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INFLUENCE OF FEED PARTICLE SIZE ON CHICKEN BROILERS PERFORMANCE

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Abstract

It is known that feed texture and particle size could influence feed conversion and other productive parameters in non-ruminant animals and especially in those with high growing velocity, such as chicken broilers. Within this context, this study aimed to test the productive effect of using different diameter size pellets (1.4; 2.2; 3.0 mm) in broilers feeding, compared the experimental; treatments (100 broilers per treatment) among them and with a control group (100 broilers) that received crumbled feed.

The results indicated better live weight and feed conversion ratio, at the slaughtering age (40 days) in the groups fed with pellets sized at 1.4 and 2.2 mm. The optimal pellet size would be the 2.2 mm diameter hence it generated 2.84% savings in feeding balance per rearing series. However, other aspects, such as energy involved in feed manufacturing, should be taken into consideration when the economic reliability is calculated to better identify the most optimal pelleting process.

Key words: broilers, performance, crumbled feed, pellets

INTRODUCTION

Usage of diets in form of flour or crumble in poultry feeding could generate multiple disadvantages, such as: ingredients disaggregation, powder in barn atmosphere, preferential intake of ingredients, especially in those ingredients with different textures, increase of digestive inflammatory and even diarrheic syndrome (Halga et al., 2005). Pelleting of feed could counteract most of these situations, both nutritionally and technically-logistically, due to some advantages: prevention of feedstuffs disaggregation, decreasing of floating powders in air, feed ingredients are not picked selectively, increasing of digestibility and absorption rate of nutrients, reduction of allergic-type or autoimmune responses in gut through thermal preconditioning of certain nutrients, such as starch and gluten type proteins, increasing of the energetic and protein density of feed; extending the preservation and stability of feed against oxidative-reductive phenomenon and thermal sterilizing processes bearing bacteriostatic and bactericide effects, decrease of storage room necessity for the same amounts of feed, automatization in transportation, storage and feeding (Behnke, 2001; Pop et al., 2006). Pelleting also contribute in reducing the nitrogen, phosphorus and total feces excretion, by 25%, therefore in better environmental preservation (Nahm, 2010). It is well known that pelleted feed usage in broilers, comparing with flour or crumbled feed induces improvements in production performances (weight gain, feed conversion), due to the higher nutritional density of pellets and to the reduction of nutrients spilling (Jensen, 2000). The same productive effects were confirmed by Engberg et al. (2010), which found better feed conversion when pellets were fed to broilers, especially through pH value reduction in gizzard and small intestine (similar action to that exerted by prebiotic type acidifiers) leading to a better development of gut beneficial microflora. Other findings, underlined the beneficial influence of pelleted feed onto the final live weight of the broilers, especially when restricted feeding is applied (Plavnik and Hurwitz, 1989). Better weight gain (+8.12%) and feed conversion (-4.95%), cumulated with +1.68% breast yield in carcass were obtained when pellets were given in broilers feeding, compared to flour or crumbled feed (Salari et al., 2006). Size of pellets (granularity) affects the feed digestive transition speed. Granules up to 2.6 mm diameter are longer retained in segments of the gastro-intestinal tract, resulting in more intense mechanical, chemical and enzymatic digestion and absorption, in better feed conversion and, eventually, in higher productive performance (Nir et al., 1994).

Despite these advantages, there are still a lot of unknown effects of pelleting onto the feed quality. Thus, certain exogenous enzymes and vitamins could be destroyed during the subsequent heating occurred in pelleting processes (Abdollahi et al., 2013). The main disadvantages are linked to the higher energetic expenses in manufacturing and to the necessity of using adequate technology for better homogenization, uniform sizing of pellets etc. However, the better achieved performance parameters, mainly the weight gain and the feed conversion, counterbalance the disadvantages (Simeanu et al., 2006).

Under such circumstances, our study aimed to test the productive efficiency of the feed given to broilers in three different pellets sizing, in comparison with the crumbled feed.

MATERIAL AND METHOD

The aim of the research was to test the effect of different feed texture on the broiler chickens' productive performances.

Four hundred ROSS 308 broilers were used as biological material from brooding till 40 days of age when they were sent to slaughterhouse.

