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National Dishes and their Role in the Transmission of Dangerous Invasive Diseases in the Arctic Regions of Yakutia

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ABSTRACT

The article presents the results of studies on the epizootic and epidemiological situation in the territory of Yakutia for particularly dangerous invasive diseases-Diphyllobothriosis, Trichinosis, Echinococcosis and Teniarhynchosis. The article reflects the results of the authors own research with such components as the infestation of fish, bears, wild and domestic animals and epidemiological surveillance of the disease of the population with these Helminthiasis. It is noted that the obtained data on the dynamics of the morbidity of the population in comparison with the indicators of Russia exceeds several times. Infection of animals and fish with pathogens of dangerous invasive diseases creates conditions for the formation of natural foci, and prevention issues remain relevant due to the high level of morbidity, infestations that transmit through fish, wild and domestic animals predominate.

INTRODUCTION

According to the bioclimatic zoning, Yakutia belongs to the extreme-severe zone. The climate is sharply continental, characterized by long winter and short summer periods. The maximum amplitude of the average temperatures of the coldest month of January and the warmest month of July is 102.8°C. According to the absolute value of the minimum temperature and its total duration of the cold period from 6.5 to 9 months per year, the republic has no analogues in the Northern Hemisphere. Yakutia consists of 35 administrative territorial units: 34 uluses and 7 cities, the total population is 949.8 thousand people, 80% of the population lives in rural areas. They are engaged in fishing, reindeer husbandry, horse breeding and cattle breeding in the direction of agricultural production [1].

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The presence of pathogenic microorganisms, artificial and natural radionuclides, heavy metal salts, nitrites, nitrates, pesticides, as well as food additives in food products is a danger to human health. And along with them, parasites that are biohazard are also detected. When conducting research and reviewing the epidemiological situation, a high level of infection of the population with dangerous invasive diseases is noted. From 3,500 to 5,000 cases of 4 to 17 nosological forms are registered annually. In dangerous invasive diseases, the course of the disease is often accompanied by chronic diseases, pathology of individual organs and tissues, irreversible complications for human health leading to disability [2].

METHODOLOGY

These research methods are widely used to determine various indices of infection of meat and fish products by the methods generally accepted in helminthology. The method of complete and incomplete helminthological dissections of parenchymal organs and intestines, the study of the muscles of 45 horses, 23 cattle, 51 reindeer. 3924 fecal samples were examined by kopro- larvoscopy, including 2523 from horses, 963 from cattle, 438 from reindeer, and 98 from brown bears. The Fulleborn method (1910). Fecal sample 3 g pour 100 ml of table salt (420 g of salt per 1 liter of water) carefully peremashivaem, filter through a sieve in another glass. The filtrate is defended for 40–60 minutes. During this time, the Helminth eggs float to the surface. The specific gravity of such a solution is 1.12–1.2. With a metal loop, we remove the film from the surface of the liquid and examine it under a small magnification microscope.

Using the method of compressor Trichinelloscopy, 28 sections of various muscles are examined: intercostal, tongue, chewing, cervical, femoral, thoracic and calf muscles. The glass compresorium prepared with the sample is viewed under a small magnification of the microscope.

The method of enzymatic digestion in artificial gastric juice and determination of the number of Trichinella larvae in 1 g of muscle minced meat.

In the middle course of the Lena River (Yakutsk, Khangalassky, Namsky, Kobayasky, Bulunsky districts), 278 copies were examined. 8 species of parasites were found in fish. Of the 269 fish discovered in the Vilyui River (Suntarsky, Mirninsky, Nyurbinsky, Verkhnevilyuysky, Vilyuysky districts), 17 species were identified. In the Kolyma River (Verkhnekolymsky, Srednekolymsky, Nizhnekolymsky districts), 71 specimens were studied. Fish that have 14 species of parasites found. 127 specimens were studied in the Indigirka River (Allaikhovskiy, Abysky, Momsky, Omyakonsky districts). Fish that have 12 species of parasites found. 79 specimens were studied in the Olenek River (Oleneksky district). Fish that have 10 types of parasites found. In the Yana River (Verkhoyansky district) 158 copies. Fish that have 7 types of parasites found.

