

# AMINO ACID COMPOSITION OF WHALE MEAT

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In Japan, the whale meat is an important source of animal protein supply. Knowledge of the amino acid composition of the whale meat protein is, therefore, of practical value in nutrition. Only a few reports on this subject have been published, and the methods used in them seem to be out of date.

The present work was carried out to know the amino acid composition of the whale meat employing the microbiological assay procedure. The amino acid composition of the meat of various parts was compared.

The present work was carried out at the request of Dr. Higashi, Chief of Tokyo Research Laboratory, and Mr. Kimotsuki, Chief of Yokosuka Factory of Taiyo Fishery Company.

## MATERIAL

I. Meat materials, sampled by Dr. M. Nishiwaki, a member of the Whales Research Institute.

Date of capture are as follows :

Species of whale....Fin, Sex....Male.  
Date of capture....Feb. 23rd, 1956.  
Time of capture....8.45 A.M.  
Time commenced treating....7.45 P.M.  
Locality of capture....67-36 S, 122-36 W.  
Thickness of blubber....P<sub>1</sub> 80cm, P<sub>2</sub> 14.5cm.

Three kinds of frozen meat — muscle of tail parts, dorsal muscle and muscle inside of the ventral grooves — were received on April 26th, 1956.

The preparative method for assay of 17 kinds of amino acid as follows. About 20 gm. piece was cut from the middle portion of each material, and taken into the previously weighed beaker. Standing for 30 min. at room temperature, each piece was weighed accurately, and then transferred to the 500 ml. pear-shaped flask. And then was hydrolyzed with 200 ml. of 6N HCl at 120°C for 10 hrs in oil-bath. The hydrolyzate was filtered and recondes were washed with water, washings being added to the filtrate, filled up to volume. Thus prepared filtrate was used for the assay of 17 kinds of amino acid except tryptophane. An aliquot of the filtrate was used for the measurement of total nitrogen.

For the assay of tryptophane, the materials were prepared as follows : each middle portion of meats, as they were frozen, in case of muscle

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of tail parts and muscle inside of the ventral grooves, about 2 gm. piece and on dorsal muscle, c.a. 1 gm. piece was cut off respectively, sliced and weighed accurately in the weighing bottle. The weighed samples were taken into the tubes and cysteine, 40% of sample weight, was added. To muscle of tail parts and muscle inside of the ventral grooves, 15 ml. and to dorsal muscle, 10 ml. of 8 N NaOH were added, washing the wall respectively.

After shaking and homogenizing thoroughly, each tube was sealed and autoclaved, initially at 120°C for about 1 hr., and when somewhat cooled shaken enough, further autoclaved at 120°C for 5 hrs. The hydrolyzate were filtered with glass-filter and washed with hot water, when the filtrates were filled up to about 80 ml., they were placed in the refrigerator. When cooled enough, saponificate and lipid were separated. Being neutralized with 5 N HCl, the hydrolyzates were paper-filtered and had saponificate and lipid removed, they were filled up to volume and supplied to assay.

## II. Whale meats supplied from Yokosuka Factory.

On April 18th, 1956, muscle of tail parts, dorsal muscle and muscle inside of the ventral grooves, each frozen, and salted meat were delivered, each meat was treated as I.

### ASSAY OF AMINO ACIDS

Amino acids were determined approximately according to the micro-biological methods described by Tsunoda (1954). Assay procedures were modified as follows:

- a) alanine: 750 $\gamma$  of G.B.I. "Liver Fraction L" per tube was added to the pyridoxal-free basal medium.
- b) glutamic acid: the initial pH of the medium was 6.8.
- c) glycine: the incubation period was prolonged to 96 hrs.
- d) serine: the preculture was cultivated in the synthetic medium for 96 hrs. containing L-serine 1.5 $\gamma$  per 2 ml.
- e) cystine: i) the hydrolyzate of the lantionized casein was used for the amino acid source in the basal medium.  
ii) the basal medium was preautoclaved at 15 lbs. pressure for 15 min. before it was dispensed.

