Methodological approaches to the veterinary and sanitary examination of Acipenseriformes species

M V Zabolotnykh¹, S V Kleimenova¹, E A Zubareva², I A Ivkova¹

¹ Department of veterinary and sanitary examination and hygiene of livestock animals, Omsk State Agrarian University named after P. A. Stolypin, 8, Institutskaya Ploschad, Omsk, 644008, Russian Federation
² Department of anatomy, histology, physiology and pathological anatomy, Omsk State Agrarian University named after P. A. Stolypin, 8, Institutskaya Ploschad, Omsk, 644008, Russian Federation

E-mail: ea.zubareva@omgau.org

Abstract. The aim of this study was to describe the methodological approaches to the peculiarities of veterinary and sanitary examination of Acipenseriformes species. Many species of this family differ in nutritional and biological value, which affects pricing. In addition, species identification prevents the sale of counterfeit and illegal (poaching) fish products. Currently, there are no available methods for accurately determining the Acipenseriformes species. 15 fishes of the sturgeon family were taken for this study. The comparative description of organoleptic, morphological, anatomical and topographic features for species identification was studied. It is necessary to develop a technique that would be applicable for quick determination of Acipenseriformes species. It is reliable to count the gill stamens, determine the number and structure of the rays of the fins and gill covers, the absence or presence of fringes on the tendrils.

1. Introduction

The fishing industry plays an important role and is considered one of the most important segments of the production markets. Fish raw materials must meet the quality and safety of the products. Fish is a highly nutritious and valuable biological product, occupies one of the first places in the human diet, it is rich in protein, vitamins and minerals that are necessary in maintaining good health. At the same time, fish can be a source of infection or contain toxic substances [1]. Today, a lot of work is being done to control the quality of fish products. Before fish and fish products get on the shelves of stores and markets, they pass mandatory veterinary and sanitary control. Fish occupies one of the main places in the human diet. In particular, the fish of the sturgeon family is an important source of easily digestible protein, essential fatty acids (especially Omega-3), vitamins and minerals [2].

According to the requirements of the sanitary regulations, the sale of fish and fish products must be carried out after a full veterinary and sanitary examination and registration of veterinary accompanying documents. The veterinary certificate or a veterinary certificate of form No. 2 is issued by the veterinary laboratory, after a number of organoleptic laboratory tests and examinations for the epidemiological safety and quality of fish and fish products [3].

Currently, in veterinary practice, there are no methodological approaches to determining the species of fish of the sturgeon family, so the rules of organoleptic studies of river fish and crayfish are
used [4, 5]. We studied the main anatomical and topographic features of bone samples of different Acipenseriformes species, these patterns of phenotypic features, taking into account the morphological structure of bone tissue.

2. Problem statement
The current problems in the fishing industry are improving the quality and safety of raw materials, species identification of fish, and improving the technological processes of processing fish products. One of the important indicators of the quality of the technological process is the extension of the shelf life of the product [6], which is of paramount importance for fish products.

Food safety is one of the main directions of ensuring the national safety of the country, a factor in preserving its statehood, sovereignty, and the most important component of demographic policy. A necessary condition for the implementation of the strategic national priority is improving the quality of life of citizens by guaranteeing high standards of life support [7].

Descriptive organoleptic, anatomical and topographical, morphological, physical and chemical methods play a special role in the assessment of the species belonging to the sturgeon family [8]. The chemical composition of this family varies greatly and depends on many factors. As a result, the fish of the sturgeon family has valuable nutritional and biological values and is a frequent object of falsification. The problem of falsification is always an integral part of high-value products. For example, honey is also often falsified. The falsification was determined by using the palynological studies [9]. Therefore, it is necessary to develop the most simple and applicable identification methods in all conditions. It is an important problem in the complex of veterinary and sanitary assessment of any products.

3. Materials and methods
The objects of the study were 15 fish of the sturgeon family: sturgeon (n = 6), sterlet (n = 5) and oster - hybrid of sturgeon and starlet - (n = 4).

The study was conducted in the laboratory of the department of veterinary and sanitary expertise of animal products and hygiene of livestock animals and in the center for collective use of scientific equipment "Agricultural and Technological Research" at the Omsk State Agrarian University named after P. A. Stolypin. Veterinary and sanitary examination of fish was carried out using generally accepted methods for determining physical, anatomical and topographic, organoleptic and physico-chemical parameters. The veterinary and sanitary assessment was conducted according to the documents of the quality and safety of fish products.

The indicators of the organoleptic assessment were appearance, color, presence of foreign impurities and damage, consistency and smell. Laboratory tests were carried out in accordance with the regulatory documents (GOST 814-2019 “The chilled fish. Technical specifications”).

Fish identification was carried out according to the "Rules of veterinary and sanitary examination of freshwater fish and crayfish" (1989), and the description of anatomical and topographic features of the "Atlas annotated. Freshwater and semi-aquatic fish" (2017), "Determinant of freshwater fish fauna of the USSR" (1977), "Atlas-determinant of fish" (1994) and “Red Book of the Russian Federation” (2001). Physical parameters were determined according to the GOST 7631-2008 "Fish, non-fish objects and products".

