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SEAFOOD (WILD AND FARMED) FOR THE ELDERLY: CONTRIBUTION TO THE DIETARY INTAKES OF IODINE, SELENIUM, DHA AND VITAMINS B12 AND D

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Abstract: A large body of published data was analyzed to determine the concentrations of DHA, vitamins B12 and D, iodine, selenium in seafood (finfish and shellfish, wild and farmed, seawater and freshwater). The data on apparent consumption per inhabitant were taken from statistics prepared by OFIMER. This was used to determine the mean consumption of the main products of seafood in France in 2004 and the mean intakes of people aged 65 years and over. Not enough seafood is consumed by older people, according to the French recommended dietary allowances (french RDA), seafood provides 25% of the vitamin D RDA, 56% of the vitamin B12 RDA, 28% of iodine RDA, 23% of selenium RDA and 203% of DHA french RDA. For DHA, mean intake is aprox. 100% of international RDA. Seafood is the only class of food that provides major fractions of all these elements. We therefore recommend that older people increase their consumption of seafood to counteract the potential problems due to the low concentrations of these elements in their usual diets; this could overcome a potentially major public health problem. All elderly people would benefit from an increased intake of vitamin D and B12, iodine and selenium. Although some segments of the population seem not to lack DHA, others, such as those whose socio-economic positions or life styles restrict their seafood intakes, would benefit greatly from an increased intake of this omega-3 polyunsaturated fatty acid.

Key words: Seafood, fish, shellfish, omega-3 fatty acids, (n-3) fatty acids, ALA, DHA, iodine, selenium, vitamin D, cobalamin.

Introduction

Specific nutritional requirements of the elderly are clear. Indeed, dietary intakes change with age (1) and older people have particular nutritional requirements that are quite different from those of other groups. The French RDAs for older people are different from those for younger adults, in agreement with values proposed in other countries. Some are lower (DHA: 100mg/day for the elderly and 120 mg/day for younger adults, while others are higher (vitamin B12: 3μg/day (elderly) and 2.4 (younger); Vitamin D: 10-15μg/day (elderly) and 5 μg/day (younger); selenium for elderly men and women: 70 and 65μg/day and 65 and 55 μg/day for younger men and women). The iodine RDA does not change (150μg/day) (2).

The nutritional requirements of older people are becoming increasingly important because the greater life expectancy of Western populations. They need more protein; hence, many older people lack key nutrients, such as vitamins, minerals, omega-3 fatty acids and essential amino-acids. Macronutrients and micronutrients affect all organ functions, including that of the brain (3). They need food that is rich in such nutrients, and one of the best is seafood.

Specific elderly diseases are in relation with dietary habits. First, older people are at greater risk of various nutritional deficiencies than are younger adults due to physiological changes associated with aging, functional decline, acute and chronic illnesses, financial and social status. Second, they may be at risk of malnutrition, especially if they are ill, live alone or have difficulty eating (4, 5), particularly if they suffer from dementia (6). Nutritional factors have been linked with Alzheimer disease; folates and vitamin B12 are important in the production of hyperhomocysteinemia (7). The mini-nutritional assessment (MNA) includes vitamins A, D, E, B1, B2, B6, B12, folates, copper and zinc (8). Epidemiological studies have shown that the diets of older people lack several nutrients, and this is directly linked to various diseases. The most significant micronutrients in this context are vitamin B12, vitamin A, C, D, calcium, iron, zinc, and most trace minerals (9). The intake of poly-unsaturated fatty acids also decreases with age (10), and most older people eat less that the recommended amounts of omega-3 fatty acids. This reduced intake of omega-3 fatty acids is linked to increased cognitive impairment and the risk of dementia (reviewed in 11). Fish consumption can reduce the risk of cardiovascular disease and help slow cognitive decline (12). French people aged 65 y and above who regularly eat fish had fewer symptoms of depression and scored higher on a Mini Mental Status Examination (13). However, some privileged aged population fit the RDA for most vitamins and minerals (14).

