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## FEEDING FISH MEALS TO PULLETS

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A number of feeding tests with chicks were conducted at the College Park Laboratory of the Fish and Wildlife Service to determine, among other objectives, whether feeding comparatively large quantities of commercial grade and experimentally spoiled fish meals would adversely affect the flavor of the flesh. Lanham and Nilson (1946) reported that no fishy or other off flavors were noted, except in a very few instances, in the flesh of 6-week old chicks fed diets containing about 30 percent fish meal. It was then thought desirable to determine whether feeding large quantities of meal would adversely affect the flavor and color of the eggs or the flesh of older birds. The premise was that if comparatively large quantities had little or no effect, smaller amounts would be even less liable to produce off flavors or undesirable color.

The pullets used were selected from series 10 of the chick-feeding experiments reported by Lanham and Nilson (1946). They were Barred Plymouth Rocks that were hatched August 12, 1941, and fed various experimental diets for a 6-week period. During this interval they were housed in battery cages fitted with screen floors in groups of 10 or 11. The cages were in a room maintained at 80° F., and each cage had brooding facilities.

Except for one group fed a commercial type growing mash (Almquist, Jukes and Newlon, 1938), the pullets were fed a semi-purified diet containing a quantity of commercial pilchard meal equivalent to 22 percent crude protein. Dextrin, sugar, and lard were used as sources of calories. The previously mentioned experiment was terminated on September 24, and on September 27 selected pullets were allotted to the following experiment.



The birds were at first kept individually in battery cages, but later they were transferred to 12 individual laying cages. Two birds were selected for each of six groups. A cockerel was selected by mistake for the group fed the commercial pilchard meal diet. It had an initial weight of only 127 grams but gained to a weight of 2526 grams on February 13, when it was killed and dressed. The flesh had no fishy flavor.

The pullets that received the growing mash during the previous experiment were fed the same ration during this experiment also. For the others, the ration, in parts by weight, consisted of the following:

Alfalfa meal - 2.5	Dried brewer's yeast - 1.0	Pilchard meal - 25	Soybean oil - 1.0
Cod liver oil - 1.0	Ground yellow corn - 68	Salt - 0.5	Wheat germ - 1.0

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This ration was very similar to that used previously, except that corn meal was used as the chief source of energy. The corn and alfalfa meals also furnished a fair quantity of vegetable protein. For one group, 2 percent liver extract was substituted for an equal weight of corn meal.

Commercial pilchard meal analyzing about 70 percent crude protein was used as the principal source of protein. This was replaced on an equal weight basis by 100, 20, and 10 percent of experimentally spoiled meal also analyzing about 70 percent crude protein. The latter was fed in order to determine whether meal that had a stronger odor would be more likely to produce off flavors in eggs and flesh. The meal was spoiled under conditions of high heat and humidity in an aerobic environment and then dried at a temperature under 120° F. Previous experiments had shown that certain vitamins, and possibly other growth-promoting factors, were synthesized during spoilage. These growth-promoting factors had been found to be water soluble (Lanham and Nilson, 1946).

The pullets grew satisfactorily and began laying between January 17 and February 10 (Tables 1 and 2). The eggs were of normal size for pullets, and the color of the yolks was commercially acceptable, although not as deeply colored as would be expected from a ration that contained so much yellow corn meal. The flavor of all the eggs was very acceptable with no traces of off flavors.

