

The Prevalence and Epidemiological Control of Taeniasis (Teniarhynchosis) in Uzbekistan

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Abstract The article presents a retrospective epidemiological analysis of the distribution of teniarhynchosis in the Republic of Uzbekistan and its administrative territories, including laboratory examinations, the incidence rate of the disease among children and adults, as well as among urban and rural populations, preventive measures, and the implementation of epidemiological surveillance.

Keywords Teniarhynchosis, Epidemiology, Epidemic process, Retrospective analysis, Morbidity, Prevention, Epidemiological control

1. Introduction

Teniarhynchosis is a parasitic disease caused by the biogelminth *Teniarhynchus saginatus*, a tapeworm belonging to the family *Taeniidae*. Currently, this parasite is known as *Taenia saginata*. The parasite uses cattle as intermediate hosts, while humans serve as the definitive hosts [2,5].

The disease is more prevalent in Africa, parts of Eastern Europe, Asia, and the Philippines than in Latin America. The parasite is found anywhere beef is consumed, including in countries with strict sanitation policies, such as the United States. The disease is most prevalent in sub-Saharan Africa and the Middle East [19,21,25].

According to the results of studies conducted in our country, teniasis accounts for 0.2% of all helminthiasis. Almost 1/5 of all teniasis cases detected in the republic are in the Khorezm region. Khorezm, Navoi, Bukhara and Samarkand regions account for almost 55% of all teniasis cases [1,8,14,15,23].

As for livestock products, in accordance with the Decree of the President of the Republic of Uzbekistan No. PF-5696 dated March 28, 2019 "On measures to radically improve the system of state management in the field of veterinary medicine and livestock breeding", preventive work is being carried out to ensure epizootic welfare, as well as timely detection, diagnosis and prevention of the spread of infectious diseases of animals.

Thus, as a result of studying the literature on the prevalence

of teniarhynchosis and cysticercosis, it can be concluded that the prevalence of this parasite differs between countries. Also, incidence rates may vary in different regions of the same country. There are contradictions regarding the prevalence of the disease in different age and gender groups.

The cattle tapeworm is one of the longest tapeworms, reaching a length of 4-12 m, sometimes reaching 25 m. It is 12-14 mm wide. The head is square-oval, 1.5-2 mm in diameter. There are 4 suckers on the head, the pronotum is rudimentary or absent, and there are no hooks. The anterior segments are short and wide, and the posterior segments are long and thin. The length of the mature segments is 16-20 mm, and the width is 5-7 mm. The eggs are oval, yellowish-brown in color, measuring 46-50 x 39-41 μm [4].

The cattle tapeworm, when mature in the intestines of humans, can excrete up to 5-15 pieces per day through feces, and they contain up to 150-175 thousand eggs. In one year, about 440 million eggs can be released. Its eggs persist in the external environment for a long time. Eggs released through feces can remain viable for several weeks or months in wastewater or pastures. Eggs remain viable at temperatures from -10 °C to 17 °C. These data indicate that one person infected with the parasite can infect many cattle with cysticercosis.

According to other scientific literature, the optimal environmental conditions for *T. saginata* eggs in the soil are a temperature of 25–30 °C and a humidity level of 80%.

Some researchers believe that cysticercosis can occur in humans if the parasite eggs are accidentally ingested through the mouth, but this is extremely rare. However, other groups of researchers believe that *T. saginata* does not cause cysticercosis in humans. In 2022, a patient with suspected *T. saginata* cysticercosis was identified in China. However,

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due to the limited availability of molecular genetic testing, a definitive diagnosis has not been made. The ability of *T. saginata* to cause cysticercosis in humans remains incompletely understood and controversial [18,20,24,25].

Cattle become infected by consuming feed or water contaminated with human feces containing *T. saginata* eggs. Eggs that enter the intestine through the mouth penetrate the intestinal wall, enter the mesenteric venous capillaries or lymphatic vessels, and move throughout the body for 8-10 weeks, settling in the intermuscular connective tissue and transverse muscle (mainly the tongue, masticatory muscles, heart, but also the muscles of the body, arms and legs, diaphragm), connective tissue of internal organs, subcutaneous tissue, eyes, and brain, where they form cysts (cysticerci). Cysticerci remain viable for 8-9 months [11,13,19,21].

