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BACTERIAL CONTAMINATION OF WATER SOURCES AND ACUTE INTESTINAL INFECTIONS IN THE REPUBLIC OF KARAKALPAKSTAN

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Abstract — In recent years, increasing evidence has highlighted the significant role of the intestinal microbiome in the overall functioning of the human body. The composition of the intestinal microflora influences the immune system, metabolic processes, and even human behavior. Therefore, maintaining an optimal balance in the gut microbiome is essential for overall health. This study aimed to evaluate the compliance of drinking water used by residents of the Republic of Karakalpakstan with state standards and hygienic regulations, and to assess its impact on the dynamics of acute intestinal diseases. Laboratory studies were conducted using bacteriological, bacterioscopic, and statistical methods. Various nutrient media, including Endo, Levine, and Ploskirev's media, were used to isolate different species of pathogenic bacteria. Fecal samples were collected and analyzed from 3,944 patients diagnosed with acute intestinal diseases during the study period. Findings indicate that in the Republic of Karakalpakstan, the incidence of acute intestinal diseases is primarily linked to bacterial contamination of open water bodies. The predominant causative agents identified were *Proteus*, *Klebsiella*, and *Shigella*. The foodborne transmission route was found to be the most common mode of infection, followed by contact and household transmission. The majority of affected individuals were children under 14 years of age, particularly preschool-aged children who were not enrolled in organized childcare facilities. Furthermore, an annual increase in cases of acute intestinal infections of unknown etiology has been recorded in the Republic of Karakalpakstan. Addressing this growing public health concern requires a comprehensive and systematic approach, integrating improved water quality control, enhanced diagnostic methods, and effective preventive measures.

Keywords — *acute intestinal infections, diarrhea, etiology, bacteria, water, regions, bacteriological methods, causative agents.*

Introduction

The World Health Organization (WHO) estimates that around 1 million people worldwide suffer from acute intestinal infections annually, with children accounting for 65–70% of cases [3,5,11]. In the past few years, almost 80 million cases have been reported, resulting in around 700,000 deaths [9]. The incidence rates of acute diarrhea, which affect people all around the world, range from 160 to 250 per 100,000 people in EU member states. While children under five years old have the highest incidence of infectious diarrhea in affluent nations, elderly individuals are most seen to have severe diarrhea that necessitates hospitalization and ultimately results in mortality [14]. In acute intestinal infections, the most common pathogens, especially in children, are members of the following families: Adenoviridae (genus Mastadenovirus), Reoviridae (genus Rotavirus), Caliciviridae (genera Norovirus, Sapovirus), Astroviridae (genus Astrovirus), Picornaviridae (genera Enterovirus, Parechovirus), Coronaviridae (genera Coronavirus, Torovirus), Parvoviridae (genus Bocavirus), and Piconaviridae (genus Piconavirus). According to published research, the prevalence of viral diarrhea in Russian children ranges from 70% in the summer to 90% in the fall and winter [3]. In addition to viruses, bacteria such as Shigella, Salmonella, Campylobacter, Staphylococcus, and pathogenic forms of Escherichia coli can cause acute intestinal infections [13]. Infectious diseases that are caused by a combination of two or more etiologic agents (also known as "mixed infections," "coinfections," "associated infections," or "satellite infections") have gained increased attention in recent years, indicating

their most varied associations and potential high proportion in the structure of infectious pathology. This means that up to 26% of acute intestinal infections have a mixed etiology, according to some studies [15]. The research indicates that viruses are the etiologic agents of both mono-infections and mixed AEI in many cases. Accordingly, Roman et al. demonstrated that rotavirus (RVI) + astrovirus and RVI + adenovirus were the most prevalent combined infections in Spanish children. According to Chung et al., a combination of viral agents is seen in 2.7% of cases in Korean children with acute gastroenteritis; the most common combinations are RVI + norovirus infection (NVI) and RVI + astrovirus. According to Koh H et al., 18.1% of cases had a mixed infection, and the most frequent combination was RVI + NVI, which happened in 12.9% of cases. Imade P.E. reports that 5.4% of cases have RVI + adenovirus. According to a 2010 study, 10.2% of cases had concurrent acute intestinal infections, with 7.2% of those instances involving the combination of RVI and adenovirus. Domestic authors report that in children with gastroenteritis, the combination of RVI + NVI was found in 4.9% and 6.4% of cases in the framework of general acute intestinal infections [13]. Acute intestinal disease development and transmission are strongly associated with several important parameters, such as drinking water quality and availability, sanitation and hygiene standards, and public knowledge of waterborne illnesses [4,6,12]. Waterborne diseases pose a significant global health threat. According to the WHO, there are approximately 250 million cases of these illnesses each year, of which 5–10 million are thought to be fatal [1]. These diseases are especially dangerous in areas with poor sanitation practices and limited access to clean water. Acute intestinal infections are frequently spread by tainted drinking water, inadequate sanitation facilities, and a lack of public hygiene education. In the Republic of Uzbekistan (UzR), in the Republic of Karakalpakstan (KKR), bacterial contamination of wells, water supply systems, and open water bodies is commonly associated with diarrheal illnesses. Diagnosing acute diarrhea and identifying the characteristics of the causative microorganisms in patients present ongoing challenges [2,5]. Modern diagnostic tools are essential for early detection of acute intestinal infections because of their high occurrence and the growing difficulty of diagnosing and treating them. Enhancing preventative measures and treatment protocols to reduce problems is also still among the top priorities for medical experts today. Addressing these issues through better sanitation, water quality, and medical development will be essential to lowering the prevalence of these illnesses worldwide