RESULTS AND DISCUSSION

Safe for health is considered to be products that do not contain or contain the minimum permissible toxic substances according to sanitary standards, should not have carcinogenic, mutagenic or other adverse effects on the human body. Yakutia is famous for its valuable varieties of fish. The national dish “stroganina” of freshly frozen “white” fish and all kinds of fish dishes at all times were not only a valuable product containing protein, micro and macro elements, vitamins and valuable fish oil, which made up for the body’s lack of vegetable fats. “One of the favorite and really very tasty and healthy dishes is considered by the Yakuts to be “stroganina” – frozen, sliced fish” [3]. For stroganina, fish of different breeds of the highest grades are taken: salmon, sterlets; other Yakuts do not use them. It is necessary that the fish is frozen to a very low temperature, not less than 40°C, otherwise it seems flabby and watery. From the parts of the fish in raw form, they eat the liver of burbot and the caviar of any fish.

In addition, in the fats of fish living in cold waters, there are specific polyunsaturated elements that are so necessary for the human body – for its beauty, strength and endurance. Large river fish of whitefish breeds (Stenodus nelma, Coregonus nasu, Coregonus autumnalis, Coregonus muksun, Coregonus, etc.), the Yakuts and other northern peoples consume fresh, low-salt fish.

The most important role in the Yakut cuisine tradition is the preparation of meat products, quite actively eaten raw liver, warm blood, brain [4]. A serious place in the Yakut cuisine is occupied by horse fat, brain, “stroganina” from bear meat. Many people prefer slightly salted fish, the salting of which is only 5–10 minutes, while undoubtedly having parasites in the fish and their larvae remain alive. Keep up with the times, because now the population is popular with dishes: sushi, rolls, sashimi, for the preparation of which raw, pickled or smoked fish is used.

According to our research data, in the general structure of infection of the population, the most common Helminthiasis in Yakutia is Diphyllbothriosis, its share for the period 1990–2019 was 98%. The average morbidity rate for the specified period was recorded in the range from 112.2 to 477.2 cases per 100 thousand of the population. A comparative analysis of the incidence in Yakutia showed an excess of 37.4 times in Russia.

Diphyllbothrium latum is a type of tapeworm, the final hosts of which are people, dogs and other carnivorous animals, intermediate–freshwater crustaceans, additional–freshwater fish. Infection of mammals occurs when eating fish in which there were larvae of the Parasite (plerocercoid) – this causes the disease Diphyllbothriosis. The broad sloth has a long history of infecting people who regularly eat fish. Especially those whose customs include the consumption of raw or poorly processed fish.

Internal fund of waters about fish production in Yakutia there are 905 freshwater rivers and more than 700 thousand lakes. The average annual catch of commercial fish is 4300-4500 tons. The Lena, Kolyma, Indigirka, Olenek and Yana rivers are of the greatest importance in fish production, in the basins where natural foci of Diphyllobothriosis are registered. The incidence of Diphyllobothriosis is registered among the population almost everywhere. When analyzing the incidence of the disease by region, the dependence on the freshwater reservoir was revealed.

When studying the caught fish, the number of infected plerocercoids of type A *Diphyllobotrium latum* is observed in Lota Lota 63.1%, *Esox lucius* 100%, with the amplitude of the intensity of the invasion, the minimum number is 15 individuals, the maximum is up to 56 individuals. In *Perca fluviatilis* 47.8%, *Coregonus tugun* 11.1%, *Gymnocephalus cernuus* 7.6% with an invasion intensity of 1 to 6 individuals. In fish of the species *Coregonus autumnalis*-13.5%, grouse-25%, *Coregonus muksun*-10.2%, *Coregonus nasus*-6.5% with an invasion intensity of 3 to 14 individuals. Plerocercoids of type E *Diphyllobotrium ditremum* in *Coregonus sardinella* – 70.3%, *Coregonus muksun*-24.8%, *Coregonus autumnalis*-53.3%.