### ASSAY RESULTS

The results are shown in table 1 and table 2. Amino acid contents are calculated on the basis of the amount of total matters, and of the amount of total nitrogen. Amino acid content shown as % is, as a

TABLE 1. AMINO ACID COMPOSITION OF MATERIAL SAMPLED BY DR. NISHIWAKI

T-N %	Muscle of tail parts		Dorsal muscle		Muscle inside of the ventral grooves	
	2.06		3.85		3.26	
	%	:N	%	:N	%	:N
Leucine	0.90	0.44	1.82	0.47	1.41	0.43
Isoleucine	0.58	0.28	1.14	0.30	0.86	0.26
Valine	0.60	0.29	1.14	0.30	1.06	0.33
Threonine	0.53	0.26	1.06	0.28	0.86	0.26
Phenylalanine	0.47	0.23	0.92	0.24	0.78	0.24
Lysine	0.81	0.40	1.71	0.45	1.29	0.40
Methionine	0.29	0.14	0.60	0.16	0.43	0.13
Tryptophane	0.10	0.05	0.25	0.06	0.16	0.05
Glutamic acid	1.62	0.79	3.09	0.80	2.81	0.86
Aspartic acid	1.08	0.52	2.24	0.58	1.61	0.49
Glycine	0.49	0.24	0.99	0.26	1.70	0.52
Arginine	0.57	0.28	1.16	0.30	0.93	0.29
Proline	0.46	0.22	0.83	0.22	1.31	0.40
Histidine	0.53	0.26	0.98	0.26	0.46	0.14
Tyrosine	0.36	0.17	0.75	0.19	0.64	0.20
Alanine	0.63	0.30	1.24	0.32	1.26	0.39
Serine	0.52	0.25	1.06	0.28	0.82	0.25
Cystine	0.07	0.03	0.14	0.04	0.15	0.05

TABLE 2. AMINO ACID COMPOSITION OF THE MATERIALS FROM YOKOSUKA FACTORY

T-N %	Muscle of tail parts		Dorsal muscle		Muscle inside of the ventral grooves		Salted meat	
	2.26		3.54		3.19		4.86	
	%	:N	%	:N	%	:N	%	:N
Leucine	1.07	0.47	1.61	0.46	1.38	0.43	2.10	0.43
Isoleucine	0.66	0.29	1.05	0.30	0.78	0.25	1.26	0.26
Valine	0.65	0.27	1.05	0.30	1.10	0.35	1.62	0.33
Threonine	0.57	0.25	0.93	0.26	0.77	0.24	1.30	0.27
Phenylalanine	0.53	0.23	0.85	0.24	0.76	0.24	1.14	0.23
Lysine	0.88	0.39	1.52	0.43	1.14	0.36	1.74	0.36
Methionine	0.32	0.14	0.53	0.15	0.42	0.13	0.68	0.14
Glutamic acid	1.84	0.82	3.04	0.86	2.58	0.81	4.15	0.85
Aspartic acid	1.17	0.52	1.87	0.53	1.65	0.52	2.62	0.54
Glycine	0.48	0.21	0.81	0.23	1.78	0.56	2.74	0.56
Arginine	0.58	0.26	0.92	0.26	1.04	0.33	1.60	0.33
Proline	0.44	0.20	0.79	0.22	1.36	0.43	1.88	0.39
Histidine	0.54	0.24	0.85	0.24	0.41	0.13	0.68	0.14
Tyrosine	0.35	0.16	0.66	0.19	0.58	0.18	0.91	0.19
Alanine	0.67	0.30	1.11	0.31	1.33	0.42	1.99	0.41
Serine	0.56	0.25	1.00	0.28	1.00	0.31	1.56	0.32
Cystine	0.07	0.03	0.15	0.04	0.16	0.05	0.24	0.05

matter of course, generally high in the sample of high nitrogen content.

Amino acid content of dorsal muscle is, therefore, higher than that of muscle inside of the ventral grooves, and is followed by that of muscle of tail parts. It should, however, be noticed that muscle inside of the ventral grooves contains more glycine, proline and alanine than other two muscles.

