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Feed Intake in Guinea Fowl, Layer Hen and Pheasant as Influenced by Particle Size of Pelleted Diets*

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Abstract: This study investigated the effect of pelleted diets prepared differing by levels of grinding preparation (2 or 4 mm) to evaluate pellet quality and diet preferences in adult breeders poultry species: guinea fowl (*Numida meleagris*), layer hen (*Gallus domesticus*) and pheasant (*Phasianus colchicus*) to improve our understanding of the diet physical structure influencing feed intake. All diets were of identical composition as well as same environment and management were provided for all treatments. The parameters evaluated in this 4 weeks feeding trial included: live body weight, feed intake, feed efficiency and pellet durability index. Body weight gain, feed intake and feed efficiency were influenced ($p<0.05$) by the dietary treatments in each poultry species. The present data suggest that pellet particle size is advantageous in terms of feed intake and efficiency in poultry.

Key words: Feed intake, pellet durability index, particle size, poultry

INTRODUCTION

The principal factors that influence intake are thus restricted to those governing the feeding drive of the poultry, primarily hunger and satiety, and the effects of the physical form of the food (Amerah *et al*., 2007).

Feed particle size can have a significant influence on bird performance, fine particles reduce feed intake and growth rates. But coarse particles in the diet may also have a different impact on commercially reared poultry performance in terms of feed conversion ratio (Tufarelli *et al*., 2007). However, studies focusing on optimal grain size, specifically corn particle size, have presented conflicting results. An understanding of grain particle size and pellet texture is critical for development of feed manufacture strategies that optimize poultry performance (Parsons *et al*., 2006).

Poultry performance benefits associated with pelleting have been well documented (Nir *et al*., 1995). The potential benefits to pellet quality of grinding to a finer particle size must be balanced against the increased energy cost of the feed mill as a result of doing so. Where pellet quality is poor and pellet breakdown is likely to occur, grinding to a finer particle size will lead to the accumulation of fine particles in the feed which will have a negative impact on broiler performance. The greatest advantage in using pellets is that there is little waste in feeding. The disadvantage is that pellets are expensive about 10% more expensive than that of feeds not pelleted (Jahan *et al*., 2006).

The benefits are only realized if pellet integrity is maintained to consumption. Zatari *et al*. (1990) showed that pellets of poor quality, simulated by a 25:75 pellet to fines ratio, diminished predicted performance improvements associated with pelleting. Moritz *et al*. (2003) reported that incorporating water into feed formulations increased pellet durability, decreased fines and improved broiler performance when compared with feeding pellets of lower moisture. However, the effects of pellet texture on broiler performance have not been documented. An understanding of grain particle size and pellet texture is critical for development of feed manufacture strategies that optimize broiler performance.

Therefore, in this study were investigated the effects of pelleted diets, prepared differing by levels of grinding preparation, to evaluate pellet quality and diet preferences in adult guinea fowl (*Numida meleagris*), layer hen (*Gallus domesticus*) and pheasant (*Phasianus colchicus*) breeders to improve our understanding of the diet physical structure influencing feed intake.

MATERIALS AND METHODS

Fourteen adult breeders(n = 14 birds/species) of guinea fowl (*Numida meleagris*), layer hen (*Gallus domesticus*) and pheasant (*Phasianus colchicus*) were kept in individual cage and offered 2 micro-feeders in alternate positions containing the different pelleted diets that could be reached from the same position of bird. Bird' cages placed in a room where temperature and humidity were together automatically controlled during the trial. During the trial, there was a constant lighting in the room.

Poultry received diets based on durum wheat (*Triticum durum*) (500 g/kg), corn (265 g/kg) and solvent-extracted soybean meal 44% CP (100 g/kg), as reported in Table 1.

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Table 1: Composition (g/100 g as fed) and calculated analysis of the diets

Ingredients	Dietary treatment
Durum wheat	50.00
Corn	26.50
Soybean meal (48% CP)	10.00
Durum wheat middling	5.00
Dicalcium phosphate	1.80
Calcium carbonate	0.70
Vitamin mineral premix*	0.50
L-Lysine	0.32
Sodium chloride	0.25
Sodium carbonate	0.20
DL-Methionine	0.10
Enzyme**	0.10
Coccidiostat	0.10
Chemical analysis	
ME (kcal/kg)	2,870.00
Crude protein (%)	20.35
Crude fiber (%)	3.41
Ether extract (%)	3.55
Neutral detergent fiber (%)	11.89
Methionine + Cystine (%)	0.84
Lysine (%)	1.25
Calcium (%)	0.85
Phosphorus available (%)	0.69

*Provided per kg of diet: 12,500 IU Vit A; 1,500 IU Vit D_3; 30 mg Vit E; 2.5 mg Vit K; 1.5 mg Vit B_1; 5 mg Vit B_2; 2 mg Vit B_6; 15 mg Vit B_{12}; 10 mg D-Pantothenate; 0.75 mg Folic acid; 0.10 mg D-Biotin; 300.00 mg Choline chloride; 150 mg Mn; 50 mg Fe; 75 mg Zn; 5 mg Cu; 1.5 mg I; 0.2 mg Co and 0.1 mg Se.
**Containing endo-1,3(4) beta-xylanase activities of 1,000 FXU/g

Diets were formulated according to the nutritional requirements (INRA, 1988) and were calculated using a specific software (Plurimix, Italy). The diets were formulated to be isonitrogenous and isocaloric. Particularly, were formulated two experimental diets, the first was a pelletted ground to 2 mm, the other was a pelletted diet ground to 4 mm. All diets were cold-pelleted (70°C). After pelleting, representative samples of each manufactured diet were collected and measured for pellet durability index.