However, one study conducted in recent years found that the proportion of infected cattle increases with age. It was also found that male cattle were more likely to be infected, although no statistically significant difference was found. The authors believe that this may be due to the fact that bulls move around more in pastures. Researchers have also observed that the prevalence of cysticercosis varies among different breeds of cattle [21].

Disease distribution and economic damage: Numerous helminthological investigations have shown that cattle cysticercosis is found in farms of all regions. 2.6 - 8.9% of cattle are affected in ordinary farms where this disease is spread, while in livestock complexes it occurs in 1.3 - 10.3%.

Cattle diseases also contribute to the development of infestation, as people with taeniarhinoses shed adult parasites and eggs for a long time, and these can survive in the environment for up to 12 months, in livestock buildings for up to 18 months, in manure and urine for up to 8 months, in water for up to 6 months, and in grass and hay for up to 4 months.

In Uzbekistan, an average of 24 people out of every 10,000 people suffer from taeniarhinoses per year. In Uzbekistan, cysticercosis, which is most common in cattle, is found in about 10% of slaughtered cattle. Veterinary specialists consider 1% of the meat of slaughtered cattle infected with this disease to be unfit for consumption. In addition, young cattle in captivity with cysticercosis lose an average weight of 40 kg due to obesity.

Thus, since taeniarhinoses differs from other helminthiasis in that it proceeds without clinical symptoms, there is no accurate information about the level of incidence of this disease. Therefore, early diagnosis, conservative treatment, and improvement of preventive measures for taeniarhinoses are among the urgent problems facing professionals in the field today.

2. Purpose of the Research

The aim of the study was to analyze the prevalence and epidemiological characteristics of the development of the causative agent of teniarinchirosis in the Republic of Uzbekistan and its administrative territories, and to improve

preventive measures against the disease.

3. Materials and Methods

The study utilized official reports on teniarinchirosis from 2010 to 2023 provided by the Sanitary and Epidemiological Welfare and Public Health Committee of the Republic of Uzbekistan and its regional departments; epidemiological investigation maps of infectious disease foci; and patient case records. Epidemiological and statistical methods were employed in the research. The epidemiological analysis was carried out dynamically, taking into account various indicators such as natural, social, occupational, age, and gender factors.

4. Results and Discussion

In particular, the analysis of the long-term dynamics of the disease allows us to study the trend, periodicity and irregular (epizootic) fluctuations of the epidemic process. In order to study the long-term dynamics of the incidence of teniarhythmia in the Republic of Uzbekistan, official data of the Committee of the Republic of Uzbekistan for Sanitary and Epidemiological Wellbeing and Public Health for 2010-2023 were retrospectively analyzed.

In the Republic of Uzbekistan, a total of 6,607 patients with taeniarhinoses were registered during 2010-2023, and the intensity index of the disease per 100,000 population was found to be between 2.7 and 0.6 in different years (Figure 1).

In the first year of the study, in 2010, the intensive index of taeniarhinoses in our republic was 2.7 per 100 thousand population, the highest index during the analyzed years. Although a downward trend in the incidence rate has been observed since 2011, it has remained at similar levels in recent years. By 2023, the intensive index was 0.6, which indicates a 4.5-fold decrease in incidence compared to 2010. During the analyzed years, no irregular fluctuations in incidence were observed across the republic.

The decrease in incidence rates from year to year may be due to the fact that patients with taeniarhinoses travel abroad for treatment and return, and that patients from regional districts travel to urban centers for treatment, as well as some shortcomings in the registration of patients.

When we determined the long-term dynamics of the incidence of taeniarhinoses in the administrative regions of the Republic of Uzbekistan, the total number of cases and the average intensity of the disease per 100 thousand population in 12 regions, Tashkent city, and the Republic of Karakalpakstan, it was found that the distribution was uneven in different regions of our Republic (Figure 2).

