experiment that pellet feed form performed better than mash counterpart and with significant influence on the gut physiology and overall better nutrient utilization.

Key words: broilers, feed forms, ilea digestibility, gut morphology,

INTRODUCTION

Feed composition, feed structure and feed form are most important factors that determines the efficiency of feed utilization by animals particularly poultry because of the simple nature of their stomach (Choct *et al.*, 2004; Ball *et al.*, 2015). Modern meat type chicken have high appetite for feed which translate to increased live production costs claiming about 60-70% of total cost (Aliakbarpour *et al.*, 2013; Willems *et al.*, 2003). Therefore, broilers' feed consumption and utilization should be well studied to ensure optimum performance of the birds so as to offset maximum and substantial profit.

The growth and development of the gastrointestinal tract is equally vital for broiler chickens as it helps to effectively utilize nutrients in their diet (Jacobs *et al.*, 2010). Feeds fed to broiler can assume different forms such as pellets, mash and crumble due to difference in processing method during feed formulation. Mash is a form of a complete feed that is finely ground and mixed so that birds cannot easily separate out ingredients; crumble also is a type of feed prepared at the mill by pelleting of the mixed ingredients and then crushing the pellet to a consistency coarser than mash; while pellet is a feed form that is small (using different dies depending on the desired size) rounded and compressed in to a mass of substance. Ileal digestibility which collects digesta from part of the ileum is a more complex method of measuring digestibility but tactically eliminates some confounding factors such as urine and microbial contributions into the excreta which may produce overestimation of nutrient utilization. The objective of the study is to determine the comparative effect of two feed forms (i.e. mash and pellet) on the performance of broiler chicken, some gut characteristics and the ileal digestibility of the birds.

MATERIALS AND METHODOLOGY

Experimental station and Birds Management.

The experiment was conducted at Obafemi Awolowo Teaching and Research Farm, Ile-Ife, Osun State Nigeria. One hundred day old Cobb 500 were obtained from a reputable farm and were brooded in a floor litter system for two weeks but the birds were together for the first week after which they were distributed randomly to their various experimental pen at the beginning of the second week. The birds were offered a starter compounded ration 23%CP and 3000kcal/kg ME and

a finisher diet 21%CP, 3000kcal/kg at the onset of the fourth. Water and feed were offered *ad-libitum* while other routine management was performed as appropriate.

Experimental diets

The ingredients used for the feed formulation were purchased from a reputable commercial feed ingredient seller in Ile- Ife while the milling, mixing and pelleting were carried out at OAU Teaching and Research Farm. The gross compositions of the experimental diets are as shown in Table 1

Table1: Gross composition of the experimental diets

Feed Ingredients	Starter	Finisher
Maize	56.0	58.0
Soya bean meal	15.0	15.0
Groundnut cake	16.0	12.5
Palm kernel cake	4.50	8.00
Fish meal	4.0	2.0
*Other feed ingredients	4.5	4.5
Calculated analysis		
Crude Protein	23.1	20.30
Crude fibre	3.53	3.93
Metabolizable Energy	2993	2957

*Other feed ingredients: bone meal=2.5, Oyster shell=1.0, Methionine=0.3. Lysine=0.3, Pre.=0.2, salt=0.2

Data collections and Analysis

The initial weight of the birds was taken by end of first week using a digital scale while feed intake was obtained on weekly basis. At the end of the feeding trial which lasted 7 weeks, two birds from each replicate were randomly selected and transferred into metabolic cage. The birds were fed with chromic oxide supplemented diet at 0.2% concentration for 5 days and after which they were sacrificed to recover the ilea content. The sampling of the ilea segment of the intestine was standardized by collecting from the region between 30 mm before the ileo-cecal junction and 30 mm after Meckel's diverticulum, in order to avoid contamination of the cecal and jejunal flow, respectively. Contents from the ileum of each bird were collected by gentle finger-stripping directly into a jar, homogenized and oven dried (80 C) for 48 h, ground (0.5mm screen), and stored in air tight labelled bags for subsequent analysis. Sample of the diets and dried ilea content were taken to laboratory for determination of chromic oxide concentration and proximate contents according to the procedure of AOAC (2009).

The length of the duodenum, jejunum and ileum were taken using a measuring tape while small portion of the duodenum and jejunum were cut and preserved in 10% formalin. Samples were later prepared on slide for micrographs. The data generated were analyzed using student T-test of SAS 2009 statistical package.

RESULT AND DISCUSSION

Production performance of broiler fed mash and pellet feed forms

Data on performance indices are as presented in Table 2. The result shows that all performance parameters were significantly different ($p < 0.05$) across the treatments. The finding aligned with earlier reports on numerous advantages associated with pelleting which include enhancement of feed intake and growth of animals as a result of the reduction in feed wastage, decreasing of energy used

for consumption, improving palatability, and the reduction of dustiness of feed (Abdollahi *et al.*, 2013). However, a marginal increase in cost is expected with bird on pellet because of extra cost accrued from pelleting as indicated by Jahan *et al.* (2006).

