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Director's Digest

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SUPPLEMENTAL DIETARY FATS FOR GROWING TURKEYS

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INTRODUCTION

The potential value of supplemental dietary fats for improving the performance of growing turkeys was demonstrated in the 1950s. Supplemental fats, however, were not commonly used in turkey feeds until the 1970s. Since that time, fats have been routinely used as ingredients of most turkey diets. In 1991, more than 750 million pounds of fats were used in this way. Main sources of supplemental fats are those derived from the animal processing industry and from byproducts of vegetable oil use and processing, namely animal fats, poultry fat, and animal-vegetable fat blends.

Supplemental fats are used to increase the energy or caloric density of diets. An impressive amount of evidence has been obtained from research and commercial field experience showing that the use of fats for this purpose improves feed efficiency and rate of gain of turkeys. Although the energy contribution of supplemental fats to turkey diets is the primary reason for improved performance, fats may also influence performance by providing essential fatty acids, improving physical texture of mash-type diets, and facilitating more efficient absorption of fat-soluble nutrients.

As a result of research done in recent years, much information has

been accumulated on factors that influence the economically effective use of fats in turkey feeds. The importance of quality characteristics of fats is recognized and criteria have been established for maximums of moisture, impurities, unsaponifiables, and free fatty acids allowable in different feed-grade fats. Guidelines are also available indicating total fatty acid minimums, ranges of titers or iodine values, assessments of stability or peroxide content that should be acceptable in feed-grade fats.

Age of Turkeys and Responses to Added Fat

Research has shown that young turkeys, from hatching to about 6 weeks of age, do not utilize dietary fats as efficiently as older birds. Early in life, the digestive processes necessary for optimum utilization of fats are not developed. Consequently, the metabolizable energy (ME) value of tallow-like fats and animal-vegetable fat blends may be 30 and 20 less, respectively, for 2-week-old than for 6-week-old poults. Despite this difference, supplemental fats can be used effectively to boost the ME content of starter feeds, but the improvements in performance will not be as large as when fats are used in turkey grower-finisher diets. Data are available showing that for each increase of 35 to 40 kcal ME/kg of diet, which can be achieved with a 1% inclusion of feed-grade fat in corn-soybean meal based diets, feed efficiency from hatching to 6 weeks of age will be improved .8 to 1.2%. Concurrently, rate of gain often is improved but to a lesser degree, depending on the ingredient composition and ME concentration of the diets. From 6 weeks onward, however, improvements of 1.4 to 2.2% in feed efficiency per 35 to 40 kcal/kg increase in ME (1% added fat) are usually obtained, together with frequent increases in rate of gain.

Results of an experiment done at Iowa State University, supported in part by the Fats and Proteins Research Foundation, illustrate the benefits often observed when fat is used to increase dietary ME concentration. In this experiment mash-type diets containing 100 or 110% of the ME levels listed by the National Research Council (1984) were fed to turkey toms from hatching to 18 weeks of age. Diets of the high ME series contained an average of about 9% of an animal-vegetable fat blend (A-V fat). The responses of toms to the high ME diets in terms of body weights and feed efficiencies are presented in the Table 1.

Table 1. Influence of dietary ME (added fat) level on performance of turkey toms.

Dietary ME, as % of that listed by NRC(1984)	Body weight		Feed efficiency	
	6 wk	18 wk	6 wk	18 wk
	(lb/tom)		(Feed/Gain)	
100	3.6	27.9	1.80	2.98
110[1]	3.8	30.3	1.67	2.60
% improvement	6.1	8.7	7.2	13.6

[1]Approximately 9% additional supplemental A-V fat.

The data show that, as compared with the ME guidelines set forth by NRC (1984), which are relatively low, the use of supplemental fat markedly improved tom performance, beginning during the early age period. It is also evident that favorable effects of additional ME on weight gain and feed efficiency were considerably greater during the 6 to 18 wk age period. In the instance of feed efficiency, an improvement of 7.2% occurred up to 6 weeks of age whereas for the entire 18 weeks period feed efficiency was improved by 13.6%. According to the feed ingredient and turkey market prices prevailing at the time, the use of fat supplemented diets increased the monetary returns above feed costs $.64 per tom, a very meaningful addition to the income of a production unit.

