

THE EFFECT OF FEED TEXTURE ON BROILER PERFORMANCE

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Özet: Yemin tavuklara pellet halinde verilmesi, dökme toz yem verilmesine nazaran daha iyi bir büyüme sağlamaktadır. Pellet yem ile genellikle daha iyi bir büyüme elde edilebilmesine rağmen, bundan bazı sapmalar da olabilmektedir. Pilicin yaşı, pellet yem yenilmesini etkileyen bir faktör olarak gösterilmiştir. Pellet tanelerinin büyüklüğü pilicin büyüklüğüne göre ayarlanmalıdır. Pilicin büyüklüğü önemli ölçüde yaşa bağlıdır.

Daha iyi büyümeyi sağlayan tek faktör yemin fiziksel şekli değildir. Pellet yapma sırasında bazı kimyasal değişiklikler meydana gelebilmektedir. Rasyonun içindeki bütün yem hammaddeleri pellet yapma işleminden aynı ölçüde etkilenmemektedir.

Pellet yem, yem yemeyi uyarmaktadır. Pellet yem yiyen piliçler dökme toz yem yiyenlere nazaran daha fazla yem tüketirler. Alınan yemin, ihtiyacın üzerinde olan kısmı yemden yararlanmayı artırmaktadır.

Pellet yem yiyen piliçler yemi daha hızlı yerler ve yem yeme işlemini dökme toz yem yiyenlerden daha önce tamamlarlar. Yem yeme işleminin kendisi belli bir miktar enerji harcanmasını gerektirdiğinden, pellet yem yiyenler diğerlerinden daha fazla enerji tasarruf ederler. Pellet yem yenilerek tasarruf edilen bu fazla enerji, produktif enerji olarak ağırlık kazancı artması şeklinde yansımış olabilir.

Summary: Offering feed to poultry in pelleted form rather than in mash form has been shown to give a better growth response. While a growth response is generally obtained on textured feed it is not invariably so. Age of

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the bird was shown as a factor to influence the textured food intake. Size of the pellet should be changed according to the size of the bird. Size of the bird, on the other hand, is generally associated with the age.

Physical form of feed is not the only factor to give better growth response. Chemical changes may also occur in the feed during pelleting process. Not all the ingredients in a ration are affected equally by pelleting.

Pelleted food stimulates the food intake. Birds on pelleted food consume more food than that on mash food. The increase in feed intake above maintenance requirement improves the efficiency of food conversion.

Birds on pelleted food can eat faster, so they can finish their eating earlier than the birds on mash. Since certain amount of energy is needed for eating process itself, birds on pelleted food will save more energy. This saved energy may then be reflected as higher body weight gain.

Introduction

In the current days Turkey has eagerly started to go into an export business. Poultry products will apparently contribute a considerable size to this effort. Competition with the other poultry product exporter countries forces one to evaluate every single facility to produce even cheaper product. One of the facility to produce more meat by using the same amount of food is fed the broilers with the pelleted food instead of mash form.

The presentation of food to broilers in textured form (i.e. as crumbs and pellets) is common commercial practice in the developed countries. The superiority of textured rations compared to rations presented in mash form either in improving the rate of growth or improving efficiency of food conversion or both, has been well documented. Despite of the several evidences, pelleted food unfortunately has not been commonly used in Turkey.

Poultry feed ingredients, such as wheat, maize and soyabean are important constituents of human diets particularly in developing countries. For this reason in the developing world, poultry production costs are high, and profit margins can be slim relative to those found in extensive livestock farming enterprises. It is, therefore, very much important to evaluate every possibility for increasing production efficiency and reducing unit output costs.

The effect of feed texture on live weight

Offering feed to poultry in pelleted form rather than in mash form has been shown to give a better growth response. The initial work reported by Heywang and Morgan (7) demonstrated this response with white leghorn stock. These authors noted that 12 weeks body weights of both cockerels and pullets were approximately 115 % of the body weights of mash fed controls. Since this work alerted researchers to this growth response the body weight advantages occurring from pellet fed birds have been repeatedly demonstrated (3, 5, 11, 13, 16).

While a better growth response is generally obtained on textured feed it is not invariably so. Calet (4) in an excellent review of the literature identified several factors responsible for variations in results including the age of the birds being fed. Ziegenhagen et al. (21) were early workers able to demonstrate that chicks preferred mash rather than pellets at ages up to 14 days and that by 28 days a preference for pellets could be demonstrated. A similar early preference was demonstrated by Savory (15) which, he speculated, may have been due to the difficulty of swallowing pellets by very young chicks. The pellets used were 3.2 mm in diameter, a size commonly used in commercial practice in the developed countries. If this was indeed the case, then feeding a smaller pellet from day-old may be superior to mash feeding. An interesting study by Wilson and Nesbeth (20) using a very small bird, the quail, was able to show that feeding a pellet of 3 mm diameter but cut to lengths of 2.5 mm or less was able to support superior rates of growth from day-old to 35 days of age. However, it is apparent that he was using an unscreened pellet with a particle size ranging from a small crumble to the pellet size described. Nevertheless, their work illustrates well that given a suitable particle size in textured feed, growth rates can be obtained which are superior to mash fed birds. It can be argued that another reason, other than the case of swallowing, may account for the early growth superiority reported with mash fed birds. It may be that birds prefer mash because of the interest aroused by variations in the colour and particle size of the feed compared with the more uniform characteristics of a pellet. It has long been observed that birds will select out certain particles from mash. However, the ability to select will directly reflect the fineness to which a mash is ground. It seems that any means of stimulating the appetite of birds will be advantageous in terms of growth. It

is this ability to stimulate food intake that is the primary advantage of pelleted food.

