

Research on Methionine in Whale

(On Methionine ($\text{CH}_3\text{S}-\text{CH}_2-\text{CH}_2-\text{CHNH}_2$) Content)
 $\begin{array}{c} | \\ \text{COOH} \end{array}$

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I. Introduction

Methionine is an amino acid containing sulphur and was discovered in the hydrolyzed product of casein by Mueller in the United States in 1922. This was synthetically produced by Bagar and Coyne in 1928 and named it methionine. After this, a large number of people attempted to synthesize and isolate it.

From the nutrition point of view, methionine, together with cystine, is an important amino acid as a source of sulphur for animals. According to recent researches, it is said that methionine transforms into cystine in a living body. In 1937, Rose⁽¹⁾ reported that methionine is a necessity and cystine is not a necessity and explained that it aids growth, and disproved Osborne and Mendel's theory.

Furthermore, in regard to its content, Baernstein in 1932, made determinations of methionine, a characteristic methylthiol group, of various proteins and reported that methionine content is greater in animal protein than in vegetable protein.

Lact albumin	2.3%(3)	Glycinin	1.8%(2)
Egg albumin	4.5%(3)	Gliadin	2.0%(2)
Casein	3.1%(3)	Zein	2.2%(3)
Sardine flesh	3.14%(4)		
Beef	3.66%(2)		
Whale meat (Kind unknown)	2.92%(4)		

In regard to methionine content in whale meat, the only report is by Tomiyama.

The author made determinations of methionine content in whale meat in order to determine its nutritional value, compared with other foodstuff and as a first step in effective separation and utilization of methionine from whale meat; a relatively detailed analysis of its content in various parts of sei whale, sperm whale and fin whale was made.

There are various methods for making this determination, but Baernstein's method was used here.

Baernstein made quantitative analysis under the assumption that methoxyl and methylimid bases does not exist in protein molecules and that the quantity of methyl iodide obtained by reaction with HI results only from CH_2S .

For accuracy, methionine content in beef protein and casein was determined and compared with previous literatures.

II. Experiment

(a) Collection of Samples

Heart, tongue, ventral meat (Sunoko) and meat was obtained from a 13.6 meter male sei whale at Ayukawa, Miyagi Prefecture. The length and sex of the fin whale and sperm whale are not known, but both were obtained at Ayukawa. For beef, the round of beef obtained on the market was used.

(b) Preparation of samples

Whale and beef protein

Flesh is first sliced thinly and soaked in cold water, which is heated to 36°C and changed to new water. The it is boiled once. This is then expressed and water removed as much as possible, chopped in a meat chopper, dried in sun, extracted with boiling alcohol for 4 hours and then with ether for 10 hours and dried for 3 hours at $105\text{--}110^\circ\text{C}$.

Baleen

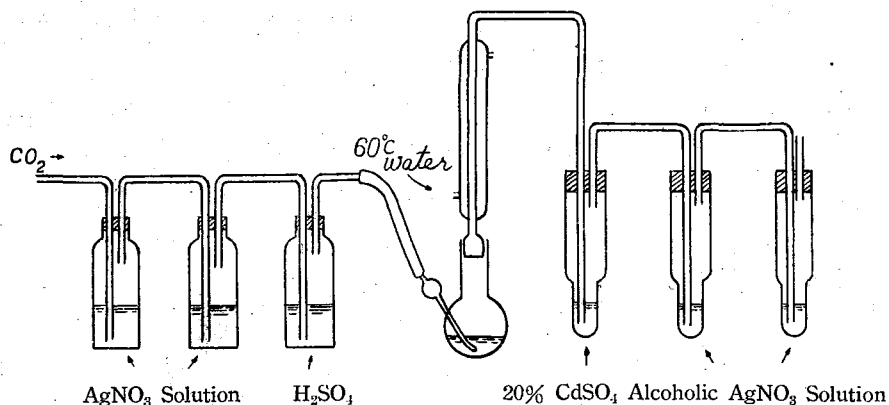
After washing with water, it is dried at room temperature, cut in thin slices, extracted with ether for 10 hours and dried for 3 hours at $105\text{--}110^\circ\text{C}$.

(c) Outline of Operation

Sample is decomposed with HI and CH_3I produced, absorbed in alcoholic AgNO_3 solution to form AgI , filtered and the residual Ag determined quantitatively with $2/100\text{ N}$ KCNS using micro-burette. The methionine quantity is calculated from the difference in Ag quantity in a blank test.

The conditions for the determination were as follows; In the original report, it is stated that about 90% of the CH_3I come over in the 1st hour but the remainder usually takes several hours more, and Baernstein adopt about 15 hours, but here the reaction time is 6 hours, about 0.5 g of the sample is decomposed with 10 cc. of HI (s. g. 1.7) and absorbed in 20 cc. of alcoholic AgNO_3 solution.

The apparatus is as follows :



(d) Experimental results

Table No. 1.

Sample		Content
Sei Whale	Heart	4.80
	Tongue	4.22
	Ventral meat (Sunoko)	4.17
	Belly meat	3.42
	Head meat	3.33
	Back meat	2.78
	Tail meat	2.71
Fin Whale Meat		4.82
Sperm Whale Meat		3.46
Blue Whale Baleen		0.82
Fin Whale Baleen		1.92
Sei Whale Baleen		1.96

The methionine content of beef and casein was determined by the same method and compared with previous literature, it is as follows :

Table No. 2.

Sample	Analyst			
	Baernstein ⁽²⁾	Baernstein ⁽³⁾	Tomiya, Hanada ⁽⁴⁾	Yoshida
Casein	3.53% 3.36 3.25	3.1%	2.54%	3.94%
Beef protein	3.66			3.56
Whale meat protein			2.92	3.06

In Table No. 1, the average methionine content of 3.06% in the various parts of sei whale, which is ordinarily called meat is very close to the value 2.92% by Tomiyama, which was obtained by the difference between

total S for Denis Benedicts method and cystine S for Okuda's method.

However, there is something here which require special attention. In the case of casein. several experiments gave the result of $3.94 \pm 0.02\%$, but in the case of beef and whale meat, there are some cases when the results of several experiments does not coincide. As to the cause of this discrepancy, on considering Table No. 1, it appears that there is a tendency for the value to be high in parts which are rich in connective tissues. Thus it was thought that there may be some relation between methionine content and the connective tissue contained in the sample, so the following experiment was performed.

The kind of whale is not known but the sample was prepared in the same manner as before, connective tissue was separated as much as possible from the meat and methionine of each was determined. The result is as in Table No. 3.

Table No. 3.

Connective Tissue	Meat Scrap
3.22%	1.43%

That is, from the determination results, it is clear that methionine content is greater in the connective tissues than in the meat scraps.

III. Summary

- (1) The methionine content of the part ordinarily called meat is 3.06% in sei whale, 4.82% in fin whale and 3.46% in sperm whale.
- (2) Of the different parts of sei whale, content is largest in heart, next in the portion rich in connective tissues (tongue, ventral) and then in the part where there is little connective tissues (meat).
- (3) The difference in methionine content in the different part of whale meat is thought due to the difference in the quantity of connective tissues in the various parts.
- (4) The large content in the heart is thought to be of great interest in relation to physiological action of renewal.

References

- (1) Womack Kemmerer: J. Biol Chem. 121 (1937) 403.
- (2) Baerstein: J. Biol. Chem. 97 (1932) 663.
- (3) Baerstein: J. Biol. Chem. 115 (1936) 25.
- (4) Tomiyama Hanada; Nogeï Kogakukai Shi 10 (1934) 53.