The highest rates of morbidity per 100 thousand population by district were recorded in the Lena River basin – 1503.9 in Kobyaikey, 1249.0 in Khangalassky, 841.7 in Olekminsky, 484.3 in Yakutsk, 416.4 in Namsky and 309.8 in Bulunsky districts. In the Kolyma River basin – 468.2 in Srednekolymsky, 270.0 in Verkhnekolymsky, 25.7 in Nizhnekolymsky districts. In the basin of the river Vilyui – 137.0 Vilyuysky, 131.8 Verkhneviluisk, to 117.8 Nyurbinsky, 71.1 66.4 Mirninsky and Suntarsky districts. In the Indigirka River basin – 158.7 in Allaikhovskiy, 48.5 Abysky, 35.3 Momsky and 5.1 Oymyakonsky districts. In the basin of the Yana River 32.9 Verkhoyansky district. In the Olenek River basin, 41.1 are located in the Oleneksky district.

Infection with *Diphyllobotrium latum* *Canis familiaris* is very common in all regions of Yakutia. *Diphyllobotrium latum* was found in 783 or 9.2% of the studied number of dogs for the period from 1999 to 2020 with an invasion intensity of 2 to 8 parasites. Dogs were infected in Central Yakutia: Megino-Kangalassky, Amginsky, Namsky, Khangalassky, Ust-Aldansky; in the Vilyu group – Mirninsky, Suntarsky, Nyurbinsky, Verkhnevilyuysky, in Southern Yakutia–Aldan, Lensky, Olekminsky (Figure 1).

Thus, the highest rates of infection of the population with pathogens of diphyllobothriosis are detected in the autumn-winter months. Most of the infection occurs in the summer, which is associated with the mass production of fish. Most often, infection occurs when eating fresh fish and caviar, fish “fast” salting called “five-minute”, lightly salted fish. Among the infected and sick people, the proportion of the adult population is 96% (Figure 2).



Figure 1 Cestoda the *Diphyllobotrium latum* (Photo of original author L. Kokolova).

On the Territory of Yakutia, natural foci of Trichinellosis are localized. The incidence of the population is recorded in the form of local outbreaks and group foci. Trichinellosis is a group of infestations caused by nematodes of the genus *Trichinella* sp, represented in the territory of Yakutia by two species *Trichinella spiralis* and *Trichinella nativa*. Natural foci of trichinosis are found everywhere. The main source of infection of the population is bear meat, among the indigenous population, bear meat is very highly valued for its gastronomic properties. Among local hunters, it has a ritual character, the formation of a young man as a real Yakut hunter, with the obligatory treat of all friends with a piece of meat from a captured bear. It should be remembered that bear meat in most cases is infected with larvae of *Trichinella* sp. According to the results of our studies, from the presented muscle samples from 98 brown bears, *Trichinella nativa* larvae were detected in 43 samples, i.e. in 43 bears, which is 43.9% of the infection rate (Figure 3).

Infection and diseases of the population with trichinosis occur annually. Recall that a major outbreak of trichinosis from *Ursus arctos*, which was officially announced in Yakutia were: 1993 in the Tomponsky district 50 people workers of the geological party; 1994 with the number of cases of trichinosis 20 people in the Mirninsky district; 1999 in the city of Neryungrisky South Yakutia, 60 people were infected,

Percentage of infection of the population by age group in the period 2015-2020

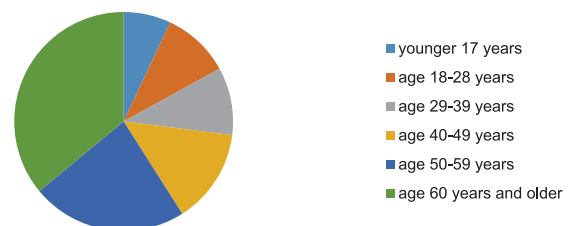


Figure 2 Diagram of the percentage of infection of the population by age group on average for 2015-2020.