The average intake of the nutrients studied in this work is altered in the elderly. Elderly persons are likely to suffer from vitamin D deficiency despite taking relatively high vitamin supplements (15), and functional mobility is more closely linked to plasma concentrations of vitamin D metabolites (25-OH D and 1,25 diOH D) and to calcium intakes (16). Subnormal or borderline plasma vitamin B12 (coblalamin) concentrations are common in the elderly. While dietary deficiency of vitamin B12 is probably rare, except in

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vegetarians, the elderly often have poorer diets than do younger persons (17). An elderly person's diet could provide only half the iodine RDA (18). Iodine prophylaxis (salt-iodization in France as in many countries) only partly corrects this iodine deficiency (19), which explains the prevalence of hypothyroidism. The plasma selenium concentration in well nourished elderly people is higher than that of those who are frail, poorly-nourished and unwell or diseased (20). Few of the volunteers who took part in the French SU.VI.MAX study (adult aged below 60 years) were selenium deficient, but 83% of the women and 75% of the men had plasma concentrations below those considered optimal for glutathione peroxidase activity, adequate immune function and protection against cognitive dysfunction and cancer (21). The French diet is clearly deficient in ALA (22-24) as is that of other countries. (25, 26). It is lower for people aged over 65 in Australia: 0.98mg/day (27). In contrast, the estimated consumption of EPA and DHA in France indicates that adults in France consume twice the French RDA for DHA (24). But this varies considerably from one person to another. A study on a small sample in Brittany asked the participants not to eat animal fats (excluding fish and sea products) and found that they obtained less than half the RDA (23). Unfortunately, little work has been done on the DHA intakes of elderly. DHA intake of people aged over 70 living in Pennsylvania (USA) is insufficient, as their EPA+DHA intake is only 200mg/day (26). The DHA intake is 106mg/day in Australia (27). Generally speaking, people aged 55-65 consume more seafood products than do younger people, while elderly people consume less.

Objective of this study was to determine to which level seafood participate to the RDA of vitamin D, vitamin B12 (cobalamin), iodine, selenium and DHA.

Materials and Methods

The data on apparent consumption per inhabitant were taken from statistics prepared by OFIMER. These, in turn, were based on figures supplied by Customs and the Fisheries Ministry. The production figures were taken from the annual estimates of fisheries and farming production published by OFIMER and the French Ministry of Agriculture and Fisheries; they are given as live weight. The import and export data were taken from the annual report of international trade in fish and aquaculture products published by OFIMER based on data provided by the Director General of Customs and the ministries of the French Economy, Finance and Industry. These import and export data are given in net weight and were converted to live weight. We first calculated the consumption per French inhabitant of the main species or groups of species of finfish and shellfish using a modification of the FAO method of dietary analysis. This method involved an assessment of supplies for the year 2004 based on the quantities of primary products of fishing and farming destined for human consumption, plus data on imports and exports of these products, both primary and processed. Intake per year and per inhabitant was thus determined using the method defined by the FAO (28), adapted and modified (29, 30). The mean % RDAs for the whole population have been adapted to those for the elderly: 24.7% of the population in France is over 65 years old, but they consume 26.5% of the seafood (finfish and shellfish) eaten.

The statistics provided the gross amounts of product, such as whole fish and shellfish in their shells. The real consumption (edible intake) was calculated from the apparent consumption per inhabitant, in g/day, from French tables (7). These estimates of comestible portions consumed (which assume that the whole portion was eaten) were high because industrial filleting results in large losses and the domestic consumption often neglects quite a large fraction of the fish. The conversion from gross weight to consumable weight varies greatly from one species to another, causing considerable, but unquantifiable, calculation error.

The nutritional values of wild and farmed fish and shellfish were calculated using composition tables, the USDA (USDA internet site database) and laboratory nutrition data. A total of 74 publications were analyzed (16 for vitamin D, 14 for vitamin B12, 15 for iodine, 12 for selenium, and 49 for omega-3 fatty acids). The reference values shown in the table are weighted averages. Some outlying figures that were very different from the bulk of data were not included in the calculations. The values for vitamin B12 are only fairly reliable as few data are available, and some of the data were produced by a single author. Those for vitamin D are somewhat more reliable.

Conclusions are based on the nutrient contents of unprocessed products.