The presented data indicate that the incidence rates vary across all regions of the Republic. During the period from 2010 to 2023, the highest rates of infection were recorded in Khorezm, Navoi Regions, and the Republic of Karakalpakstan, while moderate incidence levels were observed in Bukhara, Surkhandarya, and Syrdarya Regions. The lowest rates were reported in Tashkent city, Namangan, and Tashkent Regions.

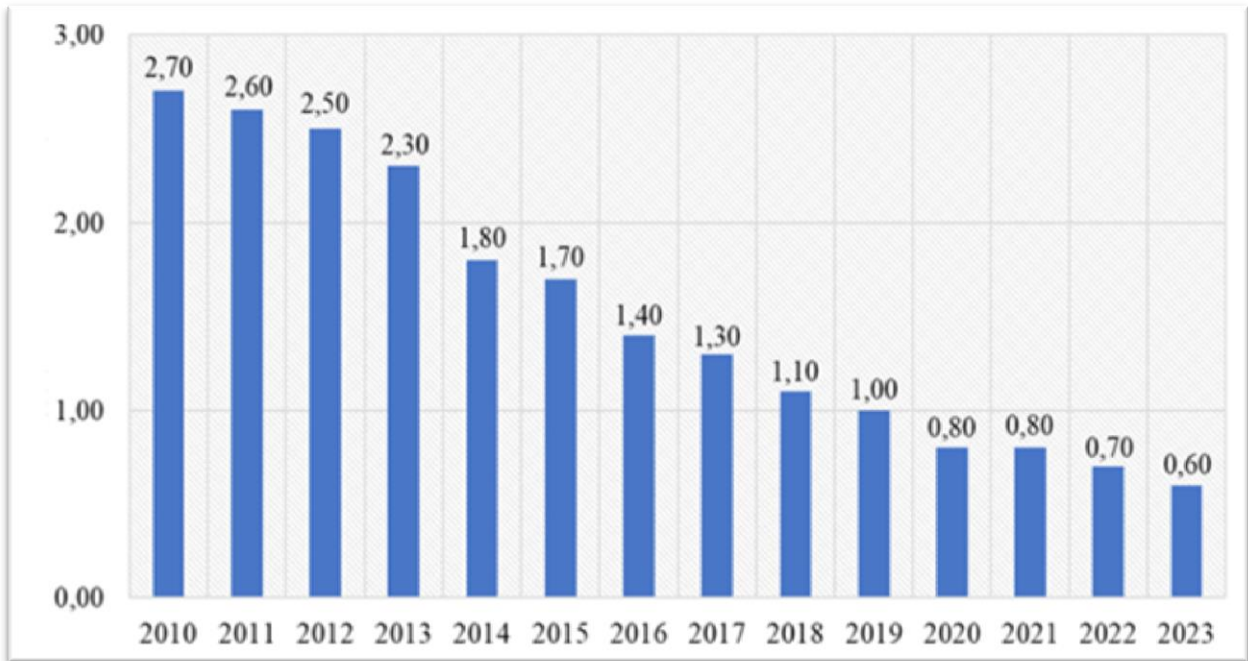


Figure 1. Long-term dynamics of teniarinchiasis in the Republic of Uzbekistan (incidence rate per 100,000 population, 2010–2023)