Four groups were randomly formed, according to the graduations of the experimental factors (feed type and feed particle size):

- Control –CG – 100 chicks fed with crumbled feed;
- Experimental group 1 – EG1 - 100 chickens fed with pelleted feed, pellet diameter = 1.4 mm;
- Experimental group 2 – EG2 - 100 chickens fed with pelleted feed, pellet diameter = 2.2 mm;
- Experimental group 3 – EG3 - 100 chickens fed with pelleted feed, pellet diameter = 3.0 mm;

All chickens received combined feed formulated in accordance with 3 specific diets recommended by the broiler management manual: starter diet (1-10 days); growing diet (11-24 days) and finisher diet (25-40 days).

Throughout the first 5 experimental days, all broilers were fed started diet, in crumble form, in order to adapt to the diet formula then the feed of the experimental groups was changed gradually in daily substitution proportions of 20% towards the specific granulation, until the presentation form of the feed was totally changed by the end of the starter period.

Certain technological parameters were recorded/calculated, as reasoning criteria, in order to measure the effect of feed particle size on the production performances:

- live weight – measured gravimetrically on day old chicks, at the end of each technological period and at the end of the experiment (g/capita);
- total weight gain (g) and the average daily gain (g/day);
- feed intake (kg/group and recalculated as kg/capita);
- feed conversion ratio (kg feed/kg gain).

The acquired data were statistically processed to obtain the main descriptors (mean, standard mean error, variation coefficient) then comparisons were run between groups, to find out absolute and relative differences of the reasoning criteria, under the influence of the experimental factor.

RESULTS AND DISCUSSION

Overall the whole rearing period, the best average live weight (males and females) was achieved by the chickens in the experimental group 2, which received pelleted feed of 2 mm diameter (2.57 kg/chicken), followed by the EG1 group (pelleted feed, 1.4 mm diameter, 2.51 kg/broiler), then by the control group individuals (2.49 kg/chicken). The last rank was given to the chickens fed with pelleted feed, 3 mm diameter (2.43 kg/chicken).

Groups homogeneity was quite good (variability below 5%), while the broilers in EG2 had the best body size uniformity for slaughter (table 1, fig. 1).

The live weight differences between the best performance group and the other ones were calculated at: +3.09% vs. CG, +2.33% vs. EG1 and +3.33% vs. LE3. Therefore, the textural and dimensional features of the feed pellets influenced the productive performance in proportion of 2.33-3.33%.

Values of the average daily gain followed the same trend of ranking. The best values were recorded in EG2 chickens (63.23 g daily gain), which were followed by those in EG1 (61.77 g/day) and in control group (61.30 g gained per day), while the ones in EG group presented the lowest growing velocity (59.74 g weight gain, daily) (table 1, fig. 1).

Table 1

Values of the main productive traits in broilers, related to the feed presentation (n=100 capitis / group)

Productive trait	**Statistics**	**CG crumbled feed**	**EG1 pellets Φ1.4mm**	**EG2 pellets Φ 2.2mm**	**EG3 pellets Φ 3mm**
Live weight at 40 days	Mean (g)	2493.10	2511.70	2570.20	2430.56
	±SME (g)	11.70	12.16	11.97	12.10
	Variability (%)	4.69	4.84	4.66	4.9
	±% vs. CG	-	+0.75	+3.09	-2.51
Average daily gains (1-40 days)	Mean (g/capita/day)	61.30	61.77	63.23	59.74
	±SME (g/capita/day)	0.29	0.30	0.30	0.30
	Variability (%)	4.76	4.92	4.73	5.06
	±% vs. CG	-	+0.76	+3.15	-2.55
Cumulated feed intake at 40 days	Mean (kg)	4.33	4.15	4.15	4.12
	±SME (kg)	0.03	0.03	0.03	0.04
	Variability (%)	6.07	7.49	6.80	9.36
	±% vs. CG	-	-4.05	-4.21	-4.79
Feed Conversion ratio at 40 days	Mean (kg feed/kg weight gain)	1.76	1.73	1.71	1.84
	±SME (kg feed/kg weight gain)	0.01	0.01	0.01	0.01
	Variability (%)	4.53	3.21	3.33	3.46
	±% vs. CG	-	-1.80	-3.21	4.52

Cumulated feed intake by the end of the rearing period was found within the 4.12 kg/capita (EG3) and 4.33 kg/capita (CG), while the chickens in EG1 and EG2 groups presented an average of 4.15 kg feed per capita. The less homogenous group, related to feed intake, was the one fed with pellets of 3 mm diameter (table 1, fig. 1).

