



Parasitic diseases and their impact on public health: a study of cases in different regions of the country

By

Kursanbek Raimkulov¹, Baken Sharsheeva², Gulzire Ashimova³, Adina Zhekshenbekova³

¹Ph.D., professor RAEN, associate professor I.K. Akhunbaev Kyrgyz State Medical Academy, Bishkek, Kyrgyz Republic

²Ph.D. associate professor Kyrgyz National University named after Zhusup Balasagyn, Bishkek, Kyrgyz Republic

³Master's student Kyrgyz National University named after Zhusup Balasagyn, Bishkek, Kyrgyz Republic



Abstract

Parasitic diseases represent a significant threat to public health in many countries, especially in regions with poor sanitary and hygienic conditions. This article explores the impact of parasitic infections on public health by analyzing cases from different regions of the country. We investigate the prevalence of parasitic diseases, their clinical manifestations, and their socio-economic impacts. The article provides an assessment of the prevalence rate of parasitic diseases and the level of infestation in the Kyrgyz Republic (KR).

Research Method. Based on the obtained results, the analysis and calculation of the infection rate per 1,000 examined individuals were conducted using the formula: (number of positive cases * 1000 / number of examined individuals). The statistical significance of the odds ratio was calculated using www.medcalc.org/calc/odds_ratio.php. The results were processed using the SPSS statistical software.

The analysis of morbidity trends indicates that parasitic infections in the republic have a complex epidemiological pattern. In recent decades, a decrease in the incidence of certain helminth infections, such as ascariasis, has been observed. However, the number of cases of other infections, including echinococcosis, alveococcosis, and toxocariasis, is increasing. High infestation rates among young children highlight the need to improve preventive measures, including health education and regular medical examinations.

Conclusion: More than 20 types of parasitic diseases have been registered in Kyrgyzstan, among which malaria was **eliminated** in 2016. Although the incidence of intestinal parasitic infections has decreased, new infestations, such as *dicrocoeliasis*, *fascioliasis*, and *toxocariasis*, have emerged. *Echinococcosis* and *alveococcosis* remain significant public health problems, with a tendency to spread throughout the republic.

KEYWORDS: parasitic diseases, Kyrgyzstan, intestinal parasitic infections, echinococcosis, alveococcosis, morbidity, nematodoses, protozoal infections.

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INTRODUCTION

Parasitic diseases are caused by various microorganisms, such as protozoa, worms, and ectoparasites. They can lead to serious health consequences, including chronic illnesses, disability, and even death. In the context of globalization and climate change, the spread of parasites is increasing, requiring attention from healthcare institutions. Parasitic **infections** remain one of the significant public health problems. Parasites are widespread elements of biological systems. According to

various estimates, about 1.5–2 billion people worldwide are infected with at least one type of helminth. In Russia, helminth infections account for 89.1% of all parasitic diseases and continue to be one of the key global health problems [1, 2, 3].

Every year, more than 40,000 cases of parasitic diseases are reported in Kyrgyzstan, although experts estimate that the actual number could reach 400,000. Currently, parasitic diseases, mainly affecting socially vulnerable groups, are



viewed by the international community as an indicator of economic inequality, which gives them significant social importance [4, 5].

According to the World Health Organization (WHO) statistics presented in 2006, there was a 7.6% increase in the incidence of parasitic diseases, including protozoal infections and helminthiasis, such as enterobiasis. Globally, 1.5 billion people, or nearly 24% of the world's population, are infected with soil-transmitted helminth infections. In countries in Asia, Africa, and Latin America, there is a trend of annual growth in the infection rates of the population with protozoal infections [6, 7].

The epidemiological situation regarding parasitic diseases in Kyrgyzstan, as well as in neighboring countries, has long been unfavorable. In terms of prevalence, parasitic diseases were second only to the flu and acute respiratory infections (ARIs) [8]. For example, the proportion of infected children in our republic was 84% just a decade ago, but it has now decreased to 74% [9].

