

## Effect of Feed Form on Turkey Performance: Experiences in Europe with BUT6

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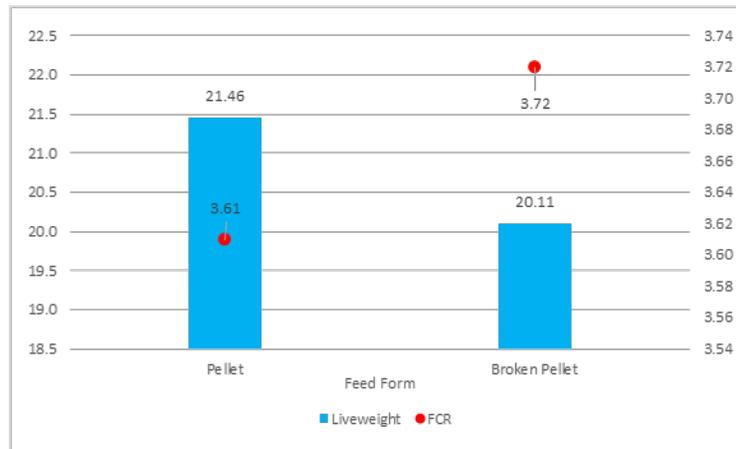
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### The effect of feed form on current genotype

The effect of feed form, processing and particle size on the growth performance of turkeys has been well established (Blakely *et al.*, 1967, Hamilton and Kennie, 1997; Jackson and Duke, 1995; Plavnik *et al.*, 1997; Nixey, 1994).

An evaluation conducted 33 years ago showed that the performance of male turkeys was affected by feed physical quality, bodyweight improved by 6.3% and FCR by 3% when birds were fed an intact pellet compared to those fed a broken pellet (see figure 1).

Figure 1: The Effect of feed form on bodyweight and FCR of male turkeys at 167 days of age



Source: BUT 1986

A more recent evaluation examining the effect of different feed forms was conducted in Aviagen Turkeys facilities in the UK. This involved feeding B.U.T.6 males varying quality crumbs and pellets to represent the range of feed physical quality observed in the field. The control, the 'good' feed physical quality treatment, was based on 100% intact pellets with no fine particles of feed present, an intermediate treatment containing 75% pellets and 25% fines and a third treatment containing 50% pellets and 50% fines. Diets were prepared according to Aviagen Turkeys Ltd's (ATL) recommended nutrient specifications and feeding programme and were fed from 0 to 20 weeks of age. The starter diet was provided as a sieved crumb for the control and an unsieved crumb for the 'poor' treatments. The 'poor' pellet quality treatments were prepared by hammer grinding pellets to a fine consistency and then blended with intact pellets to result in the required proportion of fines. The mix of fines and pellets resulted in a feed form similar in quality to that sometimes seen in the field (see figure 2 below).

