

Although the type of feed ingredients used and their chemical composition are the main factors which usually influence the nutritive value of a diet, there are several other factors which may exercise a marked effect on the

grinding grain is the second largest feed production cost after the pellet mill. Roller milled corn, having larger particle size, resulted in heavier weight broilers than a similar diet containing hammer milled corn having smaller particle

practice followed for the last 40-50 years. Poultry can utilise whole grains such as wheat since they can generate high grinding pressure and abrasive action through the muscular walls of their gizzards. Physical form of grain presumably influences gizzard development as whole grain or pelleted feed influences the ability of birds to grind food or facilitate digestion. Although, there is little information on the efficiency of grinding whole grain wheat compared to ground wheat in the diet, wheat varieties differ in their endosperm hardness which affects the

Improving The Nutritional Quality Of Feed

There are several methods readily available to help improve the nutritional value of cereals and protein sources. — By Dr C.V. Reddy

feeding value of a ration. In the last 3-4 decades, nutritionists have developed several methods to improve the nutritional value of coarse cereals and protein supplements.

Grinding

This is one of the earliest methods employed in feed processing but yet it is often ignored which may result in failure to obtain maximum efficiency in the performance of birds. The purpose of grinding cereals is to make the endosperm more available to digestive juices. This is accomplished by cracking the ectoderm or by pulverising the grains. Experiments have shown, when mash feeds containing fine, medium or coarse grains were fed to laying birds, there was an increase in feed consumption and less feed wastage with the coarser feed. Although, finely ground mash gives better appearance and a slight improvement in digestibility with less picking over and wastage, coarse granular mash is more palatable and results in better feed consumption with increased egg production involving less costs for grinding. Energy costs required for

size. Grinding corn through a roller mill reduces the cost by about 15-20% rather than using the hammer mill. Although, nutritionally there is no advantage from feeding the birds finely ground feed, preference to particle size has been shown to vary with age and that older birds prefer larger particle size. 'Fines' in the diet causes agglomeration of pasty material in the beak, increased water consumption and wasted feed in water troughs. Many nutritionists therefore recommend 'medium coarse' granulation of cereal grinding rather than either too fine or too coarse particles.

Feeding Whole Grains

Feeding whole grains to poultry is not new. It has been a standard

pressure required to grind whole grain mechanically and therefore differ in the efficiency with which they are digested by poultry. When diets containing whole, ground or pelleted wheat were fed to white Leghorn pullets up to 15 weeks of age and compared the performance at different periods, it was observed that the whole wheat diet was significantly inferior to the ground or pelleted wheat diets up to 5 weeks of age but these differences decreased with age. By the 11-15 week period, the whole-wheat diet equalled the performance of the ground wheat diet (Table 1). These findings maybe of interest to poultry farmers since whole grain feeding may improve the economics of feeding, as it does not involve

Table 1 Influence of Physical Form of Wheat on the Performance of White ** Pullets (0-15 weeks of age)**

Form of Wheat	0-5 wks		6-10 wks		11-15 wks	
	Wt gain (g)	Feed Intake	Wt gain (g)	Feed Intake	Wt. Gain (g)	Feed Intake
Whole	309	751	495	1634	327	2021
Ground	363	806	508	1666	331	2082
Pelleted	389	856	495	1683	236	1768

Adopted from McIntosh et al (1962)

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Table 2

Type of feed	Strain 1			Strain 2		
	Body wt (g)	FCR	Mortality (%)	Body wt (g)	FCR	Mortality (%)
Pellets	1536 ^a	2.26 ^a	6.2 ^a	1611 ^a	2.18 ^a	4.3 ^a
Mash	1482 ^b	2.30 ^b	8.6 ^b	1545 ^b	2.22 ^b	8.7 ^b

Figures carrying the same subscript within the same column do not differ significantly (P<0.05)

may therefore mix relatively low proportions of whole grain wheat in commercial broiler feeds without any adverse effects on the performance.