The poorest feed conversion ratio (FCR) was achieved by the broilers in EG3 (pellets of 3 mm diameter), 1.84 kg feed/kg weight gain, while the most effective nutritional conversion was observed in EG2 chickens (pellets sized 2.2 mm diameter), with a value of 1.71 kg feed/kg weight gain.

The calculated value was 3.21% better versus the control group one (1.76 kg feed/kg weight gain) and 1.16% more efficient versus the EG1 value, as well (1.73 kg feed/kg weight gain).

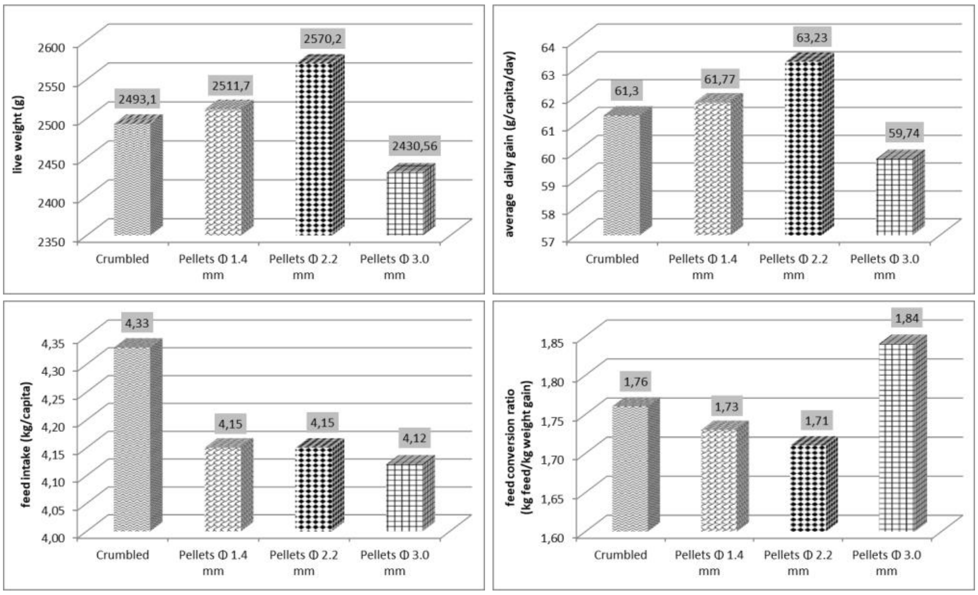

Fig. 1 – Main production perfromances in chicken broilers fed diets with different size particle and texture

CONCLUSIONS

Pelleting the feed for broilers resulted in higher productive performance in the groups fed with 2.2 mm and 1.4 mm size pellets, compared to control group, which received crumbled feed. Usage of 3 mm diameter pellets did not generate beneficial productive effects, the performance was lower than the control and the other experimental groups, due to the decrease of feed intake and to the non-effective uptake of the nutrients from the pellets with coarser texture.

Live weight was 0.75-3.09% higher in broilers fed with mixed feed pelleted at 1.4-2.2 mm diameter, compared to those fed with crumbled feed (control).

Feed conversion ratio calculated for the whole rearing period was 1.80-3.21% more efficient in the chickens that received 1.4-2.2 mm sized pellets, compared to control group and with more than 7.5% better, compared to the broilers fed with 3 mm diameter pellets.

Therefore, it is recommended to use the 2.2 mm pelleting gauge during feed manufacturing, in order to achieve the best performance, comparing to the other tested experimental factor graduations.

Although the usage of a pelleting size of 1.4-2.2 mm would generate 1.7-2.84% savings, in terms of feed intake and feed conversion, other aspects, such as energy involved in manufacturing, should be considered when the economic reliability is calculated to better identify the most optimal pelleting process.

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