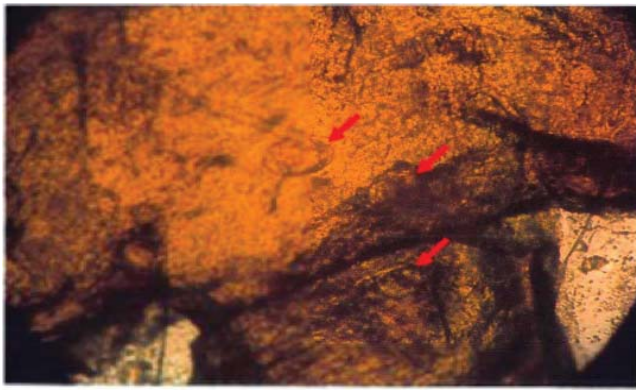


Figure 3 Larvae of *Trichinella spiralis* in the muscles of an *Ursus arctos* (Original photo by L. Kokolova).

including 4 children under the age of 14 years; in 2002, in the Olekminsky district, the village of Teene, 10 people were infected, three years later, 2 people were infected. human consumption of *Canis familiaris* meat; in 2019, 56 residents were infected with *Ursus arctos* meat produced by *Ursus arctos* in the Suntarsky district of Kyukey village. In 2020, in the village of Khandyga, Tomponsky district, a family of 3 people became infected with trichinosis after eating a steak made from *Canis familiaris* meat.

According to the factor analysis, infection of residents in most cases occurs when eating *Ursus arctos* meat in smoked and boiled form, *Canis familiaris* meat. The diagnosis of trichinosis was established on the basis of clinical, epidemiological and laboratory data confirmed by serological examination in the ELISA and calf muscle biopsy, where *Trichinella* larvae were found. The incubation period in patients ranged from 3 to 10 days. The occurrence of clinical manifestations of trichinosis and its severity depends on the type of pathogen, the level of non-specific resistance and specific immunity, and the number of larvae that have entered the human body.

A very dangerous disease echinococcosis is common throughout the territory of Yakutia, it is Cestode *Echinococcus granulosus* parasitizing in carnivorous animals, and in the larval stage in the form of Echinococcal affects parenchymatose organs (lungs, liver and sometimes larynx) in *Rangifer tarandu*, *Alces alces*, *Capriolus capreolus*, *Races bovinus* and *Equus caballus*, as well as in humans.

Echinococcus granulosus was detected in 29, which accounted for 2.2% of the 1318 *Canis familiaris* studied. Infected dogs were identified in Megino-Kangalasky district - 2, Amginsky - 1, Aldansky 3, Allaikhovskiy-1, Anabarky-3, Olekminsky-2, Oymyakonsky-4, Tomponsky-3, Suntarsky-2, Vilyuysky-3, Verkhnevilyuysky-2, Nizhnekolymsky-1, Nyurbinsky - 1, Khangalassky - 1.

Over the years (Figure 4a, 4b), *Echinococcus granulosus* (larva) blisters were found in 76.2% of *Alces alces*, 17.2%

of *Rangifer tarandu*, 1.21% of *Capriolus capreolus*, 1.2% of *Races bovinus*, 0.03% of *Equus caballus*. *Alces alces* affected by echinococcosis were obtained in the Khangalasky, Gorniy, and Amginsky districts, *Rangifer tarandu* in the Anabarsky, Oleneksky, and Oymyakonky districts, and in cattle in the Amginsky, Churapchinsky and Khangalasky districts. During the study, in addition to the above-mentioned animals, we first found echinococcal blisters in 5 roe deer in the liver in Central Yakutia and 1 *Rangifer tarandu* deer on the larynx in the Aldansky district and have 3 foals *Equus caballus* content in the liver in the Churapchinsky district (Figure 5).