In recent years, there has been an increase in the infection rates of the population with helminthiasis in the republic, with 28,000 to 40,000 cases of helminth infections reported annually. The incidence rates range from 7,900/0000 to 10,000/0000 per population. According to official data, over 50,000 cases of parasite infections are registered annually in the country, and considering the distance of many regions from main centers and the lack of adequate testing facilities, the actual number of such cases could be ten times higher.

Among the parasitic diseases registered in the republic, helminthiasis account for an average of 85%, with intestinal helminths occupying a leading position [10]. The average multi-year indicator of parasitic infections per 1,000 examined individuals for the period from 2015 to 2019 was 46.9. Children under the age of 14 formed the risk group for all registered parasitic infections, with a share of 80.4% [10].

As noted by the authors [11, 12], the incidence of echinococcosis and alveococcosis in Kyrgyzstan has significantly increased over the past 30 years, rising from 5.4 per 100,000 people per year in 1991 to 13.1 per 100,000 people per year in 2014–2016.

The incidence of echinococcosis has significantly increased over the past 30 years in Kyrgyzstan and continues to be a serious medical and social problem in the Kyrgyz Republic. Its relevance is due to the lack of a decreasing trend in the number of patients and the existence of endemic regions where the incidence rate ranges from 3.6 to 21.2 per 100,000 people. The average annual growth rate was 3.5%. The average multi-year intensive incidence rate of echinococcosis per 100,000 people was 14.6, the minimum was 9.2 (in 2004), and the maximum was 20.2 (in 2014). The average multi-year intensive incidence rate of alveococcosis per 1,000 people was 2.04, the minimum was 1.2 (in 2009), and the maximum was 3.9 (in 2015). Echinococcosis has a widespread distribution, and an increase in the incidence rate was noted in all regions of the Kyrgyz Republic [13].

Considering the above, the main goal of this study is to investigate parasitic diseases and their impact on public health in the Kyrgyz Republic (KR). The study aims to analyze the incidence of various parasitic infections, including malaria, intestinal parasitic infections, helminthiasis, and protozoal infections, with a focus on the dynamics of infections in different age groups and regions of the country. Special attention is given to identifying factors contributing to the spread of these diseases, as well as assessing their impact on public health, which will help develop recommendations for improving preventive measures and increasing awareness of parasitic infections.

RESEARCH MATERIALS

The study analyzed and processed data from government statistics, including annual report forms No. 1 "Report on Infectious and Parasitic Diseases" and form No. 18 "Report on the Work of the Center for State Sanitary and Epidemiological Supervision (disinfection station) of the Department of Disease Prevention and State Sanitary and Epidemiological Supervision of the Ministry of Health (DPDSES MH) of Kyrgyzstan" for the period from 2010 to 2021.

RESEARCH METHOD

Based on the obtained results, an analysis was conducted to calculate the infection rate per 1,000 examined people (number of positive cases * 1000 / number of examined people). The statistical significance of the odds ratios was calculated using the website www.medcalc.org/calc/odds_ratio.php. The p-value was calculated as described in [14], page 542. The results were processed using the SPSS statistical software.

CASE REPORT

According to British researchers, there are currently 1,415 known pathogens causing infectious and parasitic diseases. The largest group includes diseases caused by bacteria and rickettsia (538 types). The second-largest group is parasitic diseases with 353 types, while viral infections form the smallest group with 217 types [15].

Every year, an average of 546,454 stool samples are tested for parasitic diseases in Kyrgyzstan, which is about 8% of the country's population. In the last three years (from 2017 to 2019), an average of 759,298 people were examined, and 26,197 of them were found to be infected, making the infection rate 34.5 per 1,000 examined people. From 2015 to 2021, the average infection rate for intestinal mixed infections was 9.8 per 1,000 examined people.

In Batken region, 11,010 children were examined, and 1,434 of them tested positive, making the infection rate 130.24 per 1,000 examined children, with a proportion of 13.0%. Among the 1,434 cases, 82 children were diagnosed with mixed infections, which is 21.2%.

