DEPARTMENT OF THE INTERIOR

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Fishery products should be used freely as a main source of protein, or as a supplementary protein, to balance the deficiencies of less nutritive proteins which may be included in the average dietary.

This candid recommendation is based upon conclusions reached in a recent study by S. R. Pottinger and Willis H. Baldwin, technologists of the Fish and Wildlife Service, United States Department of the Interior. Because fish flesh is a common constituent of the human diet, and since it is eaten primarily as a source of protein, this investigation was undertaken to determine the comparative nutritive values--for bodily growth and maintenance--of the edible portion of a number of common fish and shellfish, by examination of the amino acid content--or "quality factor"--of their proteins.

"With respect to nutritive value," according to the authors, "the content of the five amino acids studied indicates that the proteins of fish, shellfish, and crustacea compare very favorably with those of casein (milk), beef, and egg albumin (white portion). Together with the ample supply of certain essential amino acids, minerals, and vitamins found in these seafoods, and the high nutritive quality and digestibility of the proteins, this group of food products may be classed among the more desirable."

For the maintenance and well-being of the human body, certain components are essential--such as carbohydrates, fats, minerals, vitamins, and proteins. Each of these has its place in keeping the body properly nourished, and any lack or deficiency of one may cause subnormal growth.

The proteins are a very complex class of organic compounds which are built up from a number of somewhat simpler compounds called amino acids. These acids are built up principally of combinations of carbon, hydrogen, oxygen, and nitrogen, and in some cases sulfur and iodine. Proteins, therefore, differ from fats and carbohydrates in that the latter do not contain nitrogen, sulfur, or iodine.

Many different kinds of proteins are found in the various types of foods. They are an essential part of plants, many of the body fluids, and of animal tissue. The flesh of fish, which consists chiefly of water, proteins, and more or less fat, is made up of a complexity of different proteins which in turn are built up from amino acids.

"Vegetable life can form protein material from carbon, oxygen, hydrogen, and nitrogen," the study explains. "Human beings can do this only to a limited extent. In order for them to grow and live properly, they must have available a supply of amino acids; and the source of these amino acids is the protein material which is found in their food. The manner in which these proteins are turned into amino acids and again converted into proteins in the body may be compared to the dismantling of a house and the rebuilding of another house from the material. That is, the first house is taken apart in order to supply the necessary building material for the second one. Likewise, the digestion of proteins is a dismantling process in which these materials are broken down into their various amino acids. These are then

absorbed and carried to various parts of the body, where they are rebuilt into the necessary proteins required by the body.

All living cells or proteins are continually undergoing wear and tear; and in order for a human being to live properly, new proteins must be built as fast as old ones are worn out or destroyed. To accomplish this building, the amino acids are necessary and, while a large number are known, less than half are considered to be essential.

There are no entirely satisfactory methods for determining how much of these amino acids is present in a certain protein. However, there are methods that are fairly satisfactory for the determination of lysine, arginine, histidine, and tryptophane and, as these amino acids are thought to be representative of the other essential ones, they were picked for the work done.

"Our data show the proteins of fish, shellfish, and crustacea, as a group," conclude Pottinger and Baldwin, "to be good sources of the essential amino acids studied. Those of blue crab and shrimp are excellent sources of arginine, and those from halibut and red snapper are also comparatively rich in this amino acid. Boston mackerel, oyster, silver salmon, cod, halibut, and mullet proteins are good sources of histidine.

"Lysine is found in large amounts in the proteins of shrimp, lake trout, Boston mackerel, sea herring, and cod. The proteins of oyster, halibut, silver salmon, Spanish mackerel, and Boston mackerel yield satisfactory amounts of tryptophane. The cystine content does not vary to any great degree, ranging from halibut protein, with 1.45 percent of this amino acid, to 1.15 percent for the protein of croaker and pink salmon.

"The protein of milk, which is largely casein, is considered to be of very satisfactory nutritional value. Other animal proteins, such as those of

meat and eggs, are also considered as being of good quality. Comparing our general analytical results, then, it will be seen that the proteins of fish, shellfish, and crustacea compare very favorably with casein, beef, and egg albumin in the content of the five amino acids studied."

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