product is not palatable. Klose *et al.* (2) have reported that roasted carcasses of turkeys from groups fed beef fat, corn oil and soybean oil were essentially free of fishy off-flavors. In fact, if anything, the beef fat showed a stability better than the control diet.

Summary

White grease, prime tallow, and soybean oil have been fed to chicks and to turkey poults at the levels of 2.2 to 5.0%. No consistent improvement in growth has been observed with chickens. A slight improvement was noted with turkeys with prime tallow. However feed utilization was improved when the various levels of fat were fed to either chickens or turkey poults. The addition of fat to poultry feeds reduces the amount of dust and improves the texture and color of the feed.

Acknowledgment

The prime tallow and part of the white grease were supplied through the courtesy of Oscar Mayer and Company, Madison, Wis.

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[Received November 20, 1953]

Use of Animal Fats in Poultry and Dog Rations[1]

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WITH the decline in the market for animal fats in soap and other industrial uses in recent years, interest has been markedly increased for developing new uses for animal fats. One of the major new uses developed has been in animal feeds. The relatively low fat content of mixed feeds (approximately 5%) and the potential value of increasing the fat content of feeds prompted the initiation of intensive studies on the value of adding fats to dry dog meals and poultry rations three years ago.

In the course of these studies the effect of adding graded levels of animal fat (choice white grease) stabilized with an antioxidant mixture (butylated hydroxyanisole, propyl gallate, and citric acid) to the ration on the growth, maintenance, food utilization, and reproduction and lactation performance of dogs was investigated. Similar studies on the growth, food utilization, and general performance of chicks raised to broiler age were carried out. It also was of importance to determine the stability of vitamin A (fish liver oil) added to feeds containing either no added fat or 6% of stabilized fat. In addition, studies were conducted by L. R. Dugan and associates on the stability of animal fats treated with different antioxidants when added to feeds.

These studies were designed to obtain basic information of two types: a) the nutritional performance of dogs and chicks fed different levels of fats; and b) the prevention of rancidity and destruction of nutrients by stabilizing the animal fats in the feeds with suitable antioxidants.

The results of our studies clearly show that the performance of dogs (Cocker spaniels) fed 4% animal fat in addition to the basal ration (a total of 8% fat in the ration) was equal to or superior to the performance of dogs fed the basal ration. The performance of the dogs fed 6 or 8% added fat also was excellent while the performance of the dogs fed sucrose (equivalent in crude calories to 8% added fat) in addition to the basal ration was less satisfactory. The composition of the ration used, designed to include ingredients commonly used in commercial meals, is shown in Table I. This ration contained 29.1% protein and 3.7% fat.

TABLE I

Composition of Experimental Ration

Ingredient	%
Corn flakes	26.75
Wheat flakes	26.70
Soybean grits (HI-PRO-CON)	19.00
Meat and bone scrap	15.00
Fish meal (Menhaden)	3.00
Wheat germ meal (defatted)	5.00
Dried skim milk	2.50
A and D oil (Nopco xx2250 U.S.P. units A, 400 A.O.A.C. units D/gm.	0.50
Iodized salt	0.25
Brewers' yeast (non debittered)	0.50
Riboflavin supplement (BY-500)	0.80
	100.00

The results obtained in the growth studies (Table II) are for one of two experiments conducted. It will be noted here that the dogs fed 4% animal fat grew at a more rapid rate than those fed the basal ration while the performance of those fed 8% or sucrose approximated that for when the basal ration was fed.

TABLE II

Effect of Feeding Different Levels of Fat on the Rate of Gain

Ration	No. of Dogs	Avg. Gain/Wk.
		grams
Experimental Ration	7	339
Experimental Ration + 4% Fat	7	360
Experimental Ration + 8% Fat	6	334
Experimental Ration + 18% Sucrose	5	328

Food consumption data showed that the fat and sucrose supplements were well utilized. Subsequent studies were conducted on the maintenance and reproduction and lactation performance of these dogs. Pertinent results are tabulated in Table III.

Food and caloric utilization during the first four weeks of lactation (based on weight change of the

[1] Journal Paper No. 80, American Meat Institute Foundation. Presented at the 27th Fall Meeting, American Oil Chemists' Society, Chicago, Nov. 3, 1953.

TABLE III

Reproduction and Lactation Performance of Dogs Fed Graded Levels of Animal Fat

Ration Fed	Supplement to Basal Ration			
	None	4% Fat	8% Fat	18% Sucrose
No. Pups born	54	51	49	27
No. Weaned	43	47	38	14
Avg. Birth weight, g.	234	250	193	190
Avg. weight 4 weeks, g.	1030	1196	951	908
Avg. weight 6 weeks, g.	1516	1722	1362	1226

female and pups, and the total food consumption) showed that the addition of fat increased the food utilization (weight increase per unit weight of food consumed) and caloric utilization (weight increase per unit of crude calories consumed) over that observed for the basal ration while some decrease in food and caloric utilization was noted with the sucrose supplement. Thus, with the additional stress of reproduction and lactation, the performance of the dogs fed sucrose was inferior to that for dogs fed the added animal fats. These results suggest that the fat improved the performance by more than merely providing calories and that the fat additions actually increased the efficiency of utilization of other nutrients from the basal ration.