Results and Discussion

Table 1 provides information about the intakes of fresh seafood in aged people, in comparison with less that 35 year old, 35-49 y old, 50-64 year old. Household consumption index by volume and by class age for the main fresh aquatic products is determined as such 100 in the left column means that the average consumption level is 100 for all population, whatever the age class. When the index for an age class is over 100, this age class has a higher than average level of consumption. The over-consumption of seafood by aged people is due mainly to fresh fish and shellfish: people over 65 years old consume 36.1% of the total fresh seafood in France. Their consumption index is almost twice the average for luxury items such as red mullet, sole, sea-bass, turbot or hake. For cheaper items like salmon, mussel or tuna, the consumption by aged people is at the same level as the French population as a whole. Table 2 gives household consumption index by volume and by class age for the main canned finfish: tuna, mackerel and sardine. Thus aged people in France consume larger quantities of fresh seafood at home than the rest of the population, but less canned finfish. Unfortunately, the distribution of the consumption out of home (restaurants, fast-foods, institutions, hospitals, etc.) by age class in not known in France.

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Table 1
Household consumption index by volume and by class age for the main aquatic products

	TOTAL FRANCE	< 35 y old	35-49 y old	50-64 y old	> 65 y old
fresh fish, total	100,00	32,24	74,98	142,91	148,47
Seabass	100,00	23,61	43,71	148,73	187,23
Pollock	100,00	34,05	96,45	132,46	131,77
Cod	100,00	32,02	66,43	142,83	158,77
Carp	100,00			170,52	152,91
Seabream	100,00	45,70	70,45	134,93	149,46
Haddock	100,00	28,94	77,49	140,81	150,50
Grenadier	100,00	34,20	63,95	160,09	143,06
Ling	100,00	31,71	74,92	160,55	131,98
Dab	100,00	16,26	59,81	150,87	172,85
Monk	100,00	19,21	63,82	142,48	173,61
Mackerel	100,00	20,91	56,77	162,51	161,02
Whiting	100,00	29,62	67,74	121,73	179,75
Hake	100,00	14,67	43,24	154,74	189,97
Nile perch	100,00	37,93	91,99	136,33	129,79
Plaice	100,00	21,91	100,10	100,02	169,66
Skate	100,00	17,13	55,43	141,25	186,50
Red mullet	100,00	17,69	58,05	127,64	196,06
Sardine	100,00	23,55	60,28	172,23	145,17
Salmon	100,00	48,37	102,89	136,90	107,13
Dogfish	100,00	24,70	64,83	149,94	160,33
Redfish	100,00	21,40	40,30	161,23	181,13
Sole	100,00	18,46	42,33	132,96	208,67
Tuna	100,00	48,66	79,40	160,90	111,25
Trout	100,00	36,49	78,98	130,67	151,79
Turbot	100,00			135,62	178,94
Other fish	100,00	28,95	75,76	149,70	143,94
crustaceans, fresh, total	100,00	27,97	63,47	155,48	153,65
Nephrops	100,00	15,33	53,66	179,90	152,88
Crab	100,00	25,43	75,35	141,28	155,69
Schrimp	100,00	73,25	84,50	107,06	135,27
Shellfish, fresh, total	100,00	32,52	72,42	154,75	139,80
Oyster	100,00	22,19	60,58	155,81	161,88
Mussels	100,00	43,16	83,71	152,49	119,23
Scallop	100,00	17,83	55,99	166,78	160,57
Whelk	100,00	44,76	96,16	135,02	120,06
Cephalopods, fresh	100,00	24,97	94,39	135,91	138,96

100 in the left column means that the average consumption level is 100 for all population, whatever the age class. When the index fro an age class is over 100, this age class has a higher than average level of consumption. After TNS panels for OFIMER.

Table 2
Household consumption index by volume and by class age for main canned aquatic finfish:tuna, mackerel and sardine

	TOTAL FRANCE	< 35 y old	35-49 y old	50- 64 y old	> 65 y old
Tuna canned	100,00	97,80	131,32	101,55	63,75
Mackerel canned	100,00	72,68	113,85	122,69	86,28
Sardine canned	100,00	47,68	93,07	133,37	122,67

Same remark as in table 1

The intakes of the major nutritional components are shown in Table 3. As there is no data for the total intakes of each individual fish or shellfish by older people, the mean intake of the whole population is shown. The last line takes into account the specific intake of seafood by the elderly. The most consumed seafood are tuna, followed by cod, salmon, Alaskan pollock, sardines, saithe, shrimps, mussels, hake, herring, trout, mackerel, scallops, monkfish, squid, anchovies, oysters and whiting. These account for 91% of the total edible fish and shellfish eaten in France.

