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STUDIES ON THE NUTRITIVE VALUE OF THE MEAT OF SEA CUCUMBER (*STICHOPUS JAPONICUS* SELENKA)

VII. Inorganic Matter in the Meat of *Stichopus japonicus*

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To determine the nutritive value of *Stichopus japonicus*, the kind and quantities of inorganic matters must be considered, also the quality of the nutrient (complete protein or not), its quantity (calories of food) and the availability of the food (digestibility).

The present authors have undertaken to study the kind of inorganic matters which exist in the so-called meat of *Stichopus japonicus* which is different from fish meat in many respects.

(1) Preparation of samples

Bodies of *Stichopus japonicus* were eviscerated and the meat part was cut and crushed homogeneously. Fifty grams of crushed meat (water-content 89.2%) was put into decomposing glass bottle and then a small amount of conc. HNO_3 was added. The mixture was decomposed on low fire with supplement of conc. HNO_3 little by little for 4~5 days. When the heating solution became transparent, the decomposition stopped. The decomposed solution was diluted to 100 cc and then was employed for the estimation of the amounts of the various sort of inorganic matter. For the estimation of chlorine, skinned meat was employed directly.

(2) Analysis of inorganic compounds

(i) Ash : By usual method.

(ii) HNO_3-insoluble matter : The filtered residue was dried with filter paper, heated to ash and weighed.

(iii) Sulfuric acid (SO_3'') : The amount of sulfuric acid was estimated as $BaSO_4$ by usual method.[1]

(iv) Phosphoric acid (P_2O_5) : The amount of P_2O_5 was estimated as $Mg_2P_2O_7$ by usual method.

(v) Chlorine : By Mohr's method.[1]

(vi) Calcium : By usual method.[2]

(vii) Magnesium : By usual method.[2]

(viii) Potassium : By Suzuki's method.[3]

(ix) Iron : By usual method.[4]

(x) Copper : By jodometry.[5]

(3) Experimental results

The results obtained are shown as Table 1. In this experiment, the amount of

aluminium was not estimated. But Ōya and Shimada[6] have determined by analysis that aluminium in the meat of *Stichopus japonicus* is about 4.4 mg%.

Table 1. Mineral composition of *Stichopus japonicus* meat

Items	mg% (in original)	mg% (in dry matter)
Nitric acid insoluble material (as oxide)	31.0	208.7
SO_3	298.0	2760
P_2O_5	179.0	1660
Cl	87.0	806
Ca	3.0	27.8
Mg	0.36	3.34
K	23.0	213
Fe	8.2	76
Cu	2.8	25.9
Ash	820.0	7600

Comparing the amounts of inorganic matters in the meat part of *Stichopus japonicus* with those in fish meat, the amount of P_2O_5 of meat part of *Stichopus japonicus* is 1660 mg (in the dried matter), that is to say, the amount of P is about 363 mg%. On the other hand, the amount of P of fish meat,[6] sardine, carp, grey mullet, mackerel, bonito, was 800~7200 mg% (water-content average 75%). The amount of P in the meat of *Stichopus japonicus* is smaller than that in fish meat. The amount of K in fish meat is 80~500 mg% (in the dried matter); on the other hand, the amount of this component in the meat of *Stichopus japonicus* is 213 mg%. That is to say, the amount of K in the meat of *Stichopus japonicus* is about half the value of the fish meat.

The amounts of calcium and magnesium in the fish meat are 100 mg% and 50~100 mg% respectively. The amounts of those components in the meat part of *Stichopus japonicus* are 27.8 mg% and 3.34 mg% respectively. The amounts of the latter are smaller than those of the former. In the meat of the land animals, the amount of magnesium is larger than that of calcium. On the other hand, the amount of calcium in fish is larger than that of magnesium. In the meat of *Stichopus japonicus* also, the amount of calcium is larger than that of magnesium.

The amount of iron in the meat of *Stichopus japonicus* is 76 mg% (in the dried matter), on the other hand, that of fish meat is 6~50 mg%. That is to say, the amount of iron of the meat of *Stichopus japonicus* is larger than that of fish meat. However, the amount of this component of *Stichopus japonicus* is smaller than that of clam (170~200 mg%). Ōya and Shimada[6] have estimated the amount of iron in the meat of *Stichopus japonicus* and stated that it was 74.1 mg% (in the dreid matter).

The amount of copper in the meat of *Stichopus japonicus* was 25.9 mg%. On the other hand, the amount of that component is 0.6–3 mg% (in the dried matter) in fish

meat and 24.6 mg% in oyster meat which is said to be rich in copper-content. That is to say, the amount of copper in the meat of *Stichopus japonicus* is equal to that in oyster meat.

Summary

The amounts of phosphoric acid, calcium, magnesium, potassium of the meat of *Stichopus japonicus* are inferior quantitatively to those of fish meat. But, contrariwise the amounts of iron and copper are larger. The amount of aluminium was not estimated, but it is said by Ōya and Shimada to be larger.

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