In Osh region, 22,059 children were examined, and 2,469 of them were infected, with an infection rate of 111.92 per 1,000 examined children and a proportion of 11.2%. Among the

2,469 infected children, 260 had mixed infections, which is 10.5%.

In Bishkek city and Sokuluk district, 1,062 people were examined, and 350 were infected, making the infection rate 329.6 cases per 1,000 examined people. Specifically, the infection rates were: ascariasis – 120.5 per 1,000, enterobiasis (pinworm) – 182.7 per 1,000, giardiasis – 15.1 per 1,000, and dwarf tapeworm – 23.5 per 1,000 examined people.

Overall, among the examined children, the infection rate was 33.0%, which is 329.6 cases per 1,000 examined children. The highest infection rate was observed among 6-year-old children – 46.4% (464.0 cases per 1,000). Children aged 9 and 11 also showed high infection rates of 34.8% each.

Children aged 3 and 4 showed significant infection rates of 33.3% and 34%, respectively. The infection rate among 8-year-old children was 24.5% (245.3 cases per 1,000), while for children aged 10 and 12, the rates were 25% and 27.9%, respectively. Among 5-year-old children, the infection rate was also high (34.7%) but lower than that of 6-year-olds.

Among registered helminth infections in the country, nematode infections were the most common, with ascariasis leading the list. Over the past 60 years, the infection rate of ascariasis has significantly decreased. In the 1960s, the average infection rate was 787.9 per 100,000 people. In the next decade, it decreased 1.8 times to 419.10 per 100,000 people.

In the following 40 years (1980–2019), the infection rate dropped 2.5 times compared to the 1970s. This decrease was due to screening programs for the population in all regions and mass deworming campaigns.

Over the observed 60 years, the infection rate of enterobiasis showed both increases and decreases. In the 1960s, the average infection rate was 461.60 per 100,000 people, which grew 1.4 times to 657.60 per 100,000 in the next decade. In the 1980s and 1990s, the rate increased further due to more active screening, reaching 850.51 per 100,000 in the 1980s and 898.51 per 100,000 in the 1990s. In the following two decades (2000–2009 and 2010–2019), the infection rate decreased 1.7 times in the 2000s and 1.9 times in the 2010s compared to the 1990s.

Echinococcosis is widespread in Kyrgyzstan with varying infection rates. In the last two decades, the number of cases of echinococcosis and alveococcosis has increased. This issue remains significant due to the lack of a declining trend and the existence of endemic regions where the infection rate ranges from 3.6 to 21.2 per 100,000 people. It affects not only rural residents involved in livestock farming but also urban populations [13].

According to the latest data, Kyrgyzstan has a population of 7,037,600 people, including 3,557,300 women (50.5%) and 3,480,300 men (49.5%). Currently, the rural population of Kyrgyzstan is 4,583,900 people, making up 65.1% of the total population, while 2,453,700 people (34.9%) live in urban

areas. Compared to 2018, the rural population increased by 368,000 and the urban population by 280,100.

During the entire observation period (1986–2022), a total of 19,262 surgically confirmed cases of echinococcosis were recorded. On average, 520 cases were detected annually. The average infection rate was 9.98 per 100,000 people, with a maximum of 16.9 in 2015 and a minimum of 2.9 in 1986. Over the observed period, the infection rate of echinococcosis showed a moderate increasing trend with an annual growth rate of 3%.

Over the analysis period, echinococcosis went from being a rare helminth infection to a common parasitic disease. The infection rate increased 4.5 times in 2022 compared to 1986, and the country became an endemic area for echinococcosis. The epidemic process of echinococcosis showed periodic fluctuations with intervals of 3–4 years (Figure 1) [16].