Methods

In 2021, the bacteriological laboratory of the Sanitary and Epidemiological Welfare and the Public Health Center of the Republic of Karakalpakstan and its territorial branches examined stool samples from 3944 patients with acute intestinal diseases. Epidemiological and statistical methods were used. The Laboratory examination was carried out by the classical bacteriological method [8]. Also, the reports of the State Statistics Center on the population of the Republic of Karakalpakstan were used [10].

Result

The analyses conducted in the cross-section of the regions of the Karakalpakstan Republic showed that, among all infectious diseases, acute intestinal disease was of special importance. First, this indicates the negative impact of drinking water quality. Thus, in the regions of the Republic of Karakalpakstan in 2021, 3944 cases of acute intestinal diseases were registered, intensive indicators - 203.7 for every 100,000 people, incidence among children under 14 years old - 3302, i.e. 83.7 Back in 2021, when we analyzed the number of primary infections among the population in the cross-section of the regions of the Karakalpakstan Republic showed that there was an increase in the city of Nukus - 669.8, Takhyatosh - 311.6, Turtkul - 275.0. Also, Bozotov - 13.8, Amudaryo - 14.8, Kegeyli - A decrease was observed in 17.7 districts. Fig.1.

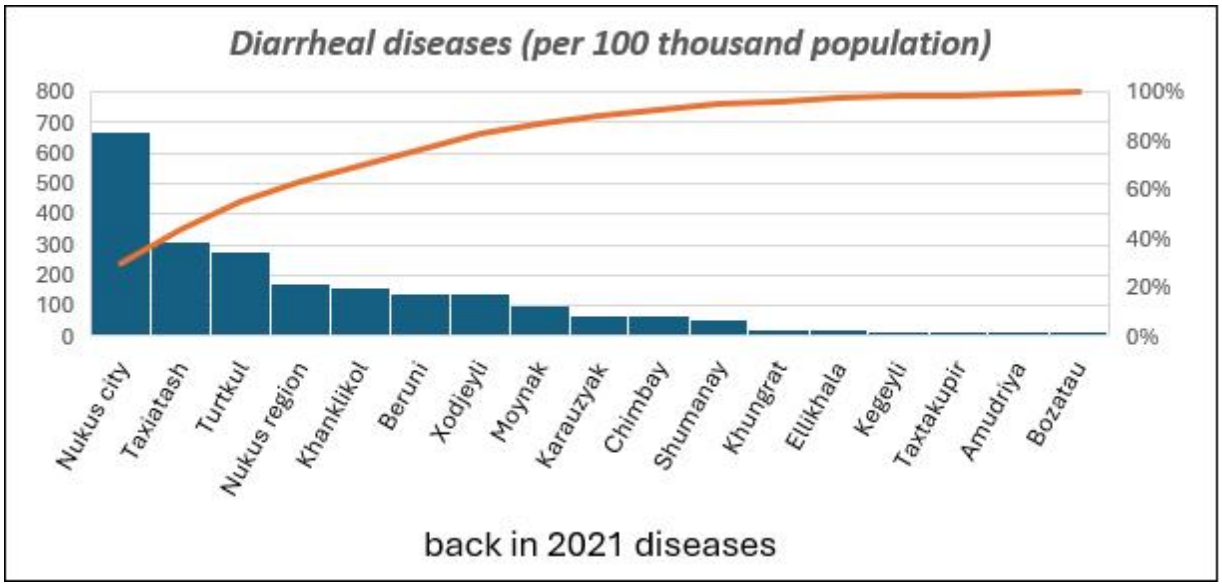

Figure 1: Primary indicators of the population in the cross-regions of the Republic of Karakalpakstan about acute intestinal disease