Table 2: Performance characteristics of broiler chicken

Treatment	Control (mash)	Pellet	P value
Initial body weight (g)	152.52±0.8869	152.16±1.0348	0.80
Final body weight (g)	2473.7±29667 ^a	2992.3±91.167 ^b	0.01
Body weight gain (g)	2321.1±29.873 ^a	2840.2±91.31 ^b	0.03
Daily weight gain (g)	55.265±0.7113 ^a	67.263±2.1743 ^b	0.04
Total feed intake (g)	4964±70.62 ^a	5533±102.8 ^b	0.01
Feed conversion ratio	2.1388±0.0229 ^a	1.9517±0.06 ^b	0.049

**ab means in the same column followed by different letter are significantly different. P<0.05

Gut morphology and Ileal digestibility of broiler fed mash and pellet feed form.

The result of the organ, intestinal and micrographs of the duodenum and jejunum are given in Table 3. Digestion and absorption of feed takes place majorly in the duodenum and the jejunum and partially in the ileum aided by the presence of the villus and crypt. Any changes observed in the villus and crypt may influence the rate of digestion and absorption as these components increase the surface area of the intestine and expose the feed to proper enzymatic reaction. The result in the Table 3 shows that the villus height of the duodenum and jejunum of birds fed pellet was significantly higher ($P < 0.05$) than birds on mash feed. The higher feed intake observed in birds fed pellet increased the activity of the villus in the intestine and may have resultant effect in their length being longer. The increased villus height may increase total luminal villus absorptive area and subsequently result in greater digestive enzyme action and enhanced transport of nutrients at the villus surface (Naderinejad *et al.*, 2016). These higher value of the villus height of duodenum and jejunum and higher value of the crypt depth of jejunum observed in birds fed pellets may be responsible for the better performance observed. Although, there were marginal rise in nutrient digestibility of birds on pellet only ether extract was significantly different ($P < 0.05$).

Table 3: Organ and intestinal measurement of broiler chickens

Treatment	Control (mash)	Pellet
Duodenum(cm)	36.00±3.03	46.00±6.02
Jejunum (cm)	85.50±6.364	80.50±3.500
Ileum(cm)	78.00±10	93.00±2.887
Gizzard (g)	57.00±2.000 ^a	38.50±0.500 ^b
Liver(g)	23.00±2.000	23.500±4.500
Heart(g)	12.00±2.000	14.00±100
Villus height duodenum(µm)	1829.30±78.760 ^b	2349.9±65.539 ^a
Villus height jejunum(µm)	664.56±46.709 ^b	1443.50±27.839 ^a
Crypt height duodenum (µm)	520.95±14.738 ^a	304.95±16.689 ^b
Crypt height jejunum (µm)	256.05±20.509 ^b	441.77±18.333 ^a

**ab means in the same column followed by different letter are significantly different. P<0.05

CONCLUSION

It was concluded that pellet feed form significantly improved feed conversion, influenced some gut changes and translated to better overall nutrient utilization in Cobb-500 broilers. Hence, farmers are advised to opt for pellet feed form for broiler chickens.

REFERENCES

- A.O.A.C. (2009). Official Methods of Analysis of the Association Analytical Chemistry revised Edition. 13th Edition Washington D.C. United States of America. Pg 1094
- Abdollahi M.R., Ravindran V., Svihus B. (2013). Influence of grain type and feed form on performance, apparent metabolisable energy and ileal digestibility of nitrogen, starch, fat, calcium and phosphorus in broiler starters. *Anim Feed Sci Technol* 186: 193-203.
- Aliakbarpour H.R., Chamani M., Rahimi G., Sadeghi A.A., Qujeq D. (2013). Inter-mittent feeding programme and addition of *Bacillus subtilis* based probiotics to the diet of growing broiler chickens: influence on growth, hepatic enzymes and serum lipid metabolites profile. *Arch Anim Breed* 56: 410-422.
- Ball M.E.E., Magowan E., McCracken K.J., Beattie V.E., Bradford R., *et al.* (2015). An investigation into the effect of dietary particle size and pelleting of diets for finishing pigs. *Livest Sci* 173: 48-54
- Choct M., Selby E.A.D., Cadogan D.J., Campbell R.G. (2004). Effect of particle size, processing, and dry or liquid feeding on performance of piglets. *Aust J Agric Res* 55: 237-245.
- Jacobs CM, Utterback PL, Parsons CM (2010) Effect of corn particle size on growth performance and nutrient utilisation in young chicks. *Poult Sci* 89: 539-544
- Jahan M. S, Asaduzzaman M and Sarkar A . K (2006) Performance of Broiler Fed on Mash, Pellet and Crumble. *International Journal of Poultry Science* 5 (3): 265-270.
- Naderinejad S., Zaefarian F., Abdollahi M.R., Hassanabadi A., Kermanshahi H., Ravindran V. (2016). Influence of feed form and particle size on performance nutrient utilisation, and gastrointestinal tract development and morphometry in broiler starters fed maize-based diets. *Anim Feed Sci Technol* 215: 92-104.
- S.A.S. (2009). SAS User's guide, version 9.1 for windows, Statistical Analysis Systems Institute, Inc., Cary, NC, U. S. A.
- Willems O.W., Miller S.P., Wood B.J. (2003). Aspects of selection for feed efficiency in meat producing poultry. *World Poult Sci J* 69: 77-88.