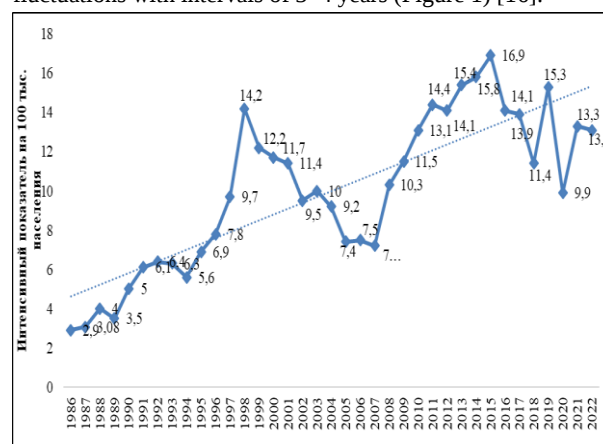


Fig. 1 - Long-term trends in echinococcosis incidence in the population of Kyrgyzstan from 1986 to 2022

Over the past 20 years, the total economic damage from echinococcosis in Kyrgyzstan amounted to 384,357,481.2 KGS (4,956,253.8 USD, exchange rate as of July 20, 2020). On average, the annual cost of this infection was 19,217,874.1 KGS (247,812.7 USD) [17]. The highest expenditures of the state sanitary-epidemiological and veterinary services for the prevention of echinococcosis were in the rural areas of Osh region (2,765,136 USD) [18].

In the 1960–1969 period, parasitic diseases represented 56.0% of the total incidence rate. In the following decade, this proportion decreased by 1.2 times, reaching 46%. In the next decade, the share of helminthiasis in total incidence decreased by 4.1 times compared to the 1960s and by 3.5 times compared to the 1970s. However, in the subsequent decades, there was an increase in the proportion of helminthiasis in the structure of infectious diseases in the country. In the 1990s, this increase was likely due to the deterioration of socio-economic conditions after the collapse of the Soviet Union, and the share of parasitic diseases increased by 2.1 times compared to the previous decade. In the following decade, the share of parasitic diseases in the structure of infectious diseases continued to grow.

Since the independence of Kyrgyzstan (1990–2019), the level of infection with taeniasis decreased by 13.6 times compared

to the previous 30-year period (1960-1989). The average intensity for the first 30 years was 15.090/0000, while in the next ten years it dropped to 1.190/0000, which led to the transition of this infection from the category of common to rare helminth diseases. The decrease in taeniasis cases was due to the reduction in taeniosis.

Until 2010, no cases of dicrocoeliosis and fascioliasis were recorded in the country. In recent years, there has been a moderate increase in dicrocoeliosis, with an annual growth rate of 5.6%. The incidence fluctuated from 0.5 per 100,000 population in 2012 to 1.6 in 2016. Fascioliasis incidence varied from 0.1 to 0.3 per 100,000. Both diseases are considered rare helminthiasis. The incidence of toxocariasis is also increasing, with an annual increase rate of 10%, ranging from 0.1 in 2010 and 2011 to 3.7 in 2019.

Among protozoan diseases, the country has registered amoebiasis, giardiasis, and toxoplasmosis. Giardiasis has been officially registered since 1998 and represents the largest share among protozoan diseases. The incidence of giardiasis has increased by 1.7 times.

Malaria was widely spread during the early years of Kyrgyzstan's formation. The incidence reached 4,000 cases per year. In 2002, transmission of *P. Vivax* malaria resumed, causing an explosive epidemic in the southern provinces of the country, with the number of indigenous cases reaching 2,725. By 2005, the number of locally acquired cases increased to 225. Nationwide, 96 cases of local malaria were registered (compared to 318 in 2006). As a result of differentiated anti-malarial measures, considering the natural and climatic risk factors of each region, Kyrgyzstan received a certificate of malaria elimination in 2016.

The prevalence of parasitic diseases varies depending on the region. In rural and remote areas, where access to medical services is limited, the level of incidence can be significantly higher.

Impact of Parasitic Diseases on Public Health:

Parasitic diseases lead to delays in the physical and mental development of children, reducing the working capacity of the adult population. Sick children perform poorly in school. In women, parasitic diseases can lead to complications during pregnancy, while men may suffer from impotence and infertility.