Vitamin D

For aged people, seafood provides 25% of the French RDA for the elderly. As most older people do not obtain the RDA in their usual food, they should eat more seafood. Vitamin D-rich foods are rare and only seafood provides good amounts of this vitamin. Eggs are also good sources of vitamin D, together with cod liver oil. Mammalian liver (veal, beef, pork) is also an interesing source, but very little is eaten nowadays.

Vitamin D is a major regulator of bone formation and turnover because of its influence on calcium (and phosphorus) metabolism. It acts mainly to regulate calcium absorption by the intestine and its renal excretion. Calcium supplements can improve bone density and reduce the vertebral fracture rate in vitamin-D depleted elderly patients (31). Osteoporosis is a debilitating disease that affects many older people; its etiology is complex, nutrition is one of the many factors that influence

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Table 3

Seafood (fish and shellfish. fished and farmed): mean compositions, intakes and contributions to the French RDA for year 2004. Contribution for aged people

Species, 2004	Total intake Kg/year	Total intake g/day	Edible intake g/day	Vit D µg/100g edible	Vit D µg/day	Vit B12 µg/100g edible	Vit B12 µg/day	Iode µg/100g edible	Iode µg/day	Se µg/100g edible	Se µg/day	DHA mg/100g edible	DHA mg/day
Tuna	3,86	10,60	4,77	5,0	0,24	6,4	0,305	45	2,14	56	2,67	420	20,50
Cod	1,72	4,70	4,04	1,3	0,05	1,1	0,044	160	6,46	35	1,41	170	6,90
Salmon	1,95	5,30	3,82	15,0	0,57	4,0	0,152	26	0,99	33	1,26	1247	47,60
Alaskan Pollock	1,93	5,30	3,45	1,1	0,038	1,2	0,041	103	3,52	20	0,69	259	8,90
Sardine	1,10	3,00	2,10	11,0	0,23	3,0	0,063	32	0,67	51	1,07	1350	28,40
Saithe	0,99	2,70	1,76	0,8	0,014	3,5	0,062	200	3,52	31	0,55	259	4,60
Shrimp	1,46	4,00	1,60	1,3	0,03	1,3	0,021	80	1,28	40	0,64	160	2,56
Mussel	2,55	7,00	1,40	2,4	0,04	10,0	0,140	365	5,11	57	0,80	178	2,50
Hake	0,87	2,40	1,39	1,5	0,02	0,7	0,010	23	0,32	43	0,60	338	4,70
Herring	0,81	2,20	1,32	17,0	0,22	10,2	0,135	38	0,50	34	0,45	937	12,40
Trout	0,71	2,00	1,20	8,0	0,10	2,3	0,027	6	0,07	26	0,31	543	6,50
Mackerel	0,53	1,50	1,05	10,0	0,11	9,0	0,094	64	0,67	43	0,45	1493	15,70
Scallop	1,86	5,10	0,92			1,6	0,015	10	0,09	28	0,26	144	1,30
Monk	0,38	1,00	0,85	1,2	0,10	9,0	0,076	23	0,19	36	0,31	126	1,10
Squid	0,29	0,79	0,71			1,3	0,009	21	0,15	57	0,40	491	3,48
Sprat + chinchard	0,56	1,50	0,60										
Anchovy	0,29	0,80	0,58	7,0	0,04	0,6	0,004	51	0,29	36	0,21	600	3,50
Whiting	0,35	0,90	0,54			2,3	0,012			32	0,17	107	0,58
Oyster	1,80	4,90	0,54	8,0	0,04	15,0	0,081	125	0,67	55	0,30	107	0,70
Redfish	0,25	0,70	0,50	2,3	0,02	3,8	0,019	99	0,69			70	0,35
Shark	0,26	0,70	0,46			0,6	0,003			47	0,22	660	3,00
Ling	0,17	0,50	0,35			0,6	0,002			36	0,13		
Nephrops	0,29	0,80	0,30			25,0	0,075						
Haddock	0,16	0,40	0,28			0,7	0,002	338	0,95	35	0,10	139	0,40
Cuttlefish	0,12	0,33	0,26			3,0	0,008			55	0,14	66	0,17
Sole	0,14	0,40	0,24					17	0,04	24	0,06	141	0,30
Crab	0,45	1,20	0,24									113	0,27
Seabass	0,12	0,30	0,21			3,8	0,008					434	0,90
Plaice	0,07	0,19	0,15	1,6	0,00	1,5	0,002	32	0,05	28	0,04	193	0,29
Pollack	0,09	0,20	0,13	0,7	0,001	1,2	0,001	103	0,14	20	0,03	259	0,30
Halibut	0,06	0,16	0,13	4,3	0,01	1,0	0,001	23	0,03	70	0,09	318	0,41
Octopus	0,05	0,14	0,13			20,0	0,026			29	0,04	81	0,10
Carp	0,09	0,20	0,12					2	0,00			108	0,10
Seabream	0,06	0,20	0,11										
Spiny lobster	0,08	0,22	0,10			25,0	0,025			99	0,10	80	0,06
Lobster	0,11	0,30	0,09	1,2	0,00	2,3		515	0,46	115	0,10	142	0,13
Crayfish	0,02	0,10	0,02	0,3	0,00	2,4	0,000					12	0,00
Cardin and other flat fish	0,27	0,70	0,00										
Roe and lever	0,05	0,10	0,00										
Eel	0	0	0,00	20,0	0,00			7	0,00	50	0,00	430	0,00
Other marine fish, non filleted	1,88	5,20											
Other marine fish, filleted	3,68	10,10											
Others, various	0,64	1,70											
Other mollusks and invertebrates	1,15	3,10											
Other crustaceans	0,04	0,10											
Total for species documented on nutrients		93,73	36,88		1,87		1,463		29,00		13,60		178,70
Total estimated for all species					2,33		1,561		32,4		14,8		188,3
%RDA for adults in all species documented for nutrients					37		61		19		23		149
% RDA for all species					46		65		22		25		157
RDA for aged					10-15 µg		3 µg		150 µg		70 µg		100mg
%RDA for elderly people in all species documented for nutrients					23%		52%		26%		21%		188%
%RDA for elderly people for all species					25%		56%		28%		23%		203%