We tried to find out the reason for the high incidence of acute intestinal diseases and the factors causing this disease in the cities and regions of the Republic of Karakalpakstan. In doing so, we mainly focused on the ways of transmission of diseases. It has been established that the disease is mainly transmitted through drinking water, food and, in a smaller number of cases, through household contact. During the study, we tried to establish a connection between bacterial contamination of drinking water, which is one of the main factors of transmission, and cases of acute intestinal diseases. As of January 1, 2022, the population of the Republic of Karakalpakstan is provided with centralized drinking water by 69.7%, including 72.4% in cities and 49.3% in villages [6]. In 2021, morbidity rates among the population of the regions of the Republic of Karakalpakstan were compared with samples of tap water that did not meet the requirements of the State Standard of the Republic of Uzbekistan No. 950 - 2011 (UzDSt) for bacteriological indicators. In 2021, the share of water samples that did not meet the requirements of Standards of the Republic of Uzbekistan was -1.6% in the city of Nukus, -6.3% in Takhiatash, -1.2% in Turtkul and -12.9% in Nukus districts. The results of the analysis allowed us to assume that the incidence of acute intestinal diseases may be associated not only with tap water, but also with bacterial contamination of water in open reservoirs, and we examined the bacterial contamination of water samples from open reservoirs. During the research, it was established that water samples from open water sources in the Tortkol, Beruni, Takhyatosh, Moynak and Khanlikol regions had high bacterial contamination and indicators of acute intestinal diseases. Fig.2.

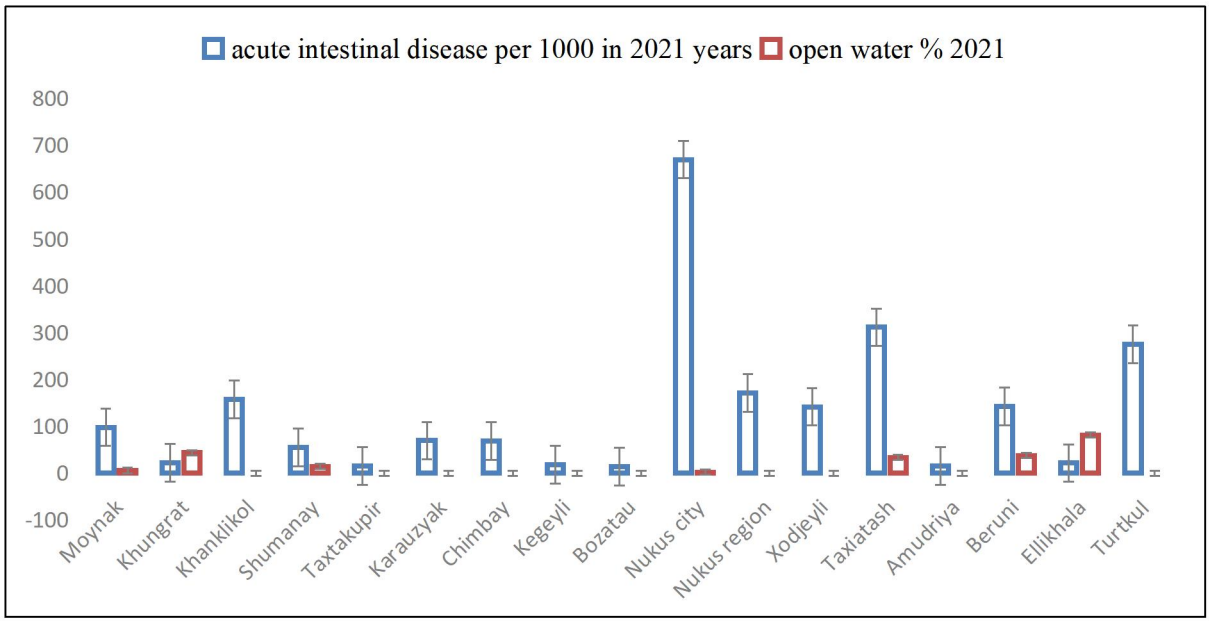

Figure 2: Incidence of acute intestinal disease in the population of Karakalpakstan by districts and comparison with water samples of open water sources.

To determine the relationship between disease indicators and the water factor, it is necessary to analyze their correlations in multi-year dynamics. To study the composition and characteristics of pathogens that cause acute intestinal diseases in areas with high incidence, bacteriologically examined stool samples from 3944 patients registered in 2021. As a result, the exciters have been isolated in 1017 cases. Shigella 129, Citrobacter 151, Enterobacter 70, Klebsiella 219, Serratia 6, Hafnia 3, Proteus 420, Staphylococcus 1, and rotavirus - 18 cases.

Discussion. The Republic of Karakalpakstan's acute intestinal illness analysis raises serious issues with water quality and public health. The significant prevalence of these illnesses, especially in regions like Tortkol, Takhiatash, and Nukus, indicates that infrastructure and environmental factors are important in the spread of disease. The results highlight the need for better sanitation and water treatment facilities by showing a link between the prevalence of acute intestinal illnesses and drinking water contamination.

Conclusions.

The study's conclusions highlight how important water quality is in determining how common acute intestinal illnesses are in Karakalpakstan. To lessen the burden of these illnesses, a multifaceted strategy including better infrastructure, increased water quality monitoring, public awareness initiatives, and fortified healthcare facilities is necessary. Effectively addressing these problems will result in notable enhancements to the region's general standard of living and public health.

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