Figure 2: Feed form treatments

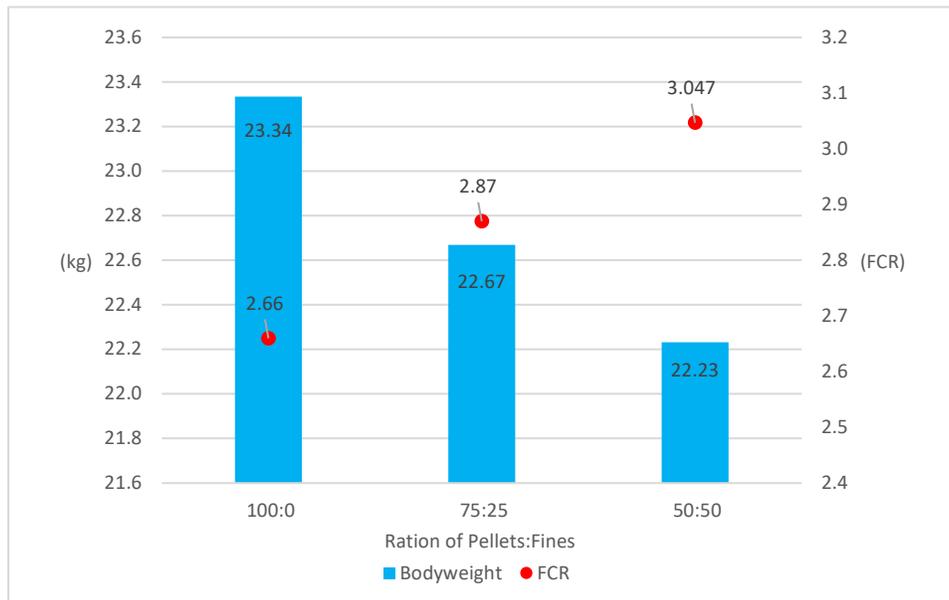
Control: 100% intact pellets

Treatment 3: 50:50 pellets and fines



The bodyweight and FCR response to increasing proportion of fines was consistent, the 75:25 and 50:50 treatments reduced bodyweight by 2.9% and 4.8% respectively. FCR deteriorated in the 75:25 treatment by 7.9% and by 14.5% in the 50:50 treatments (see figure 3 below).

**Figure 3:** The effect of feed form on bodyweight (kg) and FCR (20 weeks)



The effect of feed form on performance in this trial was greater than previously observed, in particular the magnitude of effect on FCR was unexpected. The data also suggests that those birds fed the poor feed form ate significantly more feed than birds fed the control diet. Feed wastage is often evident when birds are fed poor quality pellets, while feed wastage was evident in some pens, this was superficial and not enough to account for the degree of difference in FCR. Therefore it would appear that feed intake is not compromised when the bird is fed poor feed physical quality however digestibility of the feed could account for some of the effect on FCR. Fine particles tend to pass through the gizzard quickly (Duke, 1994; Engberg *et al*, 2002) resulting in poor gastrointestinal tract stimulation and impaired digestive function, for example lower acidic and enzymatic secretions (Engberg *et al*, 2002; Kwakkel and Moquet, 2013). Increased feeding activity associated with poorer feed physical quality will also increase energy expenditure by the bird which could also account for the difference in FCR.

The degree of fine material within the poor feed treatments was very significant (25% and 50%) and also the extent of pulverization of the pellets during the preparation process may have resulted in a more extreme response to 'poor' feed form than assessed in other trials. Also previous trials assessing the effect of feed form compared pelletised diets with mash diets which may not have the same degree of effect as degenerate pellets containing high levels of fine material. The degree of effect of feed form on performance was not just seen in one strain but was also observed in other breeds as well. Testing of Hybrid Converter commercial males on a 50% fines diet versus 100% intact pellets showed a similar degree of effect of feed form on performance indicating the potential to improve performance through feed form is across genotypes.

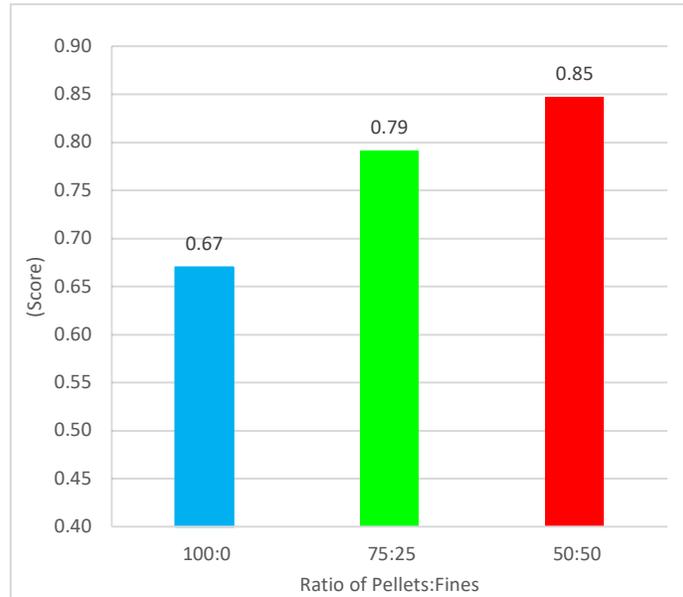
The degree of effect of feed form on turkeys in these trials is more than seen in more recent broiler evaluations (Dozier *et al.*, 2010; Mingbin *et al.*, 2015), which suggests there may be more potential to exploit turkey performance through feed form compared to other species.

