Исследования показали, наличие анемии, которая проявляется снижением уровня гемоглобина и гематокрита. Процессы происходящие в организме кур, в свою очередь, свидетельствует о кровоизлияниях, вызванных поражением кишечника, что характерно для эймериоза. Физиологические отклонения в клетках крови включают повышение базофилов, что может указывать на воспаление и снижение уровня эозинофилов, что может быть связано с истощением иммунной системы в ответ на хроническое воспаление. Количественные показатели лимфоцитов слегка повышены, что отражает активизацию иммунного ответа.

Биохимический анализ крови показал гипопротеинемию, снижение уровня мочевины и повышение креатинина, что свидетельствует о нарушении обмена веществ, повреждении печени и почек, а также разрушении мышечной ткани, вероятно, из-за воздействия токсинов, выделяемых паразитами.

Микроскопические и гистопатологические исследования тканей подтвердили диагноз эймериоза кур. В образцах кишечника были выявлены ооцисты Eimeria spp., что указывает на паразитарную инвазию. Результаты патанатомического вскрытия показала, что значительное повреждение слизистой оболочки, потерю ворсинок и некроз тканей, а также инфильтрацию лимфоцитами и макрофагами. Освобождение мерозоитов из ооцист привело к разрушению клеток и повреждению кишечной ткани.

Таким образом, все данные указывают на тяжелое поражение организма, вызванное эймериозом, с выраженными нарушениями обмена веществ и воспалительными изменениями в тканях.

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EPIZOOTIC MAP OF HELMINTH INFESTATION OF SAIGAS OF URAL POPULATION IN THE WEST KAZAKHSTAN REGION

ANNOTATION

The study focuses on the analysis of the epizootic situation related to saiga helminth infestations in West Kazakhstan region, especially in the context of migration routes crossing farm territories. In the context of increasing saiga populations and farm animal densities, close monitoring is required to prevent the spread of infestations that may affect both wild and domestic fauna. The study covers the period from 2021 to 2024, and the aim is to identify the most common helminth infestations and assess the epizootic process using modern analytical methods, including geographic information systems (GIS).

The main focus was on saiga migration routes in the Kaztalov and Zhanibek districts of West Kazakhstan region, where data on helminth infestations were collected and unfavorable points were recorded. The results showed stability of morbidity with predominance of certain parasite species. Special attention was paid to the zoning of territories according to the degree of danger, which allows effective planning of prophylactic and anti-epizootic measures. The dependence between the density of farm animals and the level of infection was established, which confirms the need for an integrated approach to the control and regulation of the number of both wild and domestic animals.

Key words: *helminth, epizootic, saiga, West Kazakhstan, map.*

Introduction. The epizootic process in helminth infections is a complex phenomenon influenced by various ecological, biological, and anthropogenic factors. Understanding these factors is crucial for managing helminth infections in wildlife and domestic animals, as well as their potential zoonotic implications for human health. Helminth infections are characterized by their ability to adapt to various hosts and environments, which contributes to their epizootic nature. Anthropogenic factors significantly influence the epizootic situation, with seasonal variations in helminth infestation observed in animals, peaking during spring, summer, and early autumn, while decreasing in winter [1]. This seasonal pattern is critical for understanding the dynamics of helminth transmission and the potential for outbreaks in animal populations. Moreover, the role of environmental conditions in the propagation of helminth infections cannot be overstated. Studies indicate that tropical climates, characterized by adequate moisture and temperature, are particularly conducive to the development of helminth infections [2]. This is further supported by the findings of Slimane, who noted that environmental factors such as temperature and moisture significantly affect the prevalence of gastrointestinal parasites in domestic chickens [3]. Such insights are essential for predicting and managing epizootic events, especially in regions where climatic conditions favor helminth transmission. The interaction between helminths and their hosts also plays a pivotal role in the epizootic process. Generalist parasites can infect a wide range of hosts, contributing to their epizootic nature [4]. This adaptability allows helminths to exploit various ecological niches, thereby enhancing their survival and transmission rates. Additionally, the immunomodulatory effects of helminths can influence host susceptibility to other infections, as demonstrated by the interactions between helminths [5] and tuberculosis [6]. These interactions complicate the epidemiological landscape, as co-infections can alter disease outcomes and host immune responses. Furthermore, the concept of zoonotic potential is critical in the context of helminth infections. Certain helminths, particularly those found in domestic animals, exhibit a higher likelihood of infecting humans, thereby raising public health concerns [7]. The changing epidemiological characteristics of zoonotic diseases, influenced by factors such as global warming and human migration, necessitate a comprehensive understanding of the dynamics of helminth infections in both animal and human populations [8]. In conclusion, the epizootic process in helminth infections is shaped by a myriad of factors, including environmental conditions, host interactions, and anthropogenic influences.

