POSTER SESSION

Effects of dietary physical form on performance and water intake of broiler chicken

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Abstract

A completely randomized design experiment was conducted to determine the effects of physical form of the diet (pellets or mash) on the growth performance and water intake of broiler chicken. Twenty seven days-old (n=32) broiler chicks were randomly allocated into 8 deep litter cages. Each cage housed 4 birds and contained a feeder and a drinker. Birds in four cages were fed a commercial broiler finisher diet (Nutrina Feed Sri Lanka) in pelleted form. The pellets of the same diet were ground and fed as a mash to the other four groups. The experimental diets were fed for two weeks from day 28 to day 42. The bulk densities of the pelleted and mash form diets were 0.67 and 0.55 g/cm^3, respectively. Feeds and water were given ad libitum. Daily feed and water intakes were measured. The mean day time temperature and relative humidity during the experiment period ranged from 26 to 32 ^{0} C (mean 29.1 ^{0}C) and 65 to 92%, (mean 76.3), respectively. Live weights were taken on day 35 and day 42. Growth performance parameters such as weight on day 42 and weight gains and feed intake were not significantly affected due to the physical form of the diets. Water intake was also not significantly affected by the dietary physical form. Water intakes of broilers between 28 and 42 days old broilers were 478 and 502 ml per day for mash and pellets, respectively. The intake of water per 100 g of BW decreased from 36 ml to 34 ml in mash form diet fed birds and from 40 ml to 36 ml in pelleted diet fed birds during day 28-35 and day 35-42, respectively. In contrast, the water intake per unit of feed ingested increased as birds grew. Water: feed ratio of the mash form diet fed birds during day 38-35 increased from 2.9 to 3.6 during day 35-42. Similarly, when pelleted diets were given, the water: feed ratio increased from 3 to 3.7 during day 28-35 to day 35-42 periods. It was concluded that growth performances of broiler chicks fed reground pellets in mash form are comparable with the broilers fed pelleted form of the same diet.

Key words: broilers, pellets, mash, performance, water intake

Introduction

Feeding cost accounts for about 70% of the total recurrent cost of the poultry industry and consequently the profitability of the operation is very much dependent on the management of feeding. Both the nutrient composition of the diet and the physical form it is presented to the poultry affect the feed intake, utilization efficiency, behaviour and welfare of the birds. Modern poultry diets come mainly in three physical forms; mash, pellets and crumbles. Mash form diets can easily be prepared and require relatively less energy in the process of preparation. Pellet is a form of complete feed that is compacted and extruded to about 1/8 inch in diameter and ¼ inch in length (Banerjee, 1988). Many studies have shown that pellets improved the weight gain (Munt et al., 1995), feed intake (Asha Rajini et al., 1998a, b) and feed efficiency (Asha Rajini et al., 1998a, b). However, the production of pellets requires approximately three time higher energy than the production of mash (21 vs 74 KWhr/ton for mash and pellet, respectively) (Jean and Trevidy, 2000). Consequently, pellets are about 10% more expensive than the mash. Also, Proudfoot and Hulan (1982) found that the incidence of sudden death syndrome was significantly higher for broilers fed pellet than mash. Recently, Atapattu et al. (2005)

found that the broilers fed on crumble diets are less active than the birds fed on mash diets suggesting possible welfare implications associated with pelleted diets. When mash diets are pelleted, starch and proteins in the diets are subjected to thermal modifications and, Behnke (1994) identified these changes among the possible reasons for improved performance of broilers when fed with pellets. If that would be the case, we assumed that the feeding of pelleted diet and the mash form diet resulting from the regrinding of the same pellets should give similar performance. In this experiment, we fed broiler chicks either with pellets or mash form of the same diet by regrinding the pellets, to test the above hypothesis. Also, the effects of the physical forms of the diet on the intake of water were also studied.

Materials and methods

Day old broiler chicks were purchased from a local hatchery. Chicks were brooded in an electric brooder for two weeks. During first three weeks chicks were given a commercial broiler starter diet *ad lib.* A commercial finisher ration was offered when the birds were three weeks old. On day 27 chicks were weighed. 32 birds were randomly allocated into 8 deep litter cages so that variation between cage weights was the minimum. The cages were randomly assigned into two treatments and thus each treatment had four replicate cages each having four birds. Birds in four cages were fed with a pelleted commercial diet while the birds in the other four cages were fed with a mash diet. Mash diet was prepared by regrinding and sieving the pelleted diets. The nutrient composition and some of the physical properties of the diets are given in Table 1. Each cage had a feeder and a bell-shaped drinker. Daily feed and water intake were measured for two weeks from day 28 to 42. Birds were weighed weekly. Data were analyzed by using GLM procedure of the SAS (1989). Cage means were taken as the replicates.