Finfish and shellfish are classified in decreasing order of edible quantities. The data on the consumption of sprats, pilchards and other pelagic fish (other than those listed in the table) are not very reliable, but their contribution to the overall French diet is marginal. Their omission does not alter the overall results. The same is true for several fresh water fish, like pike and perch. French RDA for selenium is 70µg/day for men and 60µg/day for women. The value of 70 was used in this table. RDA for vitamin D is between 10 to 15µg/day; 10µg/day was used as a reference. Mean %RDA for the whole population have been adapted for older people: people over 65 years represent 24.7% of the French population but consume 26.5% of the fish.

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bone mass and the risk of fragility fractures; dietary calcium and vitamin D deficiency are major factors (32). Humans obtain their vitamin D from two very different sources: the diet and UV irradiation of the skin; skin synthesis is dramatically reduced in older people, and its contribution varies according to the climate. Many (almost 70%) French people lack vitamin D, with women being more susceptible than men (33).

Vitamin B12 (cobalamin)

For aged people, seafood provides 56% of the French RDA. Many people do not obtain the RDA in their usual food; they should increase their seafood intake, as seafood is a good source of this vitamin. Eating seafood could also help to overcome the small amounts of vitamin B12 obtained from liver and meat because of reduced consumption (particularly beef), the only other food rich in this vitamin. The 10 finfish and shellfish with the highest vitamin B12 contents are: lobster and spiny lobster, octopus, oysters, herring and mussels, mackerel and monkfish, tuna and salmon.

The vitamins folic acid, B12 and B6 are sources of coenzymes involved in carbon metabolism. Recent years have seen increased interest in the relationship between aging and certain diseases that afflict aging populations, such as loss of cognitive function, Alzheimer's disease, cardiovascular disease, and cancers. They may be in part explained by inadequate intakes or inadequate status of these two vitamins, especially vitamin B12 (34). Vitamin B12 (and B6) may be positively related to memory performance in middle-aged people (35). A low concentration of several vitamins, including vitamin B12, might indicate that these nutrients contribute to the development of dementia in Alzheimer's disease (36). It seems that there may be a limited window of opportunity for giving vitamin B12 to patients with cognitive dysfunction and low plasma cobalamin (37).

Eating fish is certainly a good way to improve the vitamin B12 status of older people as taking oral cyanocobalamin for one month corrects the plasma vitamin B12 concentration in cobalamin deficient elderly patients (38), and restores their haematological responses.A daily vitamin B12 intake of 6μg appeared to be sufficient to correct all the vitamin B12-related variables measured in post-menopausal Danish women (17).