Table 1 - Data on Gain in Liveweight, and Feed Intake of Pullets Fed Rations Containing 25 Percent Commercial or Spoiled Pilchard Meal and Growing Mash, from October 27 to Date Indicated

Diet designation	Pullet number <sup>1/</sup>	Liveweight		Date reached	Gain in liveweight	Feed intake	Feed per gram gain
		Initial	Maximum before laying				
		Grams	Grams		Grams	Grams	Grams
Growing mash	135	540	2166	1-30	1626	11098	6.83
	200	637	2175	2-13	1538	11524	7.49
Commercial pilchard meal:							
No addition	147	181	2384	2-13	2203	12069	5.48
Two percent liver extract	192	761	2579	1-16	1818	10149	5.58
	195	616	2366	2-13	1750	8909	5.09
Twenty percent spoiled meal substituted for commercial meal	107	692	2484	1-30	1792	8979	5.01
	183	700	2491	1-30	1791	9776	5.40
Ten percent spoiled meal substituted for commercial meal	108	594	2369	2-13	1775	9442	5.32
	163	607	2185	2-13	1578	9353	5.93
Spoiled pilchard meal	165	617	2019	1-16	1402	7399	5.28
	182	717	2597	2-13	1880	10881	5.79

<sup>1/</sup>Pullets 135 and 200 were fed similar, and 147, 192, and 195 were fed analogous diets during the first 6 weeks period. Pullets 107 and 108 were fed a commercial pilchard meal diet, plus water extract, equivalent to 10 percent spoiled meal. Pullets 182 and 183 were also fed the diet containing water extract, but with the addition of 10 mg. pantothenic acid per 100-gram diet. Pullets 163 and 165 were fed the diet in which there was a substitution of 10 percent spoiled meal for commercial meal.

Since the fish meals had no adverse effect on the flavor of the eggs, it was considered desirable to determine whether the fertility and growth of the second generation chicks would be influenced by the meals fed. Some of the pullets were artificially inseminated on February 13, and all of them were inseminated on February 17 and again on February 24. The pullets, since hatching, had been kept under close confinement, and their muscles were very flabby. Consequently, the

insemination operation was difficult; and although the operator had had considerable successful practice in this technique, the pullets almost immediately discontinued laying for an extended period, and two died. Usually, range-fed pullets are used in artificial insemination experiments because their muscles have better tone from exercise. It was obvious that this part of the experimental work could not be continued.

The data in Table 1 that deal with feed intake and gain in liveweight are limited to the period of constant gain because most of the pullets lost weight after they began laying or after insemination. The loss of weight after artificial insemination was particularly marked with some pullets. Within the limits of variability for such small groups, the data indicate that all of the rations were approximately equal in producing gain in liveweight.

The surviving pullets were fed their respective rations until they began to lay again. Further observations confirmed the earlier ones that none of the eggs was off flavored and the color of the yolks was commercially acceptable.

Table 2 - Data for Egg Production of Pullets

Diet designation	Pullet number	Date first egg	Eggs per month				Artificial insemination	
			Jan.	Feb.	Mar.	Apr.	Date first insemination	Days not laying
Control mash	135 <sup>1/</sup>	1-26	4	12	13	6	2-13	22
	200 <sup>2/</sup>	1-25	4	12	5		2-13	23
Commercial pilchard meal: No addition	147 <sup>3/</sup>	2-10	-	9	-	-	2-17	-
	Two percent liver extract	192 <sup>1/</sup>	1-17	8	9	5	8	2-13
195 <sup>4/</sup>		2-7	-	6	-	-	2-17	-
Twenty percent spoiled meal substituted for commercial meal	107 <sup>1/</sup>	1-30	2	6	5	4	2-13	38
	183 <sup>5/</sup>	1-29	2	7	11	4	2-13	24
Ten percent spoiled meal substituted for commercial meal	108 <sup>1/</sup>	2-8	-	8	4	2	2-17	34
	163 <sup>1/</sup>	1-25	5	8	3	3	2-13	27
Spoiled pilchard meal: No addition	165 <sup>1/</sup>	1-17	5	2	3	3	2-13	43
	182 <sup>1/</sup>	1-30	1	3	6	2	2-17	33

<sup>1/</sup> Killed and dressed shortly after April 10.

<sup>2/</sup> Killed and dressed on April 27.

<sup>3/</sup> Died as result of internal hemorrhage shortly after first insemination.

<sup>4/</sup> Died on February 27 as a result of broken egg in abdomen.