In the modern world, parasitic diseases are a major factor contributing to immunosuppression. As a result, in addition to direct damage, parasitic diseases indirectly contribute to the widespread appearance and spread of both infectious and non-infectious diseases. The most common types of helminthiasis reduce the effectiveness of routine vaccination programs [19, 20].

Even prolonged presence of many parasites in a patient's body may not cause pronounced acute clinical symptoms. Long-term parasitic diseases are often accompanied by various non-specific clinical manifestations such as fatigue, weakness, loss of appetite, and others.

Clinical Manifestations of Parasitic Diseases

- Acute clinical picture, vulvitis (enterobiasis), chronic, often asymptomatic course, with development of: asthenia, loss of appetite, nausea, epigastric pain, irritability, sleep disturbances, fatigue, poor school performance, memory impairment, delayed physical and mental development in children, reduced work capacity in adults, anemia, pregnancy toxicosis, allergy, and immunosuppression.

These symptoms of asthenization are often not associated by general practitioners with the presence of parasites, which leads to late diagnosis and often incorrect diagnoses. Anemia, especially common in tropical regions, is also not usually linked with parasitic diseases. Typically, nutrition experts are called upon to address anemia. However, the causal relationship between intestinal helminths and anemia is well established. Anemia develops most actively in cases of hookworm infections. It has been shown that with the parasitism of just eight helminths in the body of a pregnant woman weighing 50 kg, her iron reserves are completely depleted by the fourth month, leading to a critical condition. Hookworms cause daily blood loss (2-5 g) and, consequently, iron loss (0.75 mg) [19, 20].

Socio-Economic Consequences of Parasitic Diseases:

Parasitic diseases have a significant impact on the economic development of regions. These diseases lead to a decrease in labor productivity, an increase in healthcare costs, and loss of productivity. As a result, families and communities face economic difficulties, exacerbating the problem of poverty.

DISCUSSION

Parasitic diseases remain a significant public health problem, especially in regions with poor sanitary conditions and limited access to medical care. In Kyrgyzstan, tens of thousands of cases of parasitic infections are registered annually, but the actual scale of the problem may be much larger. The high prevalence of diseases such as helminthiasis, protozoan diseases, and echinococcosis highlights the need for a comprehensive approach to their prevention and treatment.

The analysis of incidence trends shows that parasitic infections in the republic have a complex epidemiological pattern. In recent decades, the incidence of some helminthiasis, such as ascariasis, has decreased, but the number of cases of other infections, including echinococcosis, alveococcosis, and toxocariasis, has increased. The high prevalence of these diseases among young children emphasizes the need for improved preventive measures, including sanitary education and regular medical checkups.

Parasitic diseases have a negative impact not only on public health but also on the country's economy. Affected individuals suffer from chronic fatigue, reduced work capacity, and other complications, leading to significant losses in labor productivity. Additionally, the diagnosis and treatment of parasitic infections require considerable financial resources from the healthcare system.

To combat parasitic diseases in Kyrgyzstan, comprehensive measures are needed, including public health education, the development of laboratory diagnostics, mass screening programs, and strengthened environmental sanitation monitoring. International experience shows that successful control of parasitic diseases requires interdepartmental collaboration and active participation from both government agencies and local communities.

CONCLUSION

Parasitic diseases pose a significant threat to public health and require a comprehensive approach to their prevention and treatment. To improve sanitary conditions, raise awareness, and enhance access to healthcare services, joint efforts from government bodies, international organizations, and local communities are essential. Only through collective action can the impact of parasitic infections be reduced and the quality of life of the population improved. In Kyrgyzstan, more than 20 forms of parasitic diseases have been registered, with malaria being eliminated in 2016. Although the incidence of intestinal parasitoses has decreased, new infections such as dicrocoeliosis, fascioliasis, and toxocariasis have emerged. There has also been a decline in cases of arachnoidiasis, but an increase in the incidence of protozoan diseases. Echinococcosis and alveococcosis remain major public health concerns, with a tendency to spread throughout the republic (Raïmkulov K.M., 2010, 2020).

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