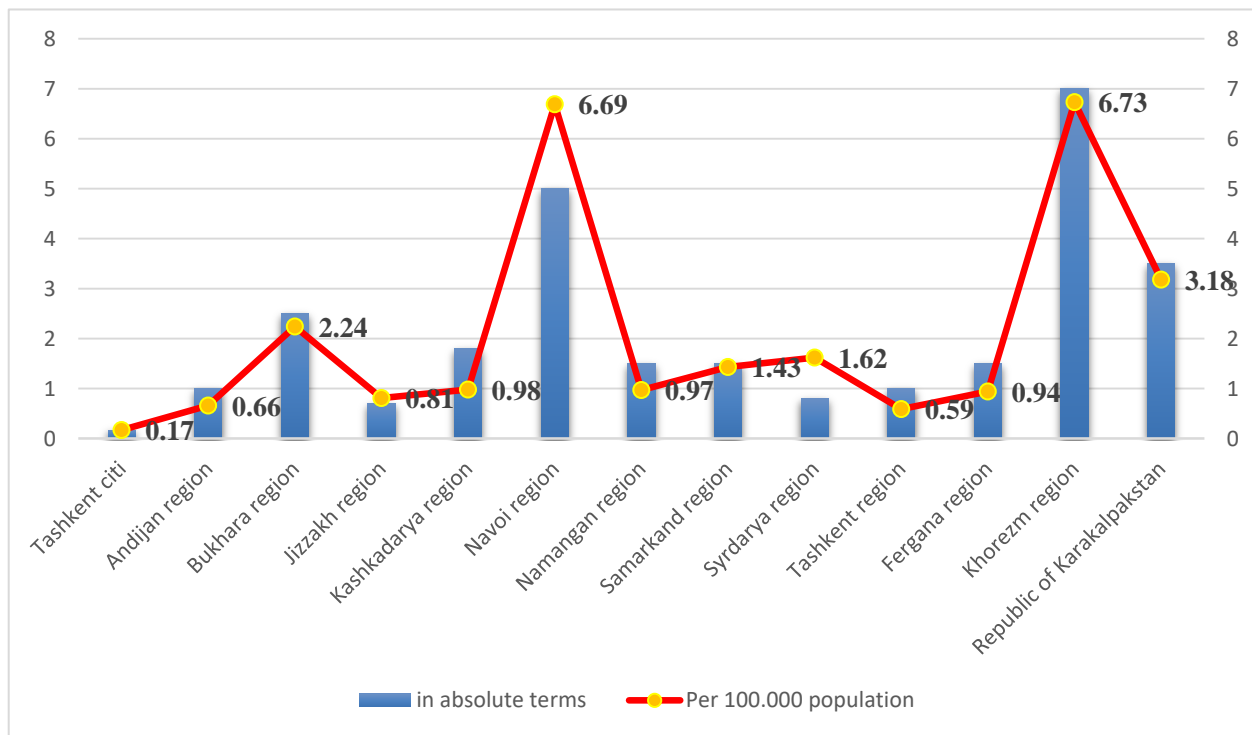


Figure 2. Incidence rates of teniarinchiasis by administrative territories of the Republic of Uzbekistan (2010–2023)

The reasons for the high prevalence of the disease in the Khorezm region, where the incidence rate is highest, are proven by the consumption of "Ijjan"-a traditional Uzbek dish prepared from raw minced beef, and the presence of a source of the disease.

The preparation of the traditional dish “Ijjan” involves

using raw (beef or mutton) meat, which is finely chopped with a sharp knife and pounded with a cleaver on a wooden block made from the trunk of a plane or oleaster tree, resulting in minced raw meat that is consumed without cooking. Freshly slaughtered beef or mutton is mainly used for preparing ijjon. Since cattle serve as the principal

intermediate hosts of *Taenia saginata*, the consumption of this dish is considered one of the contributing factors to the transmission of teniarinchirosis, which explains the high prevalence of the disease. At present, due to the implementation of sanitary education among the population, the consumption of ijjon has significantly decreased, and the slaughtering of sheep and cattle has been regulated under sanitary and veterinary supervision.

Economic efficiency of tested anthelmintics and its analysis: The main goal of all the reforms implemented in the conditions of the transition to the market economy of our republic is to mobilize the available opportunities and intellectual potential, to increase the pace of production of livestock products, to organize and implement a highly local and economically efficient veterinary service in ensuring the health of animals and epizootic sanitation of the territory of our country.

Nowadays, veterinary services are a joint effort of government organizations, agricultural enterprises, and public institutions, which undertake such responsible and at the same time honorable tasks as the prevention and treatment of livestock, poultry, and other animals from diseases, increasing the productivity and quality of livestock products, as well as protecting humanity from diseases common to animals and humans.

Nowadays, the activities of the veterinary service should be related to the economic efficiency of livestock activities. Therefore, the analysis of the economic efficiency of veterinary activities should be aimed at reducing disease and mortality among animals, shortening the duration of treatment, improving the quality of livestock products and raw materials, and preventing their deterioration.