4. Results
The mass and length of all fish were determined at the first stage of the study. All 15 samples have a spindle-shaped body, an elongated pointed shovel-shaped head, and a pointed caudal fin. The body size was 40-60 cm and weight was 226-460 g. The surface of the fish has the following characteristics: clean, natural color, inherent in this type of fish, with a thin layer of mucus. The mucus is transparent, without blood impurities and atypical smell. Skin is without seals, elastic consistency, with the color of this type of fish. The fins are solid, naturally colored, with signs of fractures. The gill covers tightly cover the gill slit. The eyes are prominent, the cornea is clear, but some samples were clouded. The
abdomen is not swollen, with a characteristic shape for these fish species. There was no mucus or discharge from the anus. The internal organs are clearly distinguishable, their structure is not changed, and the intestines are not swollen. The air bubble is two thirds air full.

During the organoleptic and physico-chemical studies of fish we obtained the indicators of freshness. After cook test we found that the broth was transparent on the surface there were large spangles of fat, the smell was specific (pleasant, fishy), and the meat was well divided into muscle bundles. The appearance of a cloud was not observed after determining the gaseous ammonia with the Eber reagent. This reaction is specific for indication of the freshness of the fish. The concentration of the hydrogen index (pH) was around 6.7.

The some atlases-determinants and other available sources were used to determine the species. The species was determined by the shape of the body and head, the structure of the oral apparatus, the number of rays of the gill covers, the structure of the tendrils and fins. The shape of the snout is one of the main identification features for identifying the sturgeon and sterlet. The location and number of beetles are also specific to each species of fish of the sturgeon family [10].

As a result of the identification of present samples, the following species were identified: Siberian sturgeon - Acipenser baerii (n = 6), starlet – Acipenser ruthenus (n = 5) and oster (n = 4) (Table 1). Distinctive species features are used in the method of identification of Acipenseriformes.

Table 1. Distinctive features of Acipenseriformes

| Features                  | Samples                      |
|---------------------------|------------------------------|
| Lower lip                 | Acipenser baerii (n = 6)     | Acipenser ruthenus (n = 5) | Oster (n = 4) |
| Mouth                     | strongly interrupted         | interrupted                | interrupted   |
| Head and snout shape      | transverse lower             | small lower                | small lower   |
| Tendrils                  | the snout is short and rounded | some samples have elongated and pointed tendrils, while in others is shortened and pointed | flattened, shovel-shaped |
| Gill caps                 | the gill stamens are in the form of a fan, have from 25 to 48 rays, the gill angle of the cap is pointed | gill stamens from 16 to 26 | gill caps are rounded with fan-shaped stamens having 32-38 rays. The lower corner of the gill cap is slightly pointed |
| Beetles                   | between the rows of beetles there are bony plates in the form of plates | dorsal beetles from 10-16, lateral from 58-69, abdominal from 10-18. Between the rows of beetles there are bone plates in the form of grains | the body is covered with five rows of special shields-beetles. Dorsal beetles 12-14, lateral beetles 43-53, ventral beetles 10-12. Between the beetles there are bony, diamond-shaped, comb-like small scales ranging in size from 2-5 mm |

5. Discussion
The organoleptic characteristics of the products are subjective, as these are based on the individual taste, visual, olfactory and tactile perceptions of the expert. Unfortunately, these characteristics cannot always be as a reliable source of information about the quality and safety of the products.
The determination of Acipenseriformes species requires extensive knowledge of their anatomical and morphological features [11]. Veterinary and sanitary (including forensic) examination of fish is a complex of anatomical and other laboratory expertise that aimed to determine the safety and quality of products and preventing the unauthorized sale of high-value fish species. Organoleptic indicators largely depend on the freshness of the fish: appearance, colour, smell, consistencies are the primary indicators of the quality and safety of fish and fish products.

The high-value fish, including fish of the sturgeon family, are often falsified. In the case of assortment (species) falsification, a less valuable type of fish is replaced by a more valuable one. According to the results of our study, there is not enough information about the species differences of Acipenseriformes by anatomical and morphological features.

Modern identification methods are aimed at studying the molecular and genetic characteristics of each species, determining their degree of hybridization. This approach is considered as the most reliable, but cannot be applied in any laboratory of veterinary and sanitary examination, for example, at the market, fisheries, etc. It was also found that the determination of mitochondrial DNA is a fairly effective method for species identification and detection of sterlet hybrids [12, 13]. Russian scientists are studying the fish-breeding, biological indicators and exterior features of the hybrid of the Siberian sturgeon with sterlet grown in warm-water industrial farming. They are studying the size, weight, and biochemical composition of samples [14]. Similar studies should be carried out for other species of fish of the sturgeon family in order to compile a complete atlas (reference book) of the fish species determinant.

6. Conclusions

Comprehensive veterinary and sanitary examinations of fish products provide its safety and quality. It is important to determine the species of fresh fish. It is necessary to conduct the physico-chemical studies of fish in case of doubtful organoleptic parameters. The most accurate one of the available methods for determining the Acipenseriformes species of fish is the determination of their anatomical and topographic features. This method is low-cost and applicable in the veterinary laboratory. The description of anatomical and topographical features of sturgeon fish requires further study in comparison with molecular-genetic and physico-chemical indicators and the formation of a data bank.

Currently, all high-precision methods are time-consuming and costly. Therefore, it is necessary to develop a technique that would be applicable for quick, visual determination the main (pathognomonic) signs of each fish species. It is very reliable to count the gill stamens, determine the number and structure of the rays of the fins and gill covers, the absence or presence of fringes on the tendrils.

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