FATS AND PROTEINS RESEARCH FOUNDATION, INC.

Director's Digest

FRED D. BISPLINGHOFF, D.V.M.
Director Technical Services

7150 ESTERO BLVD. • APT. 906
FT. MYERS BEACH, FL 33931
AREA CODE 813 — 463-4744

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IS KITCHEN GREASE SAFE FOR POULTRY?

Dr. Leo S. Jensen
Department of Poultry Science
The University of Georgia, Athens, GA 30602-2772

INTRODUCTION

The source of fat for producing feed grade fats has been changing rapidly in recent years. Initially, most of the fat came from shop fat and bone, packing house offal, and fallen animals. Now over half of the fat comes from restaurant grease which is primarily vegetable fat that has been used for deep frying of potatoes, fish, poultry, and other products. After about 100 hours of use in the restaurants the fat is discarded and made available for animal feed fats. As a result of the long exposure to heat, questions have been raised about the safety of the fat for feeding to poultry and other animals.

Many studies have been conducted in the past to determine the extent to which fats and oils are damaged by exposure to heat and/or oxidation. These studies have demonstrated that depending upon the severity of the heating and oxidation conditions, chemical changes occur in the fats and oils resulting in the appearance of a wide variety of by-products. These may or may not have detrimental effects on feeding value of the fats. Artificially exposing of fats to severe heating and oxidation conditions has been shown to result in compounds that can be toxic to laboratory animals. This prompted research on the safety of fried products for human consumption in the 1960's which concluded that fats heated in cooking were not harmful to people who eat them.

Subjecting fats to long heat treatment causes the polymerization of some of the triglycerides. Heating vegetable oils without oxygen leads primarily to carbon to carbon linkages between the triglycerides, while heating in the presence of oxygen leads to oxygen to carbon linkages. A mixture of both types may exist in restaurant grease. Investigators who have studied the thermal changes in vegetable fats indicated that the polymers formed by heating were probably not absorbed by animals. Therefore, the energy value of the fat may be lower for poultry. This has resulted in some discrimination against feed fats with higher levels of polymers.

Studies have been conducted in the Netherlands to evaluate the feeding value of fats with polymerized triglycerides for monogastric animals. Veen (1984) advised that a relatively low level of polymeric triglycerides should be permitted in waste fats fed to animals. On the hand, Janssen (1985) reported that the polymer content of feed fats had little influence on the metabolizable energy value of fats for poultry. He conducted several experiments involving fats of different composition. In one experiment, for example, he tested fats which contained levels of polymers of 2, 5, or 8% and found no negative effects of increasing polymer content on growth rate or feed efficiency of broilers. In other studies, in which feed fats containing as much as 22% polymers were used, neither performance nor metabolizable energy values of the fat were greatly affected.

The concern over the polymer content of feed grade fats prompted us to conduct some experiments on effect of restaurant heating on the value of the fat for feeding poultry. The chemical analysis of the fats used in the studies was done by Dr. Roger Garrett of Diversified Laboratories. The biological tests with broiler chickens were conducted by Dr. Linda Tufft as part of the work for her dissertation at the University of Georgia.

DESIGN OF EXPERIMENTS

Six different fat samples were obtained for use in the first study. Three fresh samples of vegetable fat delivered to different restaurants for use in deep frying were obtained and samples of the same three fats were secured after normal use in the restaurants. Chemical composition of these samples is shown in Table 1. Polymer content was increased in all samples as a result of the heating in the restaurants but the highest level reached was only 2.8%. There was some appearance of free fatty acids but the MIU content changed very little.

The six different samples were fed to one-week-old broiler chicks for a period of one week. Ten groups of eight birds were fed each of the fat samples. The total feed consumed and the total excreta voided were collected over a two-day period from each pen for analysis. Prior to the start of the feeding test all birds were fed a basal corn-soy diet containing 11% added fat which allowed the birds to become adjusted to a high-fat diet before testing the experimental fat samples. The same diet was fed during the test period but 10% of the control fat was replaced by the test fat. The feed and excreta were analyzed for total lipid content so that the digestibility of the fat could be determined. Also, these samples were analyzed for gross energy, moisture, and nitrogen to allow for the calculation of the nitrogen-corrected metabolizable energy content of the diets. The same fat samples were also fed to five-week-old broiler chicks maintained in individual cages for a period of one week in order to determine if age of bird influenced the utilization of the polymers.

In another study, additional quantities of one of the fresh samples (Sample C) was heated by Dr. Roger Garrett under controlled laboratory conditions in the presence or absence of air to simulate the typical time and temperature conditions found in commercial restaurants for deep fat frying. The samples were subjected to 195°C for approximately 96 hours. The fresh sample as well as the vegetable fat heated in the absence or presence of oxygen were fed in similar experiments to the same age birds as those used in the previously described study.

RESULTS AND DISCUSSION

The results of the feeding of new and used restaurant grease on performance of broiler chicks and metabolizable energy of the diet are shown in Table 2. There was no significant difference in body weight gain, feed efficiency, fat retention, or ME of the diet between the new and used fats within each sample at either the second or fifth week of life. Therefore, no evidence was obtained for a detrimental effect of the heating process in the restaurants on the quality of the fat for feeding to poultry.

The effect of heating fat in the presence or absence of oxygen on the performance of broilers and metabolizable energy of the diet and fat is presented in Table 3. Body weight gain and feed efficiency (gain ÷ feed) were not significantly reduced by the heated fat in the presence or absence of oxygen at either age period. Fat retention, however, was significantly reduced when the sample heated in the presence of oxygen was fed to the younger chicks. The metabolizable energy content of the diet, as well as that calculated for the fat, tended to be lower for the sample heated in the presence of oxygen, although the differences were not statistically significant (P>.05). Results indicate that if a fat is badly treated to result in a marked increase in the polymerized glyceride content (in this case 16%), a reduction in the metabolizable energy content of the fat will result.

CONCLUSION

Kitchen grease is safe for feeding to poultry. Vegetable oil heated under adverse conditions (exposed to high oxygen level) for a long period of time may reduce the metabolizable energy of the sample because of increased polymer formation. The small increase in polymer and free fatty acid content of samples used under normal conditions in restaurants has no discernible effect on the quality of the fat for feeding to poultry.

REFERENCES

Janssen, W. M. M. A., 1985. Polymer levels in commercial fats: their effect on energy level and performance of broilers. Voendervetten pp. 65-91. Centre for Poultry Research and Extension, the Netherlands.

Veen, W. A. G., 1984. Polymerized fat, feeding value and quantitative analysis. Fette Seifen Anstrichmittel 86:191-198.

TABLE 1. Chemical composition of new and used restaurant grease[1]

Determination	Sample					
	A		B		C	
	New	Used	New	Used	New	Used
Polymer content, %	.1	.8	.9	2.8	.5	2.1
Free fatty acids, %	0	.5	0	6.5	0	1.2
MIU[2], %	1.1	1.3	1.0	1.3	1.1	1.1
Stearic acid, %	18	13	6	6	17	16
Linoleic acid, %	4	8	34	31	11	11

[1]Determined by Roger Garrett.
[2]M = moisture, I = insoluble, U - unsaponifiable.

TABLE 2. Effect of feeding new and used restaurant grease on performance of broiler chicks and metabolizable energy (ME) of the diet[1]

Parameters	Sample					
	A		B		C	
	New	Used	New	Used	New	Used
Feeding period = 1-2 weeks						
Body weight gain, g	199	196	196	197	198	195
Gain/feed	.759	.762	.832	.803	.765	.773
Fat retention, %	88	87	91	89	89	91
ME of diet, kcal/g	3.33	3.30	3.30	3.37	3.41	3.34
Feeding period = 5-6 weeks						
Body weight gain, g	474	447	475	503	479	503
Gain/feed	.482	.455	.471	.501	.481	.514
Fat retention, %	82	77	91	86	87	88
ME of diet, kcal/g	3.30	3.21	3.49	3.52	3.39	3.53

[1]Feed fats were fed at a concentration of 10%.

TABLE 3. Effect of heating fat in the presence or absence of oxygen on the performance of broilers and metabolizable energy (ME) of the diet and fat

Parameter	Fat source		
	Unheated	Heated	
		O_2	N_2
Polymer content, %	.5	16.0	1.2
Feeding period = 1-2 weeks			
Body weight gain, g	215	212	212
Gain/feed	.80	.80	.80
Fat retention, %	90	81*	87
ME of diet, kcal/g	3.23	3.15	3.18
ME of fat, kcal/g	7.15	6.41	6.72
Feeding period = 5-6 weeks			
Body weight gain, g	440	468	504
Gain/feed	.51	.52	.55
Fat retention, %	93	89	91
ME of diet, kcal/g	3.22	3.14	3.22
ME of fat, kcal/g	8.35	7.51	8.33

*Significantly reduced (P<.05).