#### **The effect of feed physical quality on enteric function and condition**

Consumption of fine particles of feed or grain are considered to have a negative impact on intestinal function relative to larger particles. Birds fed mash diets with coarsely ground particles had larger gizzards and were retained for longer in the gizzard than those fed a fine particle size mash (Nir *et al.*, 1994a; Hetland and Svihus, 2001; Engberg *et al.*, 2002). Nir *et al.* (1994a) reported that coarse particles increased the relative weights of the jejunum, ileum and whole intestine. Coarse particles increase gut motility (Nir *et al.* 1995) relative to smaller particles and have also been hypothesized to improve intestinal strength (Sacranie, 2006). Finely ground pelleted diets dissolve in the crop and pass very quickly through the gizzard (Engberg, 2002 while larger particles are associated with increased gizzard grinding activity and increased pancreatic enzyme secretion (Svihus, 2011). A well-developed gizzard generates stronger reverse peristalsis contractions and increases pepsin activity in the proventriculus and proteolysis by endogenous proteases in the small intestine (Ferket, 2000; Gabriel *et al.*, 2003a). Feed particle size has also been shown to have a positive impact on gut morphology (Nir *et al.*, 1994b; 1995), microbiota profile has been shown to be influenced by the physical form of feed (Zaefarian *et al* 2016).

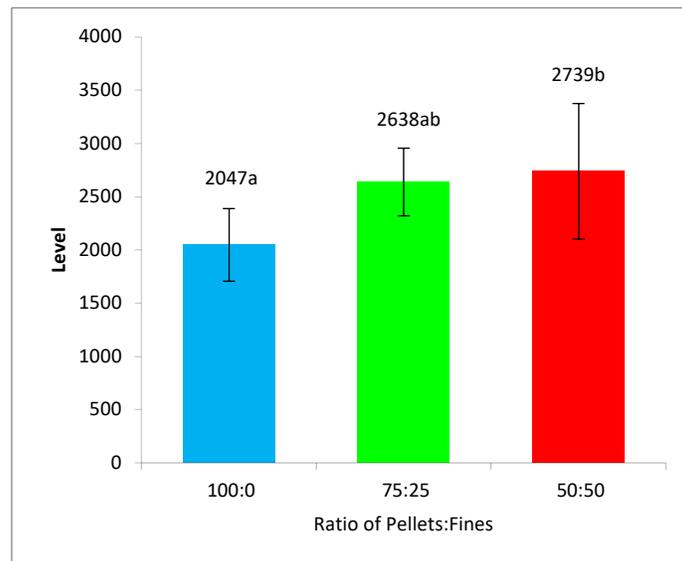
This study assessed the effect of feed physical quality on enteric condition through use of a scoring system of the intestine. The assessment was based on a number of criteria; redness, tone, amount of mucus content and watery content of the duodenum, jejunum and ileum. The caeca were scored based on the consistency of the contents and the extent of foamy and gassy contents. Enteric score was categorized as 0: normal; 1 mildly abnormal and 2 severely abnormal. Scores for each individual section of the intestine were combined resulting in an average condition score for the entire intestine. Scores show there is a consistent relationship between higher proportion of fines and increased intestinal scores (see figure 4).

**Figure 4:** The effect of an increased proportion of fine feed particles on enteric score



An intestinal biomarker was also administered which provided an indication of enteric condition by assessment of tight junction function and para-cellular leakage. The biomarker was administered as an oral gavage to birds at 12 weeks of age. An intestinal wall with good integrity will not allow the dye to pass into the tissues, poor integrity will allow the dye to pass through the gut barrier and into the blood stream. Higher presence of the biomarker in the blood serum indicates increased leakage and poorer gut condition. The results of the biomarker assessment (see figure 5) followed a similar pattern to enteric condition scores, feed treatments with higher proportion of fines (75:25 and 50:50) resulted in higher levels of serum dye relative to the control (100:0).

**Figure 5:** The effect of increasing ratio of pellets to fines on serum biomarker levels



These results suggest that tight junction function is compromised and there is increased paracellular leakage when birds are fed a higher proportion of fines relative to pellets. The results of the enteric scoring and biomarker assessments suggest an increased proportion of fine particles has a negative impact on intestinal condition.

## Summary

The trials incorporated severe 'poor' feed form treatments however these were representative of feed form quality occasionally seen in the field and resulted in a significant impact on turkey performance. Pelletised feeds resulted in superior live weight and FCR relative to broken pellets.

Enteric condition was assessed based on a scoring system and administration of a biomarker, both assessments showed that enteric condition was adversely affected by an increased proportion of fines in the feed.

The results reinforce the potential of feed form in improving performance and enteric condition and why feed physical quality should be continuously assessed within the organisation. Communication of feed physical quality standards between the farm and the mill is vital to ensure that the needs of the modern bird are understood and are met.

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