<sup>5/</sup> Killed and dressed March 30.

All of the pullets were killed late in March and early in April. They were dressed and distributed to various staff members, who reported on taste tests. All reported that the flesh was very tender, and the flavor was satisfactory. Incidentally, practically all of the pullets, before the close of the experiment, regained the weight that had been lost. There was no report of any fishy or other off flavor.

It was noted that the color of the legs and skin of the birds was very bleached, except for those birds fed the 100 percent level of spoiled pilchard meal. Normally, the yellow color is very deep when the ration that is fed contains so much yellow corn meal. The color of the legs and skin of the birds fed the growing mash was also bleached. Numerous experiments have been reported elsewhere concerning the bleaching effect of rations containing fish meal or meat scraps. This

finding, therefore, was not unexpected, especially with the rations containing so much fish meal. The significance of the darker color of the legs and skin of pullets fed the ration containing the 100-percent level of experimentally spoiled meal was not studied further, since it is not a recommended practice to treat meal in that manner before feeding.

The number of birds included in this experiment is very small, but the results consistently show that the various fish meals did not produce fishy or other off flavors in either eggs or flesh. This means that up to 10 percent fish meal can be included in farm or commercial rations that are to be fed to poultry, with the assurance that there will be no undesirable effects.

The bleaching effect of fish meals on the color of the legs, skin, and egg yolks must be recognized. It is notable, however, that even when large quantities of fish meal were fed in these tests, the yolk color was rated commercially satisfactory by experienced neutral observers. Of course, part of the color might have been due to the high percentage of yellow corn meal in the rations. The yolks of the eggs laid by those pullets fed the commercial-type growing mash had a depth of color similar to that of the egg yolks from the birds fed the experimental diets containing high levels of fish meal. Thus, although the commercial-type mash probably had less bleaching action because it contained less fish meal and meat scrap, the color of the yolks was not different because this mash also contained less yellow-pigment-carrying corn and alfalfa.

The yellow color of the legs and skin of all the birds used in these experiments was much paler than would ordinarily be the case with farm-raised pullets of the same breed. It is doubtful, however, that the lighter color would reduce commercial acceptability, since it was not unattractive. In fact, this bleaching effect might be desirable with the Mediterranean and English breeds, which have black pigmented legs and white skin.

#### CONCLUSIONS

1. The flesh of pullets that have been fed rations containing about 25 percent of commercial, or experimentally spoiled, pilchard meal or mixtures of both does not have a fishy or other off flavor.
2. The eggs have a satisfactory flavor.
3. The color of the yolks is commercially acceptable.
4. There is less yellow pigment in the legs and skin of pullets when these birds are fed rations containing fish meals, the degree of bleaching depending on the relative contents of fish meal and feeds carrying yellow pigment in the rations fed.

NOTE: An article by Drs. Max Rubin and H. R. Bird, entitled "The Apparent Antagonism Between Vitamin A and Carotinoids in the Fowl," appeared in *Science*, 103: 584-585 (1946). Their paper presents evidence that the bleaching effect may be caused by vitamin A, that carotene fed at comparable levels does not exert a suppressing effect on pigmentation, and that the inhibition of pigmentation occurs when there is a sufficiently large bodily store of vitamin A and is not an exclusively intestinal phenomenon. However, our results indicate that the degree of bleaching is not commercially serious even when large proportions of fish meal are fed.



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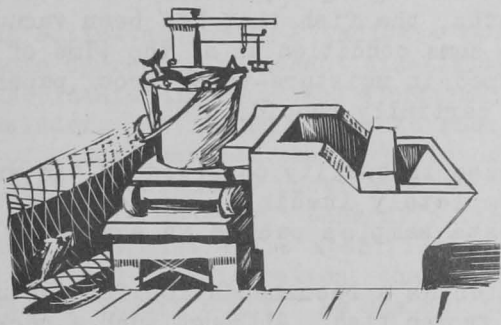
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