What About ME-to-Protein Ratios?

In addition to the documentation of the favorable effects of using supplemental fat to increase the ME of turkey diets, there is mounting evidence indicating that dietary ME concentrations and dietary protein levels exert independent effects on tom performance. Consequently, the use of ME-to-protein ratios as constraints in formulating practical diets is unnecessary, and this has important economic implications.

The data presented in Table 1, obtained when dietary ME concentration was increased and protein level remained constant, showed that performance of toms was improved even though the ME-to-protein ratio was much greater than the "ME-to-protein principle" would have allowed. Results of several other experiments done at ISU and elsewhere have been the same. An example is provided by an experiment done at ISU in which twenty diets were tested. These diets were obtained by using all combinations of five protein levels (82, 91, 100, 109, and 118% of NRC, 1984 recommendations) and four ME levels (99, 103, 107, and 111% of NRC). The low protein diets were supplemented with methionine and lysine to meet the NRC requirements listed for these amino acids. Levels of A-V fat used to achieve the high ME diets ranged up to more than 13%.

Statistical evaluation of the data showed that the effects of dietary ME and protein levels were independent. Thus, the responses of toms to changes in dietary ME were not affected by dietary protein level and vice versa. Data presented in Table 2 illustrate the

Table 2. Performance of toms fed diets differing in concentration of ME (supplemental fat).

% of that listed by NRC (1984)	Body weight	Feed efficiency	Feed cost	Income above feed cost
	(lb/tom)		(¢/lb gain)	($/tom)
99	29.5	2.91	24.3	5.22
103	30.1	2.76	24.0	5.42
107	30.1	2.63	23.9	5.45
111[1]	30.1	2.49	23.5	5.57

[1]Supplemental fat levels ranged up about 13% of the diet, depending on age of the turkeys.

influence of increasing dietary ME levels, summarized across protein levels. Although 20-wk body weights were not markedly changed by increasing dietary ME (via fat supplementation), feed efficiency improved linearly with increments of ME. Concurrently, feed cost per pound of gain decreased, and under the prevailing turkey market prices at the time, monetary returns above feed cost increased with increasing dietary ME.

Carcass Composition and Added Fats

On the basis of the data cited, use of supplemental fats to increase ME content of tom diets can be advantageous. There, however, is some concern about the impact of feeding relatively high ME diets on carcass characteristics of turkeys, especially meat yields and carcass fat. Generally, experimental data show that yields of breast meat and thigh/drum meat are not affected markedly by dietary ME level. This, however, is not true in the instance of carcass fat. Feeding high ME diets during the growing-finishing periods invariably increases the proportion and amount of fat in carcasses. Carcass composition data obtained from the experiment just cited provide examples of this effect. Carcasses of toms fed 99, 103, 107, and 111% of the ME level listed by NRC (1984) contained 10.73, 12.30, 13.50, and 14.03 % fat, respectively. Because the increasing amounts of carcass fat are deposited mainly in place of carcass water, protein (lean tissue) content is not altered. Nevertheless, "extra" carcass fat is undesirable from both a processing and marketing viewpoint.

Recently, two feeding approaches have been investigated for their potential to reduce the accumulation of body fat in market toms. The first approach involved the use of relatively high protein with and without "extra" essential amino acids in tom diets. Dietary ME of all diets was the same. In addition to measuring effects of protein level on performance, toms from each treatment group were processed at 15, 16, and 17 weeks of age and carcass traits were measured to determine possible age or body weight effects on responses to dietary treatments. Dietary protein levels ranging from 94 to 107% of NRC (1984) recommendations did not affect body weights, feed efficiency, or yields of breast meat at 15, 16, or 17 weeks. As dietary protein level increased, the weight and percentage of fat pad decreased significantly in carcasses of 15-week-old toms, indicating that carcass fat was reduced. This effect of protein, however, was transient and, in the instances of carcasses of 16- and 17-week old toms, dietary protein had no effect on fat pad. Thus, using relatively high protein diets does not seem to be a useful approach for reducing fat deposition in carcasses of toms taken to relatively heavy body weights, i.e., 27 lbs or more per tom.

