



Lower ratio of n-3 to n-6 fatty acids in cultured than in wild fish^{1,2}

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ABSTRACT Fish are the major dietary source of very-long-chain n-3 polyunsaturated fatty acids. We investigated whether cultured fish contain fewer n-3 fatty acids than do wild fish. Fifty-eight trout, 51 eel, and 5 salmon were collected from fishermen and hatcheries throughout Europe, pooled into 23 lots (8 of wild and 15 of cultured fish), and analyzed. The ratio of n-3 to n-6 polyunsaturates was significantly lower in cultured than in wild fish (2 vs 7 in trout, 2 vs 5 in eel, and 6 vs 11 in salmon). Hunted fish are a better source of n-3 polyunsaturates than are cultured fish. *Am J Clin Nutr* 1990;51:1-2.

KEY WORDS Fish, diet, polyunsaturated fatty acids, linoleic acid, eicosapentaenoic acid, food composition

Introduction

Fish are a rich source of the very-long-chain n-3 fatty acids eicosapentaenoic and docosahexaenoic acid. They acquire these fatty acids partly from the food chain and partly through endogenous synthesis from ingested α -linolenic acid (C_{18:3n-3}). With fishing grounds becoming depleted, hunted fish are increasingly replaced by pond-reared fish that are fed commercial feeds. Such feeds often contain a lower proportion of n-3 fatty acids than do natural food. Because n-3 fatty acids may lower the risk of coronary heart disease, we wanted to know if cultured fish contain fewer n-3 fatty acids than wild fish. Reports on this are scarce and contradictory, with no more than 6-18 fish having been analyzed at a time (1-3). We therefore examined the fatty acid composition of wild and cultured European trout, eel, and salmon.

Materials and methods

To avoid uncertainties regarding the origin of the fish, the first author collected most of the 114 fish in person from hatcheries and fishermen in The Netherlands or the FRG or through trusted intermediaries from Norway, Ireland, and Sweden. Fish were collected in 1987 between September and November, when the fat content of wild fish tends to be at its maximum. We were unable to obtain trout that was verifiably wild. The wild trout reported on here had been raised in a hatchery and planted out at the age of 1 y. They had lived in the wild for \geq 8 mo, during which time their weight had about doubled.

Lots of several fish were usually collected from each source. The number of fish per lot was 2-7 (median 6) for cultured trout, 3 for wild trout, 4-6 (median 6) for cultured eel, 6-11 (median 6) for wild eel, 1 for cultured salmon, and 1 or 2 for wild salmon. After removal of the viscera, head, and skin and for trout and salmon removal of the bones, fish from one lot were pooled, ground, and homogenized with water. Lipids were extracted with added *t*-butylhydroquinone as an antioxidant (4), and fatty acids were transesterified (5) and analyzed by capillary gas chromatography (6).

Results and discussion

As shown in Table 1, cultured eel and salmon contained \sim 50% more fat than do their wild counterparts; for trout, which is by nature a low-fat species, there was no significant difference. For all three species, the n-3 to n-6 fatty acid ratio was two-to-three-times higher in the wild than in the cultured species.

Our observations call to mind Crawford's (7) report that wild land animals contain less fat and more essential fatty acids than do domestic animals. Evidently hunted

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TABLE 1
Fat content and fatty acid composition of wild and cultured trout, eel, and salmon*

	Trout (<i>Salmo gairdneri</i> and <i>Salmo trutta fario</i>)		Eel (<i>Anguilla anguilla</i>)		Salmon (<i>Salmo salar</i>)	
	Wild (n = 2)	Cultured (n = 9)	Wild (n = 4)	Cultured (n = 4)	Wild (n = 2)	Cultured (n = 2)
Fat (g/100 g)	5 ± 3	6 ± 1	21 ± 6	30 ± 2†	10 ± 0.1	16 ± 0.6‡
Fatty acids (g/100 g fatty acid)						
18:3 n-3	3 ± 2	1 ± 0.3‡	2 ± 2	1 ± 0.3	1 ± 0.1	1 ± 0.1
20:5 n-3	7 ± 0.6	4 ± 1‡	4 ± 2	3 ± 0.6	5 ± 0.2	5 ± 0.1
22:6 n-3	15 ± 2	13 ± 1†	4 ± 2	6 ± 0.4	10 ± 2	7 ± 0.1†
Other n-3§	5 ± 0.6	2 ± 0.7‡	3 ± 1	2 ± 0.2†	3 ± 0.5	4 ± 0.1
18:2 n-6	4 ± 3	9 ± 2‡	2 ± 2	5 ± 0.3‡	1 ± 0.1	3 ± 0.1
Other n-6	1 ± 0.4	0.6 ± 0.1‡	2 ± 0.3	0.4 ± 0.1‡	0.2 ± 0.1	0.5 ± 0.1
Sum of n-3	30 ± 0.2	20 ± 3‡	14 ± 3	12 ± 1	20 ± 2	17 ± 0.2
Sum of n-6	5 ± 3	9 ± 2†	3 ± 1	6 ± 0.3‡	2 ± 0.1	3 ± 0.1‡
n-3:n-6	7 ± 5	2 ± 0.6‡	5 ± 2	2 ± 0.3†	11 ± 2	6 ± 0.1†


* $\bar{x} \pm SD$. n, number of lots; each lot consisted of about six trout or eel or one or two salmon.

† $p < 0.05$ compared with wild fish.

‡ $p < 0.01$ compared with wild fish.

§ 18:4 n-3 + 20:3 n-3 + 22:5 n-3.

|| 20:4 n-6 + 22:4 n-6.

fish are also a better source of n-3 fatty acids than are their cultured counterparts. 

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