Since the large number of veterinary facilities and the wide range of veterinary activities are related to the organization of a system of economic indicators, it is necessary to justify the development of measures to prevent various diseases in animals.

To determine the economic effectiveness of measures to prevent, improve and treat animal diseases, the following indicator systems have been developed: determination of actual and eliminated damage, economic efficiency of veterinary measures, economic efficiency per 1 sum of veterinary services, payback of capital investments, and labor productivity of veterinary specialists.

Taking this into account, we determined the cost-effectiveness of the treatments we conducted:

It is used in the treatment of cysticercosis of cattle veterinary expenses

Table 1

No	Name of expenses	quantity	Price
1.	Syringe 10 ml	5 pieces	5000
2.	Rubber gloves	5 pairs	10000
3.	Oxfendazole	50 ml	55000
4.	Veterinarian salary		180000
	Total:		250000

The prevented economic loss is determined using the following formula:

$$P_1 = N \times I \times V - A_1$$

Where:

- P_1 – Prevented loss;
- N – Number of cattle in the farm;
- I – Infection coefficient;
- V – Market value of one animal;
- A_1 – Actual loss.

The actual loss (A_1) is calculated as follows:

$$A_1 = L_1 + L_2 + L_3 + L_4$$

Where:

- A_1 – Actual loss;
- L_1 – Loss due to reduction in meat quantity;
- L_2 – Loss due to deterioration in meat quality;
- L_3 – Loss related to disinfection and disposal;
- L_4 – Production losses (milk yield, growth rate).

Table 2

Type of loss	Estimated amount (per 1 head of animal)
Reducing the amount of meat	50,000 – 100,000 sums
Loss of meat quality	Up to 20% off
Disinfection and disposal	10,000 – 30,000 sums
Production losses (milk, growth)	30,000 – 50,000 sums
Total damage (for 1 head)	100,000 – 200,000 sums

Calculation of Actual and Prevented Losses, and Economic Efficiency

The actual loss was determined as follows:

$$A_1 = L_1 + L_2 + L_3 + L_4 = 100,000 + 4,000,000 + 30,000 + 50,000 = 4,180,000$$

The prevented loss was calculated based on 100 head of cattle:

$$P_1 = N \times I \times V - A_1 = 100 \times 0.1 \times 13,000,000 - 4,180,000 = 13,000,000 - 4,180,000 = 8,820,000$$

Determination of Economic Efficiency:

$$E_e = P_1 - C_v$$

Where:

- E_e – Economic efficiency;
- P_1 – Prevented loss;
- C_v – Veterinary expenses.

$$E_e = 8,820,000 - 500,000 = 8,770,000$$

Determination of Return per Unit Cost:

$$R = E_e / C_v$$

Where:

- R – Return per unit cost;
- E_e – Economic efficiency;
- C_v – Veterinary expenses.

$$R = 8,770,000 / 500,000 = 17.54$$

Thus, for every 1 UZS invested, an economic return of **17.54 UZS** was achieved.

Preventive and anti-epidemic measures for taeniarhiniasis

To prevent taeniarhiniasis and effectively implement anti-epidemic measures, it is first necessary to identify the source of the disease and intermediate hosts. One of the first measures to be taken in the prevention of taeniarhiniasis is to develop highly sensitive, effective and cost-effective diagnostic methods for cysticercosis and to improve accounting and reporting on this parasite.

Centralized collection and analysis of data on livestock slaughtered in individual poultry houses and households and their contamination.

According to the current sanitary and hygienic standards in our country ("Hygienic standards for food safety" No. 0366-19 of the State Sanitary and Epidemiological Service), slaughtered meat of large horned cattle and pigs: chewing muscles, tongue, heart, neck, lumbar muscles and other muscles of the forelimbs are examined for the detection of cysticerci. In this case, regardless of the viability, if cysticerci are detected, they are not allowed for sale.