Pelleting

It has now become a common practice, even in developing Asian countries, to feed broilers with pelleted diets. When two commercial broiler strains were fed separately mash in a crumble form and pelleted form from 0-7 weeks of age, the broiler performance in both strains was significantly better in weight gain and liveability of chicks fed pelleted diets than those fed mash diets (Table 2). Several broiler experiments have revealed that

grinding expenses. Further whole grain feeding may improve the health of the bird by developing a healthier digestive tract. Experiments have shown that when shell grit is supplied separately in the feeders, the birds preferred whole grain to mash. Birds also prefer whole sorghum or Eluecine coracana to cracked grains

suggesting that they like something which stimulates gizzard activity and development seems to reduce the incidence of coccidiosis. This can be achieved with the supply of whole grains or limestone in grit form with larger particles which stay in the gizzard for a longer period rather than in powder form mixed in complete feed. Poultry producers

Table 3 Improving Nutritional Value of Some Common Feed Stuffs Used in India

Feed stuff	Anti nutrients present	Methods used to improve nutritional value
Energy Sources		
Wheat	Pentosans	Use of enzyme (xylanases)
Barley	Beta-glucans	a) water treatment b) beta glucanases
Sorghum	Tannins	a) Soaking of grains in water b) Addition of orthophosphates & dicalcium phosphate
Pearl millet		c) Sprouting of grains d) Supplementation with methionine
Small millet		a) Treatment with alkalis/acids b) Salt treatment c) Soaking in water
Salseed meal (Shorea robusta)	Tannins	a) Boiling & autoclaving b) Soaking tapioca roots in water c) Supplementation with methionine
Tapioca meal (Cassava root meal)	Tannins, cyanogenic Glucosides	a) Autoclaving and par boiling b) Addition of anti-oxidants
Rice bran/rice polish	Phytates, trypsin inhibitors free fatty acids	
Protein Meals		
Soya bean meal	Protease, trypsin inhibitors Phytins	Proper heat treatment in processing
Rape seed meal	Eruccic acid, glucosinolates Tannins, perctins	Acid or alkali treatment
Cotton seed meal	Gossypol, tannins	a) Suitable heat b) addition of iron salts
Peanut meal	Mycotoxins	Use of hydrated sodium aluminium silicate
Sunflower meal	Chlorogenic acid, high fibre	a) Low temperature processing b) Addition of methionine & chlorine
Sesame seed meal	Phytates amd oxalates	phytase enzymes

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Table 4 Performance of Broilers Fed 'Avizyme' in Vegetable Protein Diets (0-8 weeks of age)

Criterion	Corn-soya sunflower (control)	Corn-soya sunflower avizyme	Corn-soya sunflower rape seed meal (control)	Corn-soya sunflower rape seed avizyme
Live Weight (g)	1572 ^b	1653 ^a	1557 ^b	1605 ^b
Feed Conversion Ratio	2.00 ^b	1.94 ^a	2.02 ^a	1.95 ^a
Mortality (%)	4.2	5.0	2.5	1.7

Figures carrying the same subscript within the same column do not differ significantly (P<0.05)

high fibrous grains have to be incorporated in poultry rations and chickens have to be prevented from selection of feed ingredients. Pelleting produces homogenous feeds, reduces dustiness, gelatinises starches and brings out the natural oils in grains. It is also claimed that growth inhibitors, if any will be destroyed.

Steam pelleting feed in which both physical and chemical changes occur seems to bring about responses both in weight gain and also improvement in M.E content than by feeding dry pelleted diets in which only physical changes occur. Steam pelleting has also been shown to increase the available phosphorus in diets especially those containing high levels of inorganic phosphorus. All these observations

pelleting feed generally improves body weight and feed conversion compared to those fed non-pelleted rations which seems to be of economic advantage only in broiler growing. But pelleting layer rations consistently increased feed consumption and body

weight without a corresponding increase in egg production. This increased feed consumption appears to be due to increased density of the diet occurring due to hardness of food particles in pellet formulation. Pelleting is of an advantage especially when



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clearly point out that steam pelleting definitely improves the feeding value of a diet.

