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AMINO ACID CONTENTS OF FILLET PROTEIN FROM 13 SPECIES OF FISH

By

LEIF R. NJAA

Institute of Nutrition, Directorate of Fisheries
P.O. Box 1900, Nordnes N-5024 Bergen, Norway

Fish and fish products are routinely analysed by several laboratories for proximate composition and for contents of other components (e.g. vitamins, minerals, fatty acids, amino acids). The data often remain unpublished although it is of obvious interest to have them documented for reference purposes.

The amino acid composition of fish muscle protein from 10 fish species were recorded by Brækkan and Boge (1962). The results were obtained by microbiological methods. About 1970 ion-exchange chromatography replaced microbiological assay of amino acids in this institute. In the present report the amino acid composition of fish fillet protein from 13 fish species are recorded and compared with the data presented by Brækkan and Boge (1962). The fish was bought fresh at the Bergen fish market, filleted and either acetone dried (Brækkan and Boge 1962), or freeze dried. The dry samples were milled to a fine powder and hydrolysed with 6M HCl under N_2 atmosphere for 21 hours. After dilution to a known volume an aliquote was taken to dryness under vacuum in a rotary evaporator. The analyses were preformed on a first generation Technicon amino acid analyser with a buffer gradient as described in the manual. Norleucine was used as internal standard.

The fish species analysed were:
Cod *(Gadus morhua)*, Saithe *(Pollachius virens)*, Haddock *(Melanogrammus aeglefinus)*, Pollack *(Pollachius pollachius)*, Ling *(Molva molva)*, Tusk *(Brosme brosme)*, Redfish *(Sebastes marinus)*, Catfish, *(Anarhichas lupus)*, Halibut *(Hippoglossus hippoglossus)*, Greenland halibut *(Reinhardtius hippoglossoides)*, Eel *(Anquilla anquilla)*, Mackerel *(Scomber scombrus)*, Herring *(Clupea harenqus)*.

The results recorded in Table 1 show fairly good agreement with the data given by Brækkan and Boge except for serine, and for the branched chain amino acids valine, isoleucine and leucine. The reasons for theses discrepan-

cies have been looked into and it was concluded that the microbiological method probably gave the more correct value for serine because of the milder hydrolysis conditions used. Slump (1969) showed that serine (and threonine) were vulnerable to destruction during hydrolysis with 6 M HCl. Brækkan and Boge (1962) used hydrolysis with 2M HCl at 120° C for 10 hours. Microbiological assays of serine with the two types of hydrolysates gave lower values when the method described for the chromatographic method was used.

The high values for the branched chain amino acid by the microbiological method were explained by that proline was not included in the medium listed for *Lactobacillus plantarum* by Barton-Wright (1953). When this medium was used there was a lag-period in the lactic acid production in the standard runs during the first 18 hours. This resulted in lower total acid production during the 72 hours incubation period than when proline was included in the medium. Another complication was that the standard isoleucine used in the microbiological assays was not allo-free. When this standard was compared with allo-free standard, acid production was lower with the former than with the latter. Thus, the contents of the branched chain amino acids reported by Brækkan and Boge are probably too high. In table 1 are also included mean amino acid contents of 33–38 samples tabulated by FAO (1970) for fresh fish of all types. They show generally good agreement with the present results except for histidine. Histidine varies much between fish species, in Norwegian waters mackerel is especially high in histidine. This is also seen in the present analysis. Brækkan and Boge (1962) reported 45 mg/g protein in good agreement with this result. They did not include histidine from mackerel in their mean value over all species. The results recorded here seem to agree with the general findings that fish muscle protein shows a rather constant amino acid composition, with histidine as the clear exception.

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Table 1. Amino acid composition of fillets from 13 fish species (mg/g protein) and mean values taken from the literature.

	Cod	Saithe	Had-dock	Pollack	Ling	Tusk	Red-fish	Cat-fish	Hali-but	Greenland Halibut	Eel	Mack-erel	Her-ring	Mean values FAO (1972)	Mean values Brækkan and Boge (1962)	This work
Apartic acid	90	102	101	108	102	102	93	82	101	93	92	89	93	103	103	97
Threonine	38	46	50	45	42	41	44	41	44	44	43	43	39	46	46	43
Serine	41	42	38	44	43	43	37	40	43	40	39	38	35	43	51	40
Glutamic acid	90	148	139	143	131	143	124	123	127	155	122	133	116	141	149	130
Proline	35	36	32	34	33	36	30	36	38	36	46	37	33	37	35	35
Glycine	44	45	45	44	43	45	39	43	46	46	69	44	45	48	46	46
Alanine	56	59	54	60	57	60	54	50	54	54	60	55	59	60	79	56
Valine	49	53	47	51	49	50	44	45	50	51	44	54	50	61	59	49
Methionine	31	33	34	33	32	32	31	27	30	20	25	30	28	29	30	30
Isoleucine	45	49	45	49	46	45	45	42	46	48	41	44	44	48	60	44
Leucine	74	81	76	78	78	77	73	68	77	81	69	74	74	77	84	75
Tyrosine	37	36	34	40	35	37	33	33	37	35	30	36	35	37	39	35
Phenylalanine	40	42	40	39	41	42	36	36	39	37	37	38	39	39	33	39
Lysine	102	97	93	100	94	102	102	86	102	94	83	86	92	91	88	95
Histidine	22	22	21	23	22	21	19	20	25	21	28	44	27	35	20	24
Arginine	62	64	63	69	59	60	59	53	62	66	59	57	57	47	59	61
Tryptophan	10		11	10	11	11	13	10	11	11	10		11		10	11