Five samples of complete diets after the homogenous mixing were taken for the measurement of diet particle size distributions. This was determined by passing the known weights of each sample through a series of laboratory sieves and weighting the amount of samples collected on each screen and on the pan under the 0.5 mm screen.

The chemical analysis of experimental diets were performed according to the methods of the Association of Official Analytical Chemists (AOAC, 1990).

Body weight and feed intake of birds were measured weekly for 4 weeks. Feed intake was determined as the difference between the amount of feed offered and refusals. Feed Conversion Ratio (FCR) was calculated by dividing feed consumption with body weight gain weekly for each replicate. Mortality was recorded as it occurred. The pellet durability index (%), measured using the tumbling can method, was enhanced by fine grinding.

Feed intake, live weight gain, feed conversion ratio and mortality data was subjected to analysis of variance using General Linear Model (GLM) of SAS (2005). The model fitted the effect of diet their interaction on poultry performance. The means were separated using least significant difference. Differences were considered significant when $p<0.05$.

RESULTS AND DISCUSSION

The analysis of ingredients utilized in experimental diets has permitted to obtain complete pelleted diets with specific chemical and nutritional characteristics (Table 1). All physical characteristics of pelleted diets were similar with the exception in texture of pellet.

Particle-size analysis of the pellet diets used during experimentation has shown a similar distribution of particle sizes in the different experimental groups in comparison (Table 2).

Table 2: Percentage of particle size classes distribution in the diets (Mean±standard deviation)

Particle size class	2 mm diet	4 mm diet
>2.5 mm	8.32±0.89	53.11±1.68
2.0-2.5 mm	56.16±1.56	11.98±1.01
1-2 mm	17.31±0.87	19.21±0.92
0.5-1 mm	12.48±0.38	12.26±1.31
<0.5 mm	5.73±0.27	3.44±0.76

Different growth performance parameters average weekly body weight, feed intake, feed efficiency, pellet durability index and survivability of the three avian species were reported in Table 3.

Live body weight resulted higher ($p<0.05$) in guinea fowls and pheasants fed with the experimental 2 mm pelleted diet (Diet A) compared with 4 mm diet (Diet B). This result are supported by Parsons *et al.* (2006) who showed significantly performance of pellet-fed birds. Reece *et al.* (1986) also agreed that pelleted diets increased body weight than other forms. Lentle *et al.* (2006) who showed that the broilers fed pellet diet gained more weight and particle size of diet also significantly improved weight gain compared to other form of diet. Wahlstrom *et al.* (1999) reported that laying hens fed pellet diets showed improvements in live body weight.

Layer hens and pheasants not showed significantly different of feed efficiency depending on pelleted diets, whereas the diet A had improved ($p<0.05$) feed efficiency in guinea fowls, compared with diet B. This result in guinea fowl are in agreement with Tufarelli *et al.* (2007), which found a better feed conversion ratio in birds fed fine size pellet. Similar results were obtained by Parsons *et al.* (2006) who reported that pellets had a better feed efficiency in broiler chicks.

Data showed that in guinea fowls and layer hens particle size of pellet improved ($p<0.05$) feed intake when diet is prepared with diet 2 mm ground, whereas in pheasants feed choice was not significantly influenced by grinding preparation.

Table 3: Performance of guinea fowl (*Numida meleagris*), layer hen (*Gallus domesticus*) and pheasant (*Phasianus colchicus*) fed different pelleted diets

Poultry species	Diet	Body weight (g/bird)	Feed intake (g/bird)	Feed efficiency (g/g)	Pellet durability index (%)	Mortality index (%)
Guinea fowl	A	1455.34	45.63[a]	2.68[a]	74.3[a]	0.92
	B	1439.78	43.87[b]	3.11[b]	68.9[b]	0.95
Layer hen	A	1896.11	114.65[a]	1.82	75.2[a]	0.87
	B	1880.78	112.17[b]	1.93	69.5[b]	0.89
Pheasant	A	1388.45[a]	35.74	3.07	74.9[a]	0.91
	B	1367.64[b]	35.15	3.13	69.1[b]	0.94
SEM*		3.34	0.32	0.06	1.37	0.03

[a,b]Means in a column without a common superscript are significantly different ($p<0.05$). *Standard error of the means

Similar results were found by Amerah *et al.* (2007) who reported that a greater feed intake could be happened with fine pellets than others. At the similar way Nir *et al.* (1995) showed that fine pellet diet increased feed intake in broilers.

The low pellet durability index affected ($p<0.05$) feed intake, though not significant in pheasant breeders, even if the trend resulted positive for the 2 mm diet. The response in weight gain and feed efficiency of poultry fed pelleted diets is significantly improved when the diet is of good pellet quality, in particular when there is an high pellet durability and low levels of fines. Proudfoot and Sefton (1978) reported that body weight and economic returns were inversely related to the proportion of fines in diets.

The data on survivability percent did not differ significantly. These results suggest that physical form of diet had no influence on health status of poultry. This result are in agreement with Deaton (1992), who reported no difference in mortality index between pellet diets.

Performance of poultry was significantly high in birds fed pelleted diet ground to 2 mm and this diet can be supplied to guinea fowl, layer hen and pheasant without compromising growth performance. Finally, results of these study emphasize the importance of pellet diets on poultry feed preference, further trials on feed texture are required to optimize the energy expenditure of grinding.

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