FISHERY PRODUCTS AS A SOURCE OF ANIMAL PROTEIN[1/]

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ABSTRACT

THE PROTEINS OF FISH AND SHELLFISH ARE OF HIGH NUTRITIVE QUALITY AND ARE HIGHLY DIGESTIBLE. THE NUTRITIVE QUALITY IS THE SAME IRRESPECTIVE OF THE SPECIES OF FISH OR SHELLFISH (AT LEAST THOSE COMMONLY USED FOR HUMAN CONSUMPTION) AND OF THE METHODS OF COOKING OR PROCESSING USED. CONSUMPTION OF FISHERY PRODUCTS IS LARGELY DETERMINED BY CONSUMER PREFERENCES. ANY FORESEEABLE DEMAND CAN UNDOUBTEDLY BE SUPPLIED BY DOMESTIC PRODUCTION AND A REASONABLE QUANTITY OF FOREIGN IMPORTS.

INTRODUCTION

For several years the U. S. Fish and Wildlife Service has emphasized that the nutritive quality of the proteins of fishery products is the same irrespective of the species of fish and shellfish (at least those commonly used for human consumption), and of the cooking methods used or the type of processing. Furthermore, fishery products are equal in nutritive quality to the proteins of competing animal protein foods, namely, dairy products, meats, and poultry.

A second generalization has also been formulated, namely, that the proteins of fish and shellfish are uniformly very digestible, and that this level of digestibility is similar to that of competing animal protein foods.

NUTRITIVE QUALITY

Two approaches have been used to determine the nutritive quality of proteins.

The content of the various amino acids have been determined by Pottinger and Baldwin (1939), Lopez-Matas and Fellers (1948), Deas and Tarr (1949), Nielands and associates (1949), Dunn and associates (1949), and others. The conclusions drawn by Nielands and associates seem to summarize the findings by the various investigators. Lysine, methionine, and tryptophan are the three so-called essential amino acids most important in evaluating the quality of a protein. The proteins of the eight canned fishery products and three meats which they tested were found to be very good sources of lysine, and good sources of methionine, tryptophan, and the other essential amino acids. There did not seem to be any appreciable difference in the amino acid content of the different proteins tested. The data also show no significant effect of heat processing on the content of the essential amino acids of the samples which were analyzed.

At the present time the analytical methods used often give data which are more valuable for making comparisons than for expressing the true amino-acid content. A typical analysis of fish meat for the so-called essential amino acids would probably yield results about as follows:

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Amino Acid	% of Protein (N[1] x 6.25)	Amino Acid	% of Protein (N[1] x 6.25)
rginine	5.8	Methionine	2.7
istidine	1.6	Phenylalanine	4.0
soleucine	5.5	Threonine	4.3
eucine	7.3	Tryptophan	1.2
ysine	8.2	Valine	5.1

/NITROGEN.

All fishery products are probably very similar in amino-acid content.

The second approach has been to determine the nutritive quality of the protein by means of animal feeding tests. Experiments of this type have been conducted by anham and Lemon (1938), Nilson and associates (1946, 1950, 1948, 1947), Lopez-Matas nd Fellers (1948), and others. The data indicate that there are no essential differences in respect to quality of the proteins of the various species of fish and shellfish, between fishery products cooked by different methods, or those processed by freezing, canning, smoking or dehydration. These experiments were carried out by feeding rats diets containing low levels of the test protein in order to insure se of the protein for tissue-building purposes as much as possible. Some studies ave also been carried out according to the nitrogen balance method. The data from hese are essentially similar to those obtained through studies with growing animals.

It may be concluded from these studies that fishery products contain proteins hich are of high quality and are at least equal to those from the various species f farm animals or poultry.

Wilson (1949) reported that four girls who ate a fish or shellfish dish at the noon meal, and who refrained, or largely refrained, from eating meat or fowl during he other meals, had similar red cell counts, hemoglobin values, and hematocrit to hose of two girls who ate free-choice diets.

The period of test was seven weeks. Although the results may only be considered ndicative, they corroborate the data from animal experiments which indicate that the emopoietic value of fishery products is equal to the task of supplying the body with normal blood supply.

DIGESTIBILITY

Nilson and associates (1947 and 1950) have determined the apparent or true digestibility of the proteins of quite a few fishery products. The data indicate that n most instances the proteins are digested in excess of 90 percent. This means hat the proteins of fishery products are very well digested, and very similar in his respect to competing animal proteins.

SATIETY VALUE

Some work has been done on factors which may determine the satiety value of oods. It is well known that certain meats have a very high satisfaction value. ther foods, particularly lamb; poultry; dairy products, such as cheese; and fish ave a lower satiety value. Studies have been carried out by Marks (1943), Filert (1949), and Krieder (1950) in the Service's Fishery Technological Laboratory t College Park to determine factors affecting the satiety value of foods. So ar it appears that some fishery products are very quickly digested and this may

cause low satiety value. In most cases there was no great difference in stomach and intestinal evacuation time in the rat between the fish and the meats used as controls. Evacuation time may not be as important a factor as has been indicated in the literature. No important physiological factors have been found in the experiments so far conducted to account for differences in the satiety values of foods. Although all avenues in this approach have not yet been investigated, it may be necessary to consider chemical differences, particularly in the protein or nitrogenous extractives, to account for the satisfaction quality of the food.