Serious damage to the health of the population of the republic is the human disease Echinococcosis. The incidence is registered in all districts, the most unfavorable situation is observed in the Olekminsky, Kobayasky, Verkhnevilyuysky, Namsky districts. During the observation period, 290 cases were registered, the incidence rates range from 0.4 to 1.6 per 100 thousand population, which exceeds the average in Russia by up to 4 times. According to the data of patients with Echinococcosis of the population, 35.5% are over the

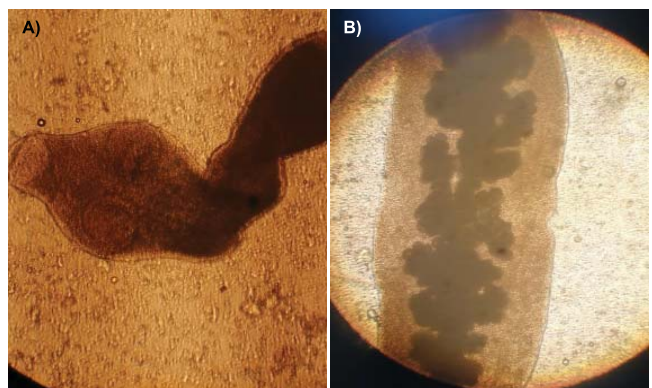


Figure 4 A: *Echinococcus granulosus* scolex; B: *Echinococcus granulosus* proglottis.



Figure 5 Hydatides Echinococcosis of the liver in *Equus caballus* (Photo of original author L. Kokolova).

age of 60 years, 55.3% of patients are women. In 57.1% of cases, they became ill as a result of prolonged contact with hunting dogs, in 28.6% – when performing work on dressing skins, 14.3% – due to work in a fur farm. The morbidity rate of the population is 3.5 times higher than that of the urban population.

Among the affected population, rural residents accounted for 90.1%. It is important to note that 55.3% of more than half of the affected residents are women. Of the total number of cases of the disease, Echinococcosis of the liver was observed in 70.5% of cases, lung–23.1%, spleen–3.8%, combined liver and lung damage–2.6%. The diagnosis of Echinococcosis in patients was established as a result of instrumental methods of examination, X-ray, ultrasound and computed tomography. Research of biological material by serological methods of laboratory diagnostics of the disease in medical laboratories of the Republic. Veterinary specialists regularly conduct raid surveys of markets, places of unidentified trade, and control over the sale of wild animal meat.

Until the end of the 80s of the 20th century, the territory of Yakutia belonged to extremely unfavorable regions according to the *Taenia saginata*, more than 2000–3000 infected with the Helminth *Taenia saginata* were registered per year. To eliminate *Taeniarhynchosis*, a set of measures aimed at breaking the epidemic chain of “man=>races bovines” was carried out. An epidemic fund was created, up to 98–99% of the infected were treated annually, and a lot of work was carried out by specialists of the veterinary service. Currently, the situation has stabilized, isolated cases of the disease are registered, however, in 2016, 7 cases were detected, and in 2020, 18 cases of the population with *Taeniarhynchosis*.

CONCLUSION

Thus, national dishes and their role in the transmission of dangerous invasive diseases [5] in the Arctic regions of Yakutia remains relevant today. Food, its composition, methods of preparing every day, festive and ceremonial dishes are based on ethnic traditions and are an integral element of the culture of the people of Yakutia, which are determined by the national way of life, forms of ethnic economy, customs and traditions that are directly dependent on the living conditions of indigenous peoples.

It is shown that *Diphyllobothriasis*, *Echinococcosis*, *Trichinellosis* and *Taeniarhynchosis* have the greatest epidemiological significance. High morbidity due to the presence of fish ponds with a significant level of *invazirovannost* plerocercoid *Diphyllobothrium latum* and widespread recreational fishing, and eating fish raw and salted form.

Infection with trichinosis pathogens in most cases occurs when eating *Ursus arctos* meat in an undigested form or smoked.

Infection with pathogens of *Echinococcosis* in most cases is due to contact with infected *Cestode Echinococcus granulosus Canis familiaris*, the development of hunting and the performance of work on the removal and dressing of fur-bearing animals.

Currently, the main preventive measures should be measures for the effective protection of the population of Yakutia, the organization of comprehensive anti-epidemic and preventive measures to combat invasive diseases that are dangerous to the health of the population.

In order to stop the foci of dangerous invasive diseases *Diphyllobothriasis*, *Echinococcosis*, *Trichinellosis* and *Taeniarhynchosis* and prevent further spread, it is necessary to carry out sanitary and hygienic and preventive measures based on the interaction of specialists in veterinary medicine, public health, hunting organizations, local governments and scientific researchers.

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