The Saiga antelope (Saiga tatarica) is a critically endangered species that has garnered significant attention due to its unique ecological role and the challenges it faces from various parasitic infections, particularly helminths. The helminth fauna of Saiga is diverse, with studies indicating a high prevalence of nematodes and other parasitic worms that can impact both wild and domestic ungulates. This literature review synthesizes findings from various studies to provide a comprehensive overview of the helminth species affecting Saiga antelopes, their transmission dynamics, and implications for conservation and livestock management. Research has shown that Saiga antelopes harbor a variety of helminths, many of which are shared with domestic livestock. For instance, Morgan reported that 36 out of 38 helminth species identified in Saiga were also found in domestic ruminants, highlighting the potential for cross-species transmission [9]. This overlap is particularly concerning given that Saiga graze extensively on pastures used by livestock, which can facilitate the spread of parasites such as Haemonchus contortus and Teladorsagia circumcincta [10]. The transmission dynamics are further complicated by seasonal migrations of Saiga, which can lead to increased interactions with domestic sheep [11]. Their study predicted that helminth transmission occurs in a cyclical pattern, with Saiga acquiring parasites from sheep in winter and potentially transmitting them back in summer. In terms of specific helminth species, Zvegintsova identified several nematodes in Saiga populations, including Setaria labiatopapillosa and P. skrjabini, which are known to have complex life cycles and host specificity [12]. Additionally, Saiga infections by nematodes varied significantly, with levels ranging from 39 to 671 eggs per gram [13]. This variability underscores the influence of environmental factors and host health on helminth prevalence. The implications of helminth infections for Saiga populations are significant, particularly in the context of conservation efforts. Kushaliyev et al. emphasized the need for therapeutic and prophylactic measures to manage parasitic diseases in captive Saiga, which could also inform strategies for wild populations [1]. Furthermore, the mass die-off of Saiga in Kazakhstan in 2015, attributed to a combination of factors including bacterial infections and possibly helminth burdens, illustrates the critical intersection of health and conservation [14]. The presence of helminths can exacerbate the vulnerability of Saiga to other diseases, complicating recovery efforts for this endangered species. In conclusion, the helminth fauna of Saiga antelopes presents a complex challenge that intertwines wildlife health, conservation strategies, and livestock management.

Methods. The study area in WKR districts Kaztalov 49°45′54″ N., 48°41′06″E and Zhanibek 49°27′N., 46°53″E. More than 400 samples of saiga feces were collected during the study (Figure 1). Saiga feces were examined using the Fülleburn and Darling method.

The Fülleborn method is the most common flotation method for diagnosing cestodoses and nematodoses. In a cup or jar put 5-10 g of feces and add 20 times the saturated solution of table salt, stir with tweezers or glass rod, then filtered through a metal strainer or gauze and stand for 40-60 minutes. Eggs float. The surface film is taken with a metal loop (diameter 0.8 cm) transferred to a slide and microscoped. It is better to examine 3 drops [15].

Darling method - 3-5 g of feces are placed in a glass or container, water is added until a semi-liquid consistency is obtained, filtered into centrifuge tubes and centrifuged for 2-3 minutes. Then the liquid from the tube is drained, and to the resulting sediment add a mixture of equal parts of glycerol and table salt, the contents are shaken and centrifuged again for 3-5 minutes, after which the helminth eggs float to the surface layer. The surface film is removed with a helminthological loop, transferred to a slide and microscoped [16].

GPS coordinates were set using RGK handheld GPS navigator (Russia). The points of helminth infestations were set using Mapsource program (Garmin company).

Figure 1 – Preparation of samples for research

Results. In Kazakhstan, contact between farm animals and saigas is most likely to occur in saiga migration areas, therefore, epizootological monitoring should be carried out annually to identify the most pathogenic helminths and protozoa affecting saigas to ensure timely anti-epizootic measures.

Due to the excessive increase in the number and density of animals, it is necessary to analyze epizootological data on hazardous infections, invasions (helminths) and their habitats in the territory to prevent the spread of these diseases to farm animals. The population of Ural saigas in western Kazakhstan in 2024 was 1,620,000 animals, making the development of mechanisms for regulating saiga numbers and preventive measures an urgent and demanded task of the current time. The emergence of modern technical methods and information technologies for material processing dramatically simplifies this process and makes processing results more reliable. Geographic Information System (GIS) allows users to process, spatially display, analyze information and therefore can be used as an additional method for epizootological analysis. The study aims to collect and map the results of samples taken for helminthosis on saiga migration routes in Kaztalov and Zhanibek districts, to assess the epizootic process of infestation, and to establish the geographical distribution of helminth infestation using GIS technology (Figure 2).

Figure 2 – Research area

When analyzing the epizootic situation, the method of complex epizootological survey was used:

a) Epizootological survey and observation of the saiga migration territory crossed by peasant farms;

b) Comparative and geographical characterization of the epizootic process;

c) Statistical study and epizootological analysis.