Studies with chicks fed a basal ration (Table IV) to which 2 to 8% animal fat was added also showed that these fat supplements were well utilized. The basal ration used in these studies contained 23.4% protein and 3.7% fat.

In duplicate experiments the growth rate of chicks was either the same or slightly increased when fat was added in 9-10-week tests (Table V).

TABLE IV

Composition of Basal Ration for Chicks

Ingredient	%
Yellow corn, ground	65.2
Soybean grits (solvent extracted)	11.0
Meat scrap	8.0
Fish meal, Menhaden	8.0
Blood meal	2.0
Corn gluten meal	2.0
Alfalfa leaf meal, dehydrated	2.0
Butyl fermentation solubles (BY-500)	1.0
Fish oil (2250 A-400 D per gram)	0.3
Iodized salt	0.5
$MnCl_2 \cdot 4H_2O$	320 mg/Kg
Niacin	20 mg/Kg

TABLE V

Effect of Level of Fat on Growth Rate of New Hampshire Chicks (25 chicks/group)

% of Fat Added	Ration Used		
	Basal	Basal + 0.2% Choline	Basal + Choline and Antibiotic + B_{12}
	wt. in grams at 10 weeks		
None	1367	1348	1352
2	1357	1415	1426
4	1414	1432	1375
8	1477	1379	1371

Further, while choline and antibiotic + B_{12} supplements stimulated early growth of the chicks in one of the two experiments, no significant advantages of these supplements were evident with any of the levels of fat added at the end of the experiment.

Other evaluations showed that the amount of feed required per pound of gain was reduced when the fat level was increased (Table VI) and, as a consequence of the increased caloric density of the ration, excellent caloric utilization was observed.

TABLE VI

Effect of Feeding Graded Levels of Fat on Food and Caloric Efficiency (9-wk. period)

% of Fat Added	Food Efficiency	Caloric Efficiency
Basal Ration		
None	.39	11.1
2	.40	11.0
4	.40	10.6
8	.43	10.9
Basal + Choline and Antibiotic + B_{12}		
None	.40	11.4
2	.42	11.5
4	.42	11.1
8	.44	11.2

A limited number of observations indicated that the carcass quality was excellent. It is also of interest that when 8% fat was fed, the fatty acid composition of the depot fats of the birds reflected the dietary treatment (Table VII).

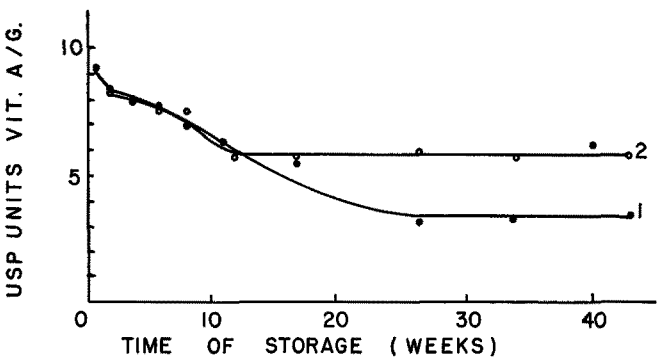
Duplicate sets of rations used in the dog studies that contained no added fat or 6% stabilized animal fat were stored at room temperature for one year and the vitamin A stability was measured during this period. Representative data are shown in the accompanying figure. It will be noted that no difference in

TABLE VII

Effect of Dietary Treatment on the Fatty Acid Composition of the Chicken Depot Fats [a]

Diet	Linoleic Acid	Oleic Acid	Iodine Value
	% of the total fatty acids		
Basal	18.8	44.4	80
Basal + 8% Fat	12.2	52.8	74

[a] Conducted in collaboration with L. R. Dugan and associates.



Vitamin A stability of rations stored for varying periods at room temperature.

Curve 1—Basal ration. Curve 2—Basal ration + 6% stabilized animal fat.

stability of vitamin A was evident during the first 12 weeks of storage while the addition of antioxidant treated fats to the ration maintained higher vitamin A stability during the remainder of the storage period. Further no evidence of rancidity was evident up to one year in the feeds that contained stabilized fat.

These nutritional findings as well as other potential advantages of adding animal fats to feeds (control of dustiness, increased palatability, decreased wear of mixing and pelleting machinery, etc.) have prompted feed manufacturers to add animal fats in commercial feed production. An evaluation of the potential market for animal fats clearly shows that large amounts of fats can be utilized in commercial feeds.

[Received November 20, 1953]