Addition of Feed Supplements

These include growth promoters like antibiotics, probiotics or

enzymes that enhance the nutritive value of a diet through their action on the utilisation of nutrients as well as improving the health of the flock. In recent years, there has been a renewed interest on the application of enzymes of

microbial origin as feed supplements for upgrading the nutritional value of high fibrous diets containing some coarse cereals (wheat, barley) and even oil meals (such as sunflower, rape seed). Most of these enzymes are based on xylanases and beta-glucanases which are mainly designed to cleave the non-starch polysaccharides (NSP's) having anti-nutritive properties causing poor digestibility of energy and other nutrients (Table 3).

The enzyme supplementation helps in partial cleavage of NSP's improving the digestion of protein, fat and starch and increase in the M.E content of the diet. It also helps in the improvement of weight gain and feed conversion efficiency. Experiments conducted on broilers from 0-8 weeks at Kerala Agricultural University (Trichur) in India have shown that when a corn-soya diet was gradually replaced by tannin-rich 'sal seed' (*Shorea robusta*) meal at 0, 1, 4 and 7% level, there was a significant growth reduction and feed conversion at higher levels of tannin containing diets.

However when these diets were supplemented with fungal protease enzymes at 0.2% level, there was significant increase both in growth rate and feed conversion efficiency. In another trial at the University of Agricultural Sciences, Bangalore, (India) it was shown that application of the commercial enzyme preparation 'Avizyme' - 1500 improved live weight and feed conversion in broilers which were fed diets based on corn-soy-sunflower seed meal, and another diet containing corn-soya-sunflower and rape seed meal mixture (Table 4).

Amino Acids

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formulating rations by precisely meeting the nutrient requirements and achieving nutrient balance. In most practical poultry diets, the order of essential amino acid (EAA) limitation is methionine, lysine and threonine.

To make up this deficiency, poultry farmers generally use supplementation methionine and lysine but overlooking threonine. In such situations, threonine becomes the first limiting amino acid in most of the commercial pullet and layer diets. In order to enhance the EAA utilisation, there should be a proper balance of EAA and their ratio to non-essential amino acid levels, bird age, genetics and sex, which affect the amino acid requirements. Therefore nutritionists have developed a

concept of providing 'ideal protein' in poultry diets rather than formulating a ration on the basis of recommended protein or total amino acid requirements. 'Ideal protein' is based on digestible essential amino acids with reference to lysine rather than total amino acids.

This is especially important, when feeds like rice bran/wheat bran and non-traditional oil seed meals (except corn and soybean meal) are included in the diets, since the digestibility of their amino acids differ considerably. Birds tend to regulate their feed consumption to satisfy their energy requirements needed for maintenance growth and reproduction. But when birds are provided an 'Ideal Protein' diet, which is balanced for essential

amino acids, they will eat to satisfy their protein rather than energy requirements.

Anti Nutritional Factors

Almost all oil seed meals and feed grains contain one or more anti-nutritional factors to a greater or lesser extent. These include the mycotoxins, protease inhibitors, tannins and non-starch polysaccharides (NSPs) contained in some commonly used feedstuffs, as shown in *Table 3*.

Most of these anti-nutrients interfere with carbohydrate, protein or lipid metabolism and result in growth depression reduced feed efficiency and lowered egg production. Feed ingredients having a high tannin content may cause liver damage and interfere with the digestibility of protein and energy and those containing high fibre and NSPs may decrease the ME content.

It has been shown that a unit increase in crude fibre decreases 78-94K.cal/kg energy in diets. A number of enzymes which have been developed in the last two decades have been found to be useful in improving the nutritional quality of wheat, barley, sunflower and rape seed meal and also especially those containing NSPs. Phytase is another enzyme which when added to poultry diets can improve the utilisation of phosphorus and it is found to be particularly useful in the diets containing rice bran and wheat bran commonly used in most Asian countries. — *Dr C.V. Reddy, Hyderabad, India* **PI**

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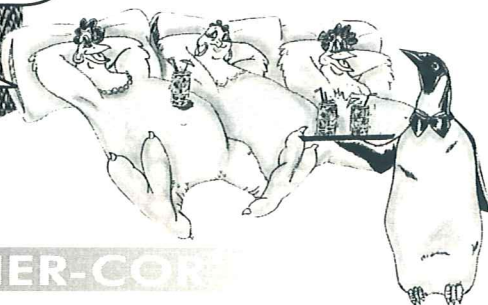
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