While the physical form in which a ration is presented to the bird is of importance, it is not the only factor involved in improving growth rate. It has been shown that beneficial effects occur as a result of chemical changes which seem to take place in the feed during the pelleting process (1, 19). When whole pellets, reground pellets and the unpeletted mash were fed to birds it has been observed that the whole pellets and the reground pellets fed in mash form produce a significantly greater growth response when compared to the unpeletted mash. At 28 days birds on pellets and reground pellets were of almost identical average weight whereas the unpeletted mash fed birds weighed 5 % less (1).

Summers et al. (19) enquired further into the benefits obtained from the pelleting process itself 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 form 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)		
	Corn	Wheat Shorts	Wheat Bran	Corn	Wheat Shorts	Wheat Bran
Mash With unprocessed ingredient	231	233	164	3.45	2.10	1.46
Mash With processed ingredient	248	267	259	3.51	2.16	1.70
Pellet With unprocessed ingredient	314	303	303	3.61	2.20	2.05

Not only did the processed ingredients result in greater average live weight but it was apparent that the difference could not be solely explained on the basis of the physical form in which the feed was pre-

sented. Measurement of the metabolisable energy of the ration showed that the pelleted and processed rations had consistently higher energy levels supporting the view that chemical changes occurred on pelleting which partially account for the increase in body weight.

The evidence suggests that not all ingredients in a ration are affected equally by the pelleting process. In the initial work, Allred et al. (2) were able to show that pelleted and reground corn alone in a basal ration was affected by the pelleting process in such a way that growth was improved, but not significantly so. When rations contained pelleted and reground soya bean oil meal or oat mill feed or a combination of them both, there was no growth response compared with that obtained on an unpeleted basal diet. However, when pelleted reground corn was fed in combination with either or both of the two other ingredients, pelleted and reground soyabean oil meal or oat mill feed, growth was significantly better. A highly significant response was obtained when the ration was fed in pelleted form rather than in mash form.

Several possibilities have been advanced to explain the beneficial growth effects that arise as a result of the pelleting process *per se*. The increase in temperature and in pressure during pelleting have been proposed as being primarily responsible. When corn was steamed, water soaked and then autoclaved but not pelleted, this heat only treatment did not produce significantly better growth than when birds were fed a control ration (2). Although these results suggest that pressure exerted on the feed as it is forced through the 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, 9).

A claim that the growth responses noted in birds fed pellets and reground pellets as opposed to mash was due to mechanical rather than chemical changes in the feed was advanced by Hamm et al. (6). This conclusion was supported by Bolton (3) who determined that the crude protein, oil, total carbohydrate and the available carbohydrate levels did not change as a result of the pelleting process and he attributed better growth to increased consumption of pelleted food.

As already noted, Summers et al. (19) found metabolisable energy levels to be increased as a result of pelleting, an observation not supported by Husser and Robblee (8). No significant change in gross energy of the grain dry matter of pelleted feed was reported by Sibbald (17) but he did observe true metabolisable energy (TME) to be changed by cold pelleting but not significantly so and the changes differed between grains. The TME of oats actually fell on cold pelleting. In later work (18) the relevance of TME was questioned. The argument was advanced that during the pelleting process the grain kernels were further broken and the effects observed may have 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. According to Calet (4) 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. This supports the view that the beneficial effects of pelleting may be due to mechanical factors rather than chemical changes.

Evidence that food intake was involved in producing the growth response was provided by Hamm and Stephenson (5). These authors found that 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 voluntary intake on pelleted food above the maintenance requirement is a major factor. In almost all the trials cited by Calet (4), in his review, an increase in food intake associated with pellet feeding was noted. This increase in intake can be explained in terms of palatability. The work of Ziegenhagen et al. (21) referred to earlier, concluded that although young chicks preferred mash to pellets up to 14 days of age, as the birds grew in size such that they were able to consume pellets easily, preference for pellets emerged. This preference for pelleted feeds amongst older birds has been noted by other workers in free choice feeding experiments (4, 12).

An alternative explanation which may partially explain the improved growth rates achieved on pellets may involve the rapidity with which birds can consume pellets as opposed to mash. Jensen et al. (10). 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 while 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 energy of the feed by decreasing the time spent feeding is supported by Savory (15).

The effect of feed texture on efficiency of food conversion

It has been argued that the extra food consumed over and above the maintenance requirement will be directly reflected in increased growth. This being the case, the efficiency with which this extra consumption will be converted to extra weight gain will be high, thereby raising the overall efficiency with which the pelleted food intake is converted into weight, any improved efficiency therefore being associated with increased body weight when pellets are fed. This link between better growth and improved food conversion has been demonstrated in experiments comparing pellet and mash feeding systems at 28 days of age (1, 14) but in not 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 efficiency may be due to less energy being expended by the bird when eating pellets and this saved energy being converted into body weight (10, 15). Alternatively, this improvement in efficiency of food conversion may be due to an increased feed intake on pellets above maintenance requirement (5, 8). Allred et al. (1) concluded that better food conversion observed on pelleted 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 pelleting the ration (14, 20). Runnels et al. (14) 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 (20)

showed identical food conversion efficiency at 35 days of age by using bobwhite quails.

Conclusion

There is no recent literature which warrants changing the conclusion of Calet (4) that on a scientific level, the reason for the efficiency of pellets are not yet completely understood. Yet it is undeniable 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 partial explanation.

In the absence of any conclusive evidence for the occurrence of chemical or mechanical changes to wholly explain the increase in growth associated with pellet feeding, the definite practical value of pellet feeding may be considered to be due to the ability of pellets to increase the bird's appetite.

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 slightly better than that obtained on mash fed rations.

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