Collection of data from 2021 to 2024 (number of sick, dead animals, species, age of sick animals, seasonality of the disease, number of animals examined) using a GPS receiver and Mapsource program and registration of unfavorable points.

Table 1 provides sampling locations and coordinates for Kaztalov and Zhanibek districts during the project implementation period (Figure 3).

Table 1 – The locations and coordinates of sampling for Kaztalov and Zhanibek districts are given

Years	Sample locations	Coordinates	
		Latitude	Longitude
2021	Kaztalov district, Birik village	49º69549	48º67478
		49º65645	48º73612
		49º67569	48º63076
	Kaztalov district, Terenkol village	49º57453	48º38633
	Zhanibek district, Talov village	50º32657	47º52515
		50º2959	47º58548
	Zhanibek district, Kuigenkol village	49º31564	47º66688
2022	Zhanibek district, Talov village	50º33194	47º63675
	Zhanibek district, Borsy village	50º09969	47º44315
		50º07811	47º49723
		50º05382	47º41184
2023	Zhanibek district, Talov village	50º26805	47º41969
		50º22414	47º36475
		50º23644	47º45402
		50º27156	47º34553
2024	Zhanibek district, Voroshilov village	49º38510	47º82391

Analysis of helminth infestation of saigas (cenurosis and monieziosis) as a result of the 2021-2024 survey. The disease is registered annually, and the number of foci of this disease is characterized by stability.Surveys of saigas from the Ural population revealed Trichuris skrjabini, Moniezia expansa, Nematodirella sp., Nematodirus spathiger, Oesophagostomum venulosum, Echinococcus granulosus, T.multiceps, Trichuris ovis, Eimeria elegans and Eimeria tekenovi.The animal migration routes for 2021-2024 present the results of information data collection on saiga helminth infestation and recording of unfavorable points, as shown in Table 1.Analyzing the data of adverse helminth infestation points shown in Figure 3, it should be noted that the highest number of adverse points among those recorded was in 2021.

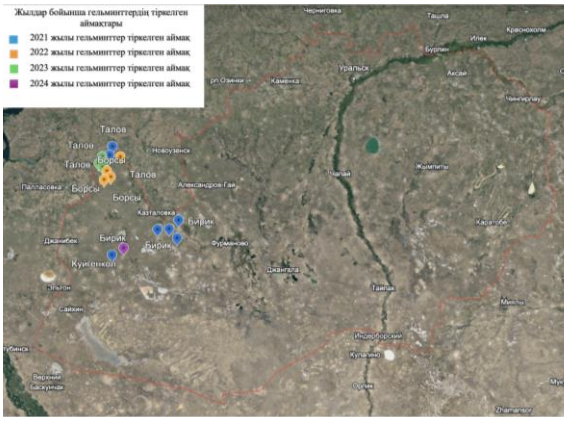

Figure 3 – Unfavorable points for animal helminthiasis in the period 2021-2024 in Kaztalov and Zhanibek districts

Currently, the territory is zoning both among wild and farm animals according to the unfavorable degree of this or that infestation to rationally organize preventive and anti-epizootic measures.

Based on the data obtained, we zoned the territory of the Kaztalov and Zhanibek districts against saiga helminthiasis, defined the zones according to the degree of potential danger of these diseases and proposed preventive measures.

In Kaztalov district, more helminth species were found in saigas during the study period. This is due to the general area of grazing and irrigation and the predominance of peasant farms and small cattle.

Thus, in 2021 in Kaztalov district the number of cattle amounted to 100 187 heads, small cattle in 2022 amounted to 216 524 heads, respectively 106 236 and 225 637 heads compared to Zhanibek district in 2023-113 792 and 240 531 heads, where the number of peasant farms almost 4 times, the number of cattle in 2022 amounted to 216 524 heads. Cattle 2 times less, small cattle 4 times less.

2024 in Kaztalov district the number of cattle amounted to 178,893 and small cattle 366,985 heads, in Zhanibek district the number of cattle amounted to 76,701 heads and small cattle 91,698 heads (according to the Bureau of National Statistics of the Agency of the Republic of Kazakhstan on Strategic Planning and Reforms) [17].

Discussion. The epizootic process in helminth infections is a multifaceted phenomenon encompassing transmission dynamics, host interactions, and environmental influences. Understanding these processes is crucial for effective management and control of helminth infections in both wildlife and domestic animal populations, as well as their implications for human health. One of the primary factors influencing the epizootic process is the interaction between helminths and their hosts. Co-infection with multiple helminth species can significantly alter the dynamics of infection. For instance, Co-infection can lead to increased egg production and bacterial load in hosts, which can enhance the transmission potential of these parasites [18]. This phenomenon of "super-shedding" can elevate the primary reproduction number (R0) of helminths, thereby facilitating their spread within populations.

Similarly, interactions among co-infecting parasites can generate significant variability in disease transmission dynamics, highlighting the importance of understanding these relationships in free-ranging populