QUALITY AND SAFETY OF FLY FISH CAVIAR

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Fish caviar represents not only delicacy, but also a valuable food substance, health-giving and having excellent natural properties. Depending on the fish species, it contains 14–31% of protein, 0.3–15% of oil, and 1.5–2,0% of mineral substances. Fish proteins are almost completely assimilated by a human organism; it is rather unusual for animal proteins. Proteins from the fish caviar contain the full set of nonessential and essential amino acids, biologically active polyunsaturated fatty acids (including essential ones), liposoluble vitamins, and mineral substances, required for the normal metabolism.

The most important fishes, used for the industrial processing of caviar, are sturgeon fishes, which caviar is one of the most health-giving and expensive food products. Its consumption can be considered as a living standard indicator. The caviar of salmon fishes also has a high biological and nutritive value and is a subject of the national pride.

However, other fish species are also used to obtain a valuable caviar production. The output of the caviar of such fishes as codfish, flatfish, mullet, whitefish, carp, perch, ordinary fish, and also nototheniid fishes, whiptail, capelin, sea hen, mackerel, and herring makes thousands of tons.

According to the type of preservation and preparation, the following types of caviar are manufactured: frozen, soft, pasteurized, roe, salted and dried, salted and smoked, etc.

In recent years some products with flying fish caviar (Tobiko), a specific product of the Japan cuisine, appeared on the Russian market. The stock of the flying fish caviar in the World Ocean is very large; only in the Pacific Ocean it makes about 1.5–4 million tons. The flying fish fishery is well developed in some regions, including Japan, the Philippine islands, Indonesia, and Polynesia. In China flying fishes are considered as an anemia-healing product.

The caviar is a traditional sushi component (rolls made from rice, fish, caviar, and other components and wrapped in alga sheets); in addition, it is used in snacks and is prepared in different sauces, imparting unusual smells and tastes.

The technology of the flying fish caviar preparation was developed in Japan more than 500 years ago; this secret was imparted from generation to generation up to our time. The special property of flying fish caviar is the presence of some apophyses on the caviar capsule, which represent thread-like appendices, necessary to fix eggs on plants during the spawning. In many countries people collect flying fish caviar, dry it, and then recover when necessary; this is the main distinction of this technology from other known traditional technologies.

The natural color of this fine crispy caviar is brownish, so it is usually stained in different colors using both natural and artificial staining agents.

Until now flying fish caviar was imported into Russia as the frozen product. However, now the suppliers show interest in the drying-recovery technology of its preparation.

The purpose of our study was to investigate the properties of flying fish caviar for the further development and substantiation of the technology of its preservation, providing the quality and safety of the final product.

The objects of our study were the samples of frozen and dried caviar.

The protein and lipid content was determined according to the State Standard 7636–85. The amino acid composition was studied using a Hitachi A-A-A-835 amino acid analyzer. The fractional composition of lipids was determined by a high-performance thin-layer chromatography, and the fatty acid composition of lipids was analyzed by a gas-liquid chromatography using a Shimadzu 16A. Safety parameters were determined according to the Sanitary Standard 2.3.2.1078-01: microbiological parameters were determined using the common State Standards, the content of toxic substances was determined using a Shimadzu AAS 6701, and the content of chloroorganic pesticides was used by the gas-liquid chromatography using a Carlo Erba HRGC 5300.

The content of water, proteins, lipids, and ash in the dried caviar was 20, 55, 5.5, and 7.11%, respectively. In the case of the frozen caviar, the values of these parameters varied within the following ranges: 7,0–78,0% (water content), 9.0–15.8% (protein content), 1.2–1.6% (lipid content), and 2.97–6.1% (ash content).

The results of our studies showed that the proteins from flying fish caviar are characterized by a full set of essential and nonessential amino acids (the tryptophan content was not analyzed). According to the content of essential amino acids (valine, isoleucine, leucine, lysine, threonine, and the sum of tyrosine and phenylalanine), flying fish caviar proteins even exceed an "ideal" protein. Methionine and cystine represent limiting amino acids. The amino acid composition of caviar proteins is comparable with that of other caviar types, including sturgeon caviar.

The fractional composition of the lipids of flying fish caviar is mainly comparable with that of the caviar of other fish species; however, waxes are absent and the sterol content is twice higher than in the lipids of other caviar kinds.

The content of polyunsaturated fatty acids is rather high in both frozen and dried caviar. In addition, the presence of many fatty acids of ω3 and ω6 classes evidences a high biological value of the lipid fraction of the caviar.

In the most of the examined caviar samples (both frozen and dried) we revealed the presence of bacteria from the colibacillus group and the exceeding of the standard level of a total microbial contamination. At the same time, during the whole storage period we did not revealed any *Salmonella* bacteria, *Staphylococcus aureus*, sulphite-reducing clostridia, yeast, and mould in all examined samples.

The content of lead, arsenic, cadmium, and mercury in the samples of recovered frozen caviar was 0.007, 0.005, 0.005, and 0.02 μg/kg, respectively, which is 100–1000 times lower than the standard values. The content of HCH and isomers did not exceed 0.005 μg/kg, whereas the standardized value makes 0.2 μg/kg; the content of DDT and its metabolites was 0.007 μg/kg, which is significantly lower than the standardized value (2.0 μg/kg).

The revealed inadequacy of the flying fish caviar samples to standard microbiological parameters can indicate, from the one hand, some violations in the sanitary state of the producing facilities and, from the other hand, some breakdowns in the applied technology or its imperfection. Thus, the purpose of our further studies is the substantiation of technological procedures for the recovery of dried flying fish caviar to provide the quality and safety of prepared caviar products.

MARBIO- A MEDIUM/HIGH-THROUGHPUT SCREENING PLATFORM

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Marbio is a medium/high-throughput analytical platform at the University of Tromsø for the identification of novel bioactive compounds from marine organisms. The workflow in Marbio relies heavily on automation of sample handling, preparation and analysis, and this is true for all the three workstations; purification, bioactivity screening, and identification.

Marbio is routinely screening for molecules with these activities:

- Anti-viral
- Anti-bacterial
- Antioxidants
- Anti-diabetes
- Immunomodulatory
- Anti-cancer

In order to extract the widest possible array of compounds from the marine organisms, both aqueous and organic (dichloromethane:methanol) extracts are prepared from freeze-dried biological material. Larger organisms are divided into organ or tissue specific subsamples prior to extraction. The extracts are fractionated by semi-preparative reversed-phase HPLC, and 40 semi-purified fractions from each extract are screened for biological activity. High-resolution mass spectrometry is our primary tool to identify known compounds in active fractions from the bioactivity screening. Accurate mass data acquired by a time-of-flight MS is used to calculate elemental composition of the active compounds. All the available information on the active compound, i.e. elemental composition, biological source and the total bioactivity profile, is used to search databases. If the active compound is known, it is eliminated from further development. Novel compounds are characterized both chemically and biologically in order to evaluate their potential as drug leads. The presentation will give an overview of the workflow and some of the results in the screening program for MabCent-SFI.