Regular deworming of livestock and children is of great importance in the prevention of taeniarhinosi. The most commonly used drugs for deworming include phenasal and pisiquantel. Phenasal may also be effective against cattle tapeworm, among other parasites. Its effectiveness is highest when the duration of the infestation does not exceed 1 year. According to various estimates, its effectiveness ranges from 45% to 90%, with an average of 70%.

In order to protect healthy farms from helminthiasis, helminthological examination of livestock and poultry brought to the farm is necessary. If necessary, they should be dewormed and kept in separate buildings. If there are 100-200 animals, 10-15%, if there are 10-15 animals, all of them must be helminthologically checked.

The medical knowledge and culture of the population are of great importance in the fight against this parasite. Unfortunately, even among students studying at medical universities, the level of knowledge about taeniarhiniasis is low. In one of the studies aimed at studying the level of knowledge about taeniarhiniasis among students of the 1st and 4th stages of medical education, it was found that 40.2% of students did not have information about its transmission routes. When these students were asked whether this parasite can be transmitted from person to person, only about 34% of them answered that there was no.

5. Conclusions

Thus, an analysis of the literature on measures aimed at preventing taeniarhiniasis shows a number of problems and shortcomings. The problem is mainly related to identifying the source of the disease, since infected people may not show obvious clinical signs, which means that they can spread parasite eggs for a long time. In addition, the effectiveness of laboratory diagnosis of patients cannot be called high. Even when conducting a veterinary examination of large-horned cattle for cysticercosis, fins are not fully detected. In rural

areas, most households have livestock, and they always consume animals slaughtered for their own needs without undergoing veterinary examination. The nutritional and medical culture of the population is also of great importance in the fight against this parasite.

Epidemiological control of teniarhynchosis. To prevent people from contracting taeniarhiniasis, measures against this disease should be taken in two directions. First, it is necessary to identify the source of the disease early, make an accurate diagnosis, and treat it.

Secondly, it is necessary to take into account that butchers have a great epidemiological importance in the fight against taeniarhinosi in livestock areas. Therefore, they should know the ways of transmission of teniarhinosi, factors and measures to combat its spread. In addition to butchers, shepherds and all agricultural workers should also know this. Teniarhinosi is most often contracted by rural residents or those who prepare dishes and salads from meat products. All waste generated during the slaughter and dressing of cattle infected with teniarhinosi should be disinfected.

To avoid infection, it is necessary to follow personal preventive measures. These include taking care of pets, as they may have pinworm eggs on their fur. After each pet care, hands should be washed thoroughly with soap.

It should be remembered that children constantly put their hands and various objects in their mouths, which may be contaminated with tapeworm eggs. This shows how important it is to maintain good hygiene in children. Since people are often infected through their hands, it is advisable not to shake hands.

It is difficult to give specific advice for every situation in life, of course, but from what has been said, it is clear that personal hygiene is of great importance in the fight against tapeworm disease.

Mass medical examination of the population in endemic foci will allow for early detection of the disease. Data on animal infestation, data from medical and preventive institutions and the level of organization of medical care in the region will be developed, as well as effective measures will be taken and the organization of medical care will be improved.

Epidemiological analysis is carried out at a certain time interval (month, half-year, year) in the outbreak and a retrospective epidemiological analysis should be conducted. For this, it is necessary to use all elements of epidemiological analysis: where (place, region), when (month, seasonality), in what form (in an epizootic outbreak, during an epidemic, epidemic) and who (patients, gender, age) became ill or are at risk of contracting taeniarhinosi.

Epidemiological surveillance of taeniarhinosi should be carried out taking into account the pathogenetic characteristics of this invasion, the interrelationship of epizootic and epidemic situations, the type of circulating pathogen, as well as the social and environmental conditions that ensure a certain level of disease transmission among animals and humans. The results of regular epidemiological surveillance form the basis for planning rational, targeted measures

against taeniarhynchosis. In addition, they allow us to identify changes in the trend of epidemic and epizootic situations.

In conclusion, the complete eradication of this disease from all livestock farms through preventive measures is an urgent issue of national economic importance, which, along with strengthening the livestock economy, is also a struggle to protect human health.

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