A second approach evaluated in two experiments involved a step-down in dietary ME during the last 2 weeks of the finishing period of toms. In these experiments, toms were fed from 6 to 15 weeks of age diets that contained either 102 or 108% of the ME levels listed by NRC (1984). At 15 weeks of age, half of the toms previously fed the high ME diets (108%) were switched to the moderate ME diets (102%) for the last 2 weeks of the finishing period. The results of both experiments showed that 17-week body weights were increased slightly and feed efficiencies improved considerably by feeding the 108% ME diets (Table 3). Changing from the 108 to the 102% ME diets did not change these responses noticeably.

Table 3. Influence of a 2-week dietary ME step-down program on performance and fat pad size of toms.

Dietary ME[3] Sequence	Experiment 1[1]			Experiment 2[2]		
	Body[4] weight	Feed efficiency	Fat[5] pad	Body[4] weight	Feed efficiency	Fat[5] pad
102	26.0	2.57	1.01	29.3	2.60	1.31
108	26.6	2.42	1.38	29.7	2.46	1.40
Step-down[6]	26.8	2.46	1.18	29.6	2.49	1.49

[1]Toms were finished in the summer with in-house temperatures ranging from 80 to 91° F.
[2]Toms were finished in the winter with in-house temperatures ranging from 55 to 61° F.
[3]All toms were fed 102% ME from 1 day to 6 weeks of age.
[4]Lbs/tom at 17 weeks of age.
[5]Percent of live weight.
[6]Dietary ME was changed from 108 to 102% of NRC (1984) from 15 to 17 weeks of age.

In the instance of Experiment 1, in which toms were finished during a period of high ambient temperature, the ME step-down program resulted in a reduction of fat pad percentage as compared with toms fed the high ME diet. In fact, laboratory analysis showed that carcasses of toms on the ME step-down program contained about the same percentage fat (11.77%) as the carcasses of toms fed the 102% ME diets throughout the growth period (11.49%). In contrast, carcasses of toms fed 108% ME to finish in Experiment 1 contained 13.07% fat.

The results of Experiment 2 were similar to those of Experiment 1 with respect to finishing body weights and feed efficiency; both were improved by feeding the 108% ME diet and the 2-week ME step-down did not change these effects. Dietary effects on fat pads of toms in Experiment 2, however, were different from Experiment 1. Feeding 108% ME diets increased percentage fat pad only slightly as compared with feeding 102% ME, and this effect was not altered by the 2-week ME step-down. The different effects of dietary ME (fat level) on carcass fat observed in the two experiments was probably related to differences in body weights at the finish. Previous research at this station showed that, as toms increase in body weight beyond 26 to 27 lbs, body fat increases rapidly as long as toms can consume sufficient "extra" energy. Evidently, in Experiment 2, toms were able to do so, irrespective of dietary ME level and cool ambient temperature.

<u>Overview</u>

Results of research done recently at ISU and elsewhere, as described briefly herein, has served to further emphasize the value of supplemental fats for creating diets of high ME content for growing turkeys. This research has also shown that the economical use of supplemental fat to boost dietary ME should not be hindered by the notion that certain specific ME-to-protein ratios must be maintained in diets of growing turkeys. To the contrary, dietary ME and protein levels exert essentially independent effects on turkey performance and most carcass traits when used within "practical limits". "Practical limits" of fat use will be determined by the costs of supplemental fats versus other major energy sources, the expected economic benefits anticipated from the use of fats, physical limitations related to feed preparation and handling equipment, and concern about fat content of market turkeys.

With regard to carcass fat, recent data suggest that toms respond differently to a 2-week ME step-down program when finished in hot versus cool ambient temperatures. ME step-down was effective in reducing the accumulation of body fat of toms finished in hot weather but was not effective for toms finished in cool temperatures. Whether these differences are only related to differences in final body weights of finished toms remains to be determined. If body weight is a major factor in determining carcass fat, irrespective of short-term adjustments in dietary ME, the usefulness of a ME step-down program may be limited to instances in which toms are finished at relatively light body weights (i.e., less than 27 lbs).

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