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THE EFFECTS OF FEED TEXTURE ON PERFORMANCE IN BROILERS

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In commercial practice the broilers usually fed by textured food (i.e. as crumbs and pellets). The textured food has ben shown to give a growth response on poultry.

It is reported that 12 week body weights of both cockerels and pullets which have been fed by pelleted food were approximately 115 % of the body weights of mash fed controls (5). Following this very early work, some other researchers were also tried to show the advantage of feeding pellet feed over mash. According to Calet (3) thereare some factors including the age which are responsible for variations in growth of pellet fed birds.

It was demonstrated that chicks preferred mash rather than pellet at early ages (14). This researcher speculated that mash preference by young chicks may have been due to the difficulty of swallowing pellets at that ages. The pellets used were 3.2 mm in diameter. If the size of the pellets was really influence the pattern of feed intake then feeding a smaller pellet from day-old may be superior to mash feeding.

Wilson and Nesbeth (13) were able to show that feeding a pellet of 3 mm diameter but cut to lengths of 2.5mm or less was able to support superior growth rates from day old to 35 days of age guails, which is very small birds. However, it is apparent that they were using an unscreened pellet with a particle size ranging from a small crumble to the pellet size described.

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The physical form is not the only factor inolved in improving growth rate. It is reported that some chemical changes which seem to take place in feed during the pelleting orocess are responsible from the beneficial effects of pellet feeding (1, 12).

When unpelleted mash, whole pellets and reground pellets to mash form were fed to birds the inferiority of mash to the others were observed. The whole pellets and the reground pellets to mash form produce a growth response significantly greater than the growth response obtained from the unpelleted mash. Birds on pellets and reground pellets were of almost identical average weight whereas the unpelleted mash fed birds weighed 5 % less (1).

Summers et. al. (12), worked further into the benefits obtained from the pelleting process it self by using corn (a high energy ingredient), wheat bran (a low energy ingredient) and wheat shorts (a medium energy ingredient). These ingredients were processed by steam pelleting and were then reground to a mash from before including in the ration. Either the reground sample or an original unprocessed mash sample was mixed 50 : 50 with a corn, soya diet and then fed as a mash containing no processed ingredients, a mash containing processed ingredients and as steam pellets containing no processed ingredients (table 1).

Table 1- The effect of regrinding after steam pelleting on growth and metabolisable energy of corn, wheat shorts and bran

	Average Weight (g)			Metabolisable energy (kcal/g)		
	M a s h		Pellet	M a s h		Pellet
Ingredients	Without processed ingredient	Without processed ingredient	Without processed ingredient	Without processed ingedient	Without processed ingredient	processed ingredient
Corn	231	248	314	3.45	3.51	3.61
Wheat Shorts	233	267	303	2.10	2.16	2.20
Wheat Bran	164	259	303	1.46	1.70	1.05

According to the result it was apparent that the difference on average live weight could not be solely explained on the basis of the physical form in which the feed was presented. Metabolisable energy of the rations showed that the pelleted and processed rations had consistently higher energy levels supporting the view that some chemical changes occurred on pelleting may partially account for the increase in body weight.

Temperature and pressure increment together during pelleting have been proposed as being primarily responsible for the increase in body weight. When corn was steamed, water soaked and then autoclaved but not pelleted, this heat only treatment did not produce significantly better growth than birds were fed a control ration (2). Although these results suggest that pressure exerted on the feed as it is forced through the pelleting die is of major importance, it does not deny the fact that temperature during the pelleting process is of importance in specific instances. For example, it is commercial practice to pellet feed elite breeding stock where the heat treatment may effectively kill any Salmonellae which may be contaminating the feed and heat treatment may also destroy toxic factors or other growth inhibiting factors (1, 7),

It was reprorted that, during the pelleting process the grain kernels were further broken and the effects observed may hava been due to the disruption of the kernels on pelleting and the resultant greater surface areas exposed to the digestive process rather than to the production of pellets themselves (11). Calet (3) supporting the same view, reprorted that the effect of pressing alters not only the cell wall but the whole cell structure making maize starch in particular much more susceptible to be damaged by amylase. This alteration in the starch grains may explain the better energy availability measured in cereals. Therefore a new idea came on to the table that the beneficial effects of pelleting may be due to mechanical factors rather than chemical changes.

However the reasons for the efficiency of pellets are not yet completely understood, one should not deny that in general growth benefits do arise when pelleted food is fed. If these benefits cannot be completely and satisfactorily explained at a scientific level one has to look towards the effect of the pelleting on food intake to offer a partial explanation.

As a matter of fact, when the food intake of pellets and reground pellets was limited to the same level of mash intake in the controls, no growth response was obtained with food that had been pelleted suggesting the greater voluntray intake on pelleted food above the maintenance requirement is a major factor (4).

The rapidity which birds can consume fellets as opposed to mash may form an alternative explanation to the improved growth rates achieved pellets. Jensen et. al. (8) showed that there was little difference in the number of times birds fed mash and pellets went to the feed trough each day. However, the time spent at the trough on each visit varied markedly. Mash fed birds spent 14.3 % of their day eating whilst those fed pellets only 4.7 %. Since the eating procedure itself requires a certain amount of energy it can be postulated that birds on pellets will save more energy as they spend less time eating. This saved energy may be reflected as

productive energy in improved body weight gain. This suggestion that pelleting increases the productive enervy of the feed by decraesing the time spent feeding is supported bv Savory (10).

A correlation between better growth and improved feed conversion has been demonstrated in experiments compraing pellet and mash feeding systems at 28 days of age (1, 9) but in all cases can such a link be shown to exist beyond all doubt.

The majority of authors who showed significantly better food conversion when the diet was pelleted concluded that this improvement in food conversion efficiencv may be due to less energy being expended by the bird when eating pellets and this saved energy being converted into body weight (8, 10). This improvement in efficiency of food conversion mav be due to an increased feed intake on pellets above maintenance requirement (4, 6). Allred et. al. (1) concluded that better food conversion observed on oelleted rations may be due to some chemical change during the pelleting process possibly by the inactivation of a growth inhibitor in the ration.

Other authors have observed no significant improvement in the efficiency of food conversion by pelletin2 the ration (9, 13). Runnels et. al. (9) could show no significant food conversion improvement at 56 days of age by pelleting the ration, yet was able to demonstrate a significant improvement at 28 days of age. Wilson and Nesbeth (13) showed identical food conversion efficiency at 35 days of age by using bobwhite quails.

As a conclusion, there is no evidence that the pelleting process impairs the efficiency of feed conversion. On balance, the literature suggests that food conversion on pelleted rations will be the same as or, slightly better than that obtained on mash fed rations.

MATERIALS AND METHODS

A) Experimental Facilities And Materials

a) Housing: A house containing four blocks of equal size separated from one another by solid light proof partitions was usedb Two of the blocks were on one side of the house corridor while the other two on the opposite. Each block has six small pens of equal size (2.25 x 5.25 m) separated from one another by wire mesh partitions. So, there were altogether 24 small pens of equal size in the house.

b) Equipment: Solid hardboard chick surround 60 cm high enclosing an area of approximately 2 m^2 were placed in the centre ofeach pen. Fresh white wood shavings were used as litter to a depth of approximately 10 cm. The pens were fumigated with a commerical paraformaldehyde preparation (Alphagen) one day before the arrival of the chicks.

Feed was supplied from tubular feeders and water was provided continuously bv one circular hanging automatic drinker in each pen. For the first ten days water was supplied from two glass jar water founts in each pen to attract chicks to drink.

Liquid petrolium gas brooders were used for brooding the chicks. The brooders were 100 cm above the chick level at day-old.

c) Stock: Day-old 2952 rnale broiler chicks from a commercial strain (Ross-1) were used in the experiment. The boxes of chicks were weighed on arrival. Only small non-significant differences were noted in the weight of the day-old chicks. The chicks were then allocated to one of the 24 pens at random, 123 chicksto each pen.

d) Brooding Management: The brooding temperature was adjusted by chick behaviour as the chicks grew by raising the height of the brooder and enlarging the enclosed by the surround. The pen temperature initially was about 27 °C and this was reduced to approximately 20 °C at the end of the fourth week when the brooders were turned off.

E) Experimental Method

a) Experimental Design: Two feed texture treatments were applied three times at random in each block for all four blocks.

b) Experimental Treatments: Only one treatment applied was feed texture treatment.

For the first 14 days all birds were fed a broiler Starter ration in rnash from. From 14 days to 28 days one half of the six pens in each block received broiler Starter pellet, while the other half of the six pens in each block continued on the Starter mash. The three srnall pens in each block to receive pellets were determined at random before the start of the experiment so that six small pens in each side of the house corridor were fed pelleted food and the rernaining 6 were fed mash food. From the 29 th. day onwards the birds that had previously received broiler Starter mash recevied broiler finisher mash and the birds that had previously received broiler starter pellet were fed broiler finisher pellet.

Rations were computer formulated to include a pellet binder. Mash formulations were rerived from the original formulae by eliminating the pellet binder. Computer formulations for pelleted starter and finisher rations and the formule of starter and finisher mashes derived from these computer formulated pelleted rations are presented in table 2. Metabolisable energy value of the computer formulated starter pellets and finisher pellets were 12.61 MJ/kg and 13.04 MJ/kg respectively. Laboratorv analyses of the finisher mash and finisher pellets used are shown in table 3. For laboratory analyses, representative food samples were taken from each bag before feeding and these were bulked, mixed thoroughly and sampled for routine chemical analyses to determine the percentage dry matter, crude protein, true protein, ether extract, ash crude fibre. The gross energy content of the samples were also determined by using an adiobatic bomb calorimeter.

c) Data Collections: The total body weight of birds in each pen was measured at 0, 14, 28, 42 and 56 days of age. The total net food consumption of birds in each pen was measured at 14, 28, 42 and 56 days of age. Average body weight gain, food consumption and food conversion ratio (g feed consumed/g body weight) were calculated for the birds in each pen for each two week period.

RESULTS

The effects of feed texture treatment on broiler performance from 14 days onward are shown in table 4.

It can be seen from table 4 that while there were no signigicant effects of feed texture treatment on body weight gain during the period of 14 to 28 days and 28 to 42 days of age, the feed texture effect became significant ($P<0.05$) during the period of 42 to 56 days of age with improved body weight gains being obtained when pellets were fed. When considering the last two periods together (28 to 56 days) this effect still remained significant.

The effect of feed texture on food consumption showed a similar pattern to that of body weight gain birds fed pellets consuming more food than thcse fed mash (table 4). The differences between treatments were only significant for the period of 42 to 56 days ($P<0.01$) and to 56 days of age ($P<0.05$).

Food conversion ratio was not significantly affected by feed texture treatments during any of the periods being considered.

DISCUSSION

Table 4 summarises the effects of feed texture on the performance of broilers. The pellet fed broilers in this experiment gained significantly ($P<0.05$) more weight than the mash fed birds during the periods of 42 to 56 days of age and 28 to 56 days of age. An improvement in weight gain on pelleted food is supported by numerous workers cited in the literature review (1, 8, 9, 10, 11, 12, 13). The improvement in body weight gain is partly related to the significantly improved food consumption figures for pellets during these same two periods. This is in agreement with the general findings in the literature (4, 14). The voluntary feed intake on pelleted food above the, maintenance requirement being a major factor producing increased growth (4).

The efficiency with which birds converted food offered either in mash or pelleted form didnot differ overall at any stage of the experiment as indicated by the non-significant differences in the food conversion ratios shown in table 4. This is in agreement with Runnels et. al. (9) and in keeping with the general conclusion of the literature review.

CONCLUSION

There is no doubt that pelleting the poultry ration improves the growth rate and this improvement is always associated with the increased food consumption. Several factors apper to be responsisle from this benefit obtained from pelleted ration, the followings may be advanced as some of those factors:

-Possible chemical changes in the nature of feed ingredients,

-Possible mechanical changes in the physical form of the grain kernels,

-Increased palatability leading to the greater voluntary feed intake and therefore increase in productive energy,

-Increased food density (weight/volume) leading to the rapidity of food consumption,

-Possible destruction of the toxic factors or other growth inhibiting factors and bactericidal effect caused by increased heat during pelleting process.

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Table 2- Formulation of the starter and finisher rations (%)

Raw Material	Mash		Pellet	
	Starter	Finisher	Starter	Finisher
Wheat meal	31.41	51.64	30.99	51.00
Maize meal	30.80	20.63	30.89	20.37
Soya (44 % protein)	24.82	13.77	24.49	13.60
Herring (72 % protein)	7.59	7.09	7.49	7.00
Meat/Bone (45 % prot/8 % oil)	2.52	4.05	2.49	4.00
Soya oil	1.51	2.03	1.49	2.00
Vit. min. suppl.	0.50	0.51	0.49	0.50
Limestone flour	0.41	0.20	0.40	0.20
Methionine	0.04	0.08	0.04	0.08
Dicalcium phosphate	0.40	-	0.39	-
Pellet binder	-	-	1.24	1.25

Table 3- L.CIboratory analses of finisher ration (%)

	Finisher	
Analyses	Mash	Pellet
Crude protein	23.18	23.65
True protein	21.09	21.57
Fat	1.74	1.70
Crude fibre	2.45	2.69
Dry matter	87.60	86.65
Ash	4.92	4.84
Gross energy MJ/ kg	19.20	19.40

Table 4- Effects of feed texture on broiler performance

Performanca Characteristics	Mash	Pellets	LSD
Body Weight Gain (g)			
From 14 to 28 days	561[a]	567[a]	12.0
" 28 to 42 days	889[a]	864[a]	39.9
" 42 to 56 days	986[a]	1039[b]	33.9*
" 28 to 56 days	1876[a]	1896[b]	17.4*
Food Consumption (g)			
From 14 to 28 days	1184[a]	1178[a]	62.6
" 28 to 42 days	1812[a]	1832[a]	73.1
" 42 to 56 days	2243[a]	2347[b]	39.4**
" 28 to 56 days	4055[a]	4157[b]	78.1*
Food Conversion Ratio			
From 14 to 28 days	2.11[a]	2.08[a]	0.11
" 28 to 42 days	2.04[a]	2.13[a]	0.13
" 42 to 56 days	2.18[a]	2.26[a]	0.06
" 28 to 56 days	2.16[a]	1.19[a]	0.06

a, b : Means with unlike superscripts in the same row are significantly different (P<0.05)

LSD : Least significant difference (P<0.05)

* : P<0.05

** : P<0.01

SUMMARY

Two different feed texture (pellet and mash) were tested and the effects on broiler performance were determined.

Pelleted feed improved body weight gain significantly when compare to mash feed during the period of 42 to 56 days of age and 28 to 56 days of age.

Similarly, feed consumption increased significantly when the birds were fed pelleted ration rather than mash during the period of 42 to 56 days of age and 28 to 56 days of age.

ÖZET

İki ayrı yem tipi (pellet ve toz yem) test edilmiş ve bunların broiler performansına olan etkisi tesbit edilmiştir.

Pellet yem, toz yeme göre vücut ağırlık kazancını 42 nci gün ile 56 ncı gün arasındaki ve 28 inci ile 56 ncı gün arasındaki periyotlarda önemli derecede artırmıştır.

Buna benzer şekilde yem tüketimi de, hayvanlar pellet yem yediklerinde toz yem yedikleri duruma göre 42 nci gün ile 56 ncı gün arasındaki ve 28 inci ile 56 ncı gün arasındaki periyotlarda önemli derecede artmıştır.