Table 1. Nutrient composition and some physical properties of the diets

Nutrient	Pellets	Mash
Protein (%)*	20.0	20.0
Metabolizable energy*	3050 kcal/kg	3050 kcal/kg
Calcium (%)*	0.9	0.9
Available Phosphorus (%)*	0.4	0.35
Bulk density	0.67g/cm^3	0.55g/cm^3
Length and (diameter)	5mm and 3 mm	(<1 mm)

* As given by the feed manufacturer

Results and discussion

Broiler performance

Performance of the broiler chicks as affected by the physical form of the diet are shown in Table 2. Live weight on day 42 was not significantly affected by the dietary physical form. In contrast to our results, several studies (Preston et al., 2000, Munt et al., 1995), and Chun (1996) and Choi et al. (1986) have reported that broilers fed pellets gave better growth performances than those fed mash form of diets. Meanwhile, Husar and Robble, (1962) reported that reground pellets did not affect the performance of broiler chicks during early ages. Feed intakes of the broilers fed pellet and the mash resulting form the regrinding of the pellet were not statistically different. These results are also

contradictory to results of Berechni et al. (1992) and Nir et al. (1994) who found that the intake of pellets was significantly higher than that of mash. However, it must be noted that the feed intake values we found were very similar to the standard feed intake values set out by NRC (1994) for the broiler chicks at a similar age. Though we did not measure the feed wastage, we did not observe a notable difference in feed wastage between the birds fed mash or pellets.

Table 2. Performance and water intake of broiler chicken as affected by the dietary physical form

	Diet Type		P Value
	Mash	**Pellets**	
Weight on day			
28	1072±75	1053±104	0.78
35	1647±131	1600±143	0.64
42	2121±64	2181±138	0.46
Feed intake			
28-35 d	134±9	140±12	0.49
35-42 d	153±3	152±10	0.73
Weight gain (42-28d)	1050±102	1128±37	0.20
Total feed intake (42-28 d)	2020±87	2053±149	0.71
FCE (%)	52.6±0.12	55.5±0.09	0.17
Water intake (ml/day)			
28-35d	391±29	421±65	0.43
35-42 d	565±51	583±101	0.75
28-42 d	478	502	0.65
Feed:Water			
28-35 d	2.9±0.05	3.0±0.57	0.68
35-42 d	3.6±0.27	3.7±0.46	0.64
Overall (28-42d)	3.3±0.14	3.4±0.48	0.66
Water intake (ml/100 g of BW)			
28-35 d	36±04.8	40±7.1	0.43
35-42 d	34±1	36±5	0.45

Why performances of broilers were not affected by the physical form of the diets is of importance. Better performances of chicks fed pelleted diets, compared to mash diets have been attributed to several factors including decreased feed wastage, reduced selective feeding, decreased ingredient segregation, less energy cost of feed ingestion, destruction of pathogenic organisms, thermal modification of starch and protein and improved palatability (Behnke, 1994). In the process of pelleted diets preparation, finely ground mash is mixed with a binding agent and then subjected to high temperature (80-85 ^{0}C), steam and then forcefully pressed through a die. Similar growth performances and feed

intake values of the broilers given pellets and mash form diets in our experiment suggest that improved performances and feed palatability of pelleted diets are not attributed to the physical nature of the pellets but due to the chemical and physical treatments such as heating and steaming were applied during the pelleting process. If this would be the case, a considerable amount of energy could be saved and consequently the feed cost could be reduced by subjecting the mash feeds into the high temperature and steaming without further processing into pellets. To test our hypothesis, further research involving diets in mash, mash diets subjected to steaming and high temperature, and pellets are needed.

Though not statistically significant, the FCE was 3% units higher in pellet fed birds compared to mash diet fed birds. This effect seems to be related to increased weight gain in pellets fed birds compared to mash fed birds. Wahlstrom et al. (1999) found that digestibility of nutrients was increased in some layer strains when pellets were fed compared to mash. Atapattu et al. (2005) found that broiler chicks spend more time on feeding and less time on resting when mash diets were fed compared to when pellets were fed. Therefore, the availability of nutrients and net energy for growth could be higher when pellets are fed and consequently, the efficiency of feed conversion may be increased. However, since pellets are 10% more costly than mash (Jahan et al. 2006), the actual financial benefit of such improved FCE needs to be carefully analyzed.

Water intake

The daily water consumption was also not significantly affected by the physical form of the diet (Table 2). Leeson and Summers (1987) found that water intake was closely correlated with feed intake and factors that affect the feed intake indirectly influenced the water intake. Since the physical form of the diet did not affect the feed intake, water intake may also not have been influenced. Irrespective of the treatment, the intake of water we observed, was higher than the value (219 ml/bird/day) reported by Puminn (2003). However, previous experiments conducted in our laboratory (Atapattu and Gamage, 2006) also showed that broilers consumed as high as 350 ml/bird/day when they weigh around 1500g and are five weeks old. The intake of water per unit of feed consumed was also not significantly different between the treatments. The water: feed ratio of the birds increased from around 3 at day 35 to 3.5 at day 42. Normally, water: feed ratio ranges from 1.5-2.5 (NRC1994) and thus the values we observed are higher than those reported in literature. The intake of water per unit body weight was also not affected by the dietary physical form but changed as birds grew and matured. The mean water intake per 100g of live weight decreased from 38 ml during fifth week to 35 ml during the sixth week. The mean ambient temperature and the relative humidity during the period of experiment were 29^0C, and 79%, respectively. Most probably the higher water intake values are attributed to those environmental factors.

It was concluded that growth performances of broiler chicks fed reground pellets in mash form are comparable with the broilers fed pelleted form of the same diet. Under local hot-humid conditions, broilers consume as high as 3.5 times of water as feed.

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