PROTEIN CONTENT OF PREPARED FISH DISHES

Incidentally, very few data are available in the literature on the protein-content of dishes made from fishery products as prepared for the table. Lee (1950) has analyzed about 400 samples in the past two years. The data indicate that the dishes can be classified into four groups in respect to protein content.

(a) Pan fried, oven fried, baked, or broiled fish and some cooked shellfish dishes usually contain 22 to 24 percent protein, and all of it is from the fishery product used.

(b) Fish loaves, cakes, and casserole dishes in which the fishery product used is not greatly diluted with potatoes, crumbs, or other ingredients, and fish or shellfish served with sauces or stuffings contain 16 to 20 percent protein of which 85 to 90 percent is derived from the fishery product.

(c) Most salads, canapes, creamed dishes on toast, au gratin dishes, souffles, the more diluted fish cakes and loaves, and the more concentrated chowders and soups contain from 10 to 15 percent protein of which 75 percent is derived from the fishery product used. Milk, eggs, and cheese are the principal secondary sources of protein.

(d) Most chowders, stews, bisques, some salads, and shrimp and crabmeat creoles, curries, jambalayas, or similar dishes containing rice contain 5 to 10 percent protein of which 75 to 80 percent is derived from the fishery product. The low protein content in these dishes is due to a high water or high carbohydrate content or a combination of both.

PROTEIN CONSUMPTION

From the standpoint of the nation's food supply it has been calculated from the data supplied by the U. S. Department of Agriculture (1950) that the average per-capita consumption of proteins was 93 grams per day in 1949, which amounts to 74.8 pounds per year. Of this quantity, 39.6 pounds or 52.9 percent was animal protein. Fishery products supplied 2.1 pounds of protein. The protein of fishery products, therefore, amounts to 2.8 percent of the total protein intake or 5.3 per percent of the total animal-protein intake. This quantity most certainly can be increased since it is not due so much to a lack of available supply, except in certain areas, as it is due to a comparatively low level of consumer acceptance in comparison with dairy products (18.2 pounds protein), meats (15.5 pounds protein), and poultry products (3.8 pounds protein per year).

The U. S. Fish and Wildlife Service has estimated that any foreseeable demand for fishery products can be satisfied by domestic production and a reasonable quantity of imported fishery products.

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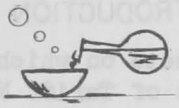
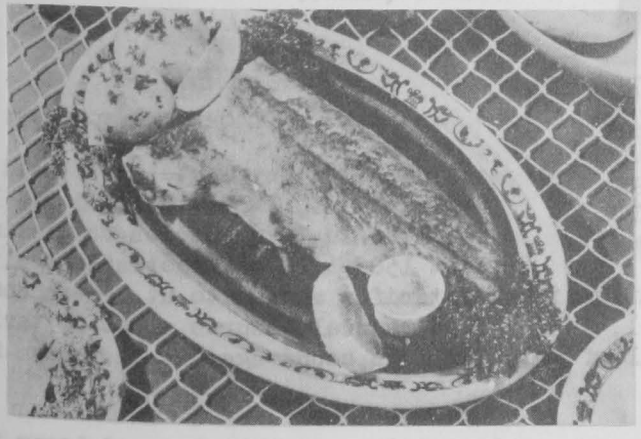


PLANKED WHITEFISH

3- OR 4-POUND WHITEFISH, DRESSED
1 1/2 TEASPOONS SALT
1/8 TEASPOON PEPPER
1/4 CUP BUTTER OR OTHER FAT, MELTED
SEASONED MASHED POTATOES
SEASONED COOKED VEGETABLES (PEAS, CARROTS, CAULIFLOWER, TOMATOES, OR ONIONS)

If hardwood plank is used, oil well and place in a cold oven and heat thoroughly as oven preheats.

Clean, wash, and dry fish. Sprinkle inside and out with salt and pepper. Brush with melted fat. Place fish on the hot, oiled plank or on a greased oven-glass or metal platter. Bake in a moderate oven 400° F. for 35-45 minutes or until fish flakes easily when tested with a fork. Remove from oven and quickly arrange a border of hot mashed potatoes around fish. Place in a preheated broiler until potatoes are slightly browned, about 5 minutes. Remove and arrange two or more hot vegetables around fish. Garnish with parsley and lemon or tomato wedges. Serve immediately on the plank. Serves 6.



A Fish and Wildlife Service tested recipe. This is one in the series of recipes using fishery products tested and developed in the Service's test kitchens.