Iodine

For aged people, seafood provides 28% of the French RDA. As quite a lot of older people do not reach the RDA in their usual food, they should increase their seafood intake, as only marine fish and shellfish provide appreciable quantities of this trace element. A lack of iodine causes several health problems (39), and is the major preventable cause of brain disorders worldwide. Hypothyroidism increases with age in some regions (40). A perfectly natural way of obtaining iodine is by eating marine fish and shellfish (but not freshwater fish). Multi-enriched eggs are also a good source of iodine (41).

Selenium

For aged people, seafood provides 23% of the French RDA for selenium. But, again, many people do not obtain the RDA from their usual food - they should eat more seafood. A number of surveys have shown that the selenium intakes of older people are less than the RDA (42). Supplementation with antioxidants nutrients, including selenium, increases the antioxidant defense system in the elderly (43). There is a direct link between a lack of dietary selenium and oxidative stress. Free radicals are believed to be the cause of several disorders, particularly cerebral aging. Most of the biological functions of this trace element are due to its incorporation into selenoproteins, where it is bound to the amino acid cysteine. The glutathione peroxidases provide an important defense against damage caused by free radicals, including within the brain (44). Vitamin E modulates the activity of the enzyme that is specific for phospholipids (45). The most important enzymes containing selenium are the glutathione peroxidase, the thioreductases and the deiodinases that catalyse the removal of iodine from thyroxine (T4) to give triiodothyronine (T3). In this respect, selenium is associated with thyroid structure (46). A low selenium concentration is related to inflammation and increased mortality in older women (47) and selenium could be a indicator of longevity in an elderly population (48). Selenium is also involved in many diseases, including prostate cancer (49) and in the detoxification of xenobiotics and some heavy metals.

Omega-3 fatty acids

The first member of the omega-3 family of fatty acids is the essential fatty acid alpha-linolenic acid (ALA, 18:3(n-3)). The other omega-3 fatty acids are derived from ALA and have longer, more unsaturated aliphatic chains; the main components are eicosapentaenoic acid (EPA, 20:5(n-3) and docosahexanoic acid (DHA, 22:6(n-3), cervonic acid). The 10 finfish and shellfish with the highest DHA contents are: mackerel, sardine, salmon, herring, shark, anchovy, trout, squid, sea bass, eel and tuna.

For aged people, seafood provides 203% of the french RDA for DHA. Interestingly, the French RDAs are lower than those of other countries or authorities. For example, the international committee, the ISFFAL, recommends a minimum of 220 mg DHA, which is about twice the French RDA. Thus, intakes represent actually aprox. 100% of the international RDA. There is good evidence for the role of omega-3 fatty acids in aging in both humans and animal; a lack of these fatty acids can alter phospholipid compositions and lipid turnover in membranes, including those of the brain (50). They are even implicated in psychiatry, in dementias including Alzheimer's disease (11). A balanced intake of omega-3 and omega-6 fatty acids that reflects the historical composition of the human diet can reduce the impact of several disorders or delay their onset (51). In fact, omega-3 fatty acids are most important for the development of the brain (3), from the composition of cell membranes to cerebral function (50). All the omega-3 fatty acids are important for treating or preventing cardiovascular ischemic

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diseases and stroke (52, 53) and even blood pressure in the elderly. They are also favorably implicated in some other diseases, such as colon (54) and breast cancers (55), prostate cancer (54, 56), inflammatory disorders (57) and perhaps even type II diabetes (58). Interestingly, in older adults, intake of tuna and other broiled or backed fish in efficient on cardiac structure, function and hemodynamics, in contrast with fried fish (59).

The only foods that provide large amounts of DHA are seafood (fish and shellfish) and multi-enriched eggs (41). Some enriched meat from animals fed linseed may also be interesting (60). Seafood that contain most DHA are sardines, mackerel, salmon, sprats, herring, anchovies, and squid. All seafood contains appreciable quantities of DHA. Although shellfish contain little fat, they contain appreciable amounts of DHA.

Conclusion

Seafood also contains other nutrients such as vitamin A, other B group vitamins and high quality proteins. Older patients should eat good, rich food, including seafood. The dietary importance of a foodstuff depends not only on its constituents but also on their bioavailability. Undoubtedly some foods are much better dietary sources than others, and seafood is among the best.

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