TABLE 3. COMPARISON WITH OTHER MEAT

Sample	Fish* (Sardin)	Cattle* (Beef)	Whale						
			Nishiwaki sample			Yokosuka sample		factory	
			A	B	C	A'	B'	C'	D
Amino Acids									
Leucine	6.2	8.2	7.0	7.6	6.9	7.6	7.3	6.9	6.9
Isoleucine	4.3	5.2	4.5	4.8	4.2	4.7	4.7	3.9	4.1
Valine	4.9	5.0	4.7	4.8	5.2	4.6	4.7	5.5	5.3
Threonine	4.0	4.7	4.1	4.4	4.2	4.0	4.2	3.8	4.3
Phenylalanine	3.5	4.5	3.7	3.8	3.8	3.7	3.8	3.8	3.7
Lysine	8.3	9.3	6.3	7.1	6.3	6.2	6.9	5.7	5.7
Methionine	2.6	2.9	2.3	2.5	2.1	2.3	2.4	2.1	2.2
Tryptophane	1.1	1.3	0.8	1.0	0.8	—	—	—	—
Glutamic acid	12.3	15.9	12.6	12.8	13.8	13.4	13.7	12.9	13.7
Aspartic acid	8.7	9.8	8.4	9.3	7.9	8.3	8.5	8.3	8.6
Glycine	5.1	4.5	3.8	4.1	8.3	3.4	3.7	8.9	9.0
Arginine	4.9	5.4	4.5	4.8	4.6	4.1	4.2	5.2	5.3
Proline	—	3.6	3.6	3.4	6.4	3.1	3.6	6.8	6.2
Histidine	—	3.8	4.1	4.1	2.2	3.9	3.8	2.0	2.2
Tyrosine	—	4.1	2.8	3.1	3.2	2.5	3.0	2.9	3.0
Alanine	—	7.3	4.9	5.2	6.2	4.8	5.0	5.0	5.0
Serine	—	4.5	4.1	4.4	4.1	4.0	4.5	5.0	5.1
Cystine	—	4.5	0.5	0.6	0.7	0.5	0.7	0.8	0.8

A: Muscle of tail parts    B: Dorsal muscle

C: Muscle inside of the ventral grooves    D: Salted meat

\* Cited from "Tables of the Amino Acids in Foods and Feedingstuffs" by Commonwealth Bureau of Animal Nutrition, Rowett Institute, Bucksburn, Scotland, 1956.

For comparison of muscle protein, values per total nitrogen had better be compared. Seeing the values calculated to total nitrogen, amino acid composition of muscle of tail parts well agreed with that of dorsal muscle with exceptions of lysine, tyrosine and serine. Muscle inside of the ventral grooves contains more glycine, proline and alanine, on the other hand, less lysine and histidine.

Entirely the same results were obtained on the samples supplied from Yokosuka Factory (Table 2). The amino acid composition of salted meat (probably made of muscle inside of the ventral grooves) is agreed with that of the source. Tryptophane was not determined.

Comparison of the present data with earlier reported ones is shown in Table 3.

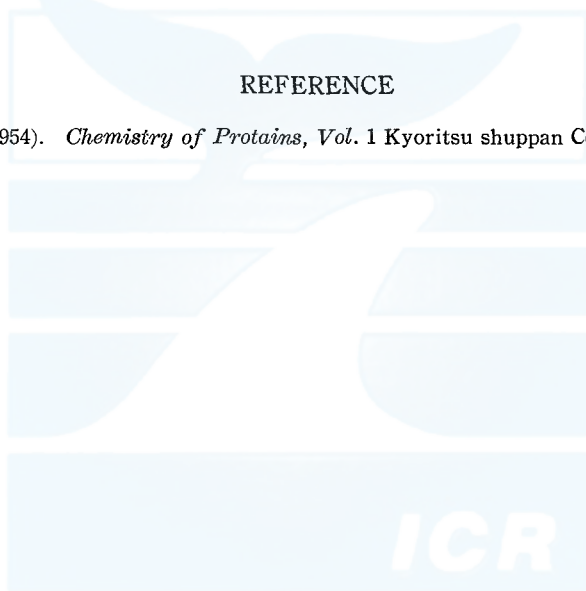
## SUMMARY

1. The amino acid composition of whale meat was determined by microbiological assay.
2. Muscle of tail parts, dorsal muscle and muscle inside of the ventral grooves respectively seem to have their own amino acid composition independent of individuals sampled.
3. The amino acid composition of muscle of tail parts is well agreed with that of dorsal muscle with exceptions of lysine and serine. Muscle inside of the ventral grooves contains more glycine, proline and serine, less lysine and histidine, and is distinguished from the two others.

The present work was carried out under the order of late Mr. S. Hori, the former Manager of the Central Research Laboratory, Ajinomoto Co., Inc.

## REFERENCE

- TSUNODA, T. (1954). *Chemistry of Proteins, Vol. 1* Kyoritsu shuppan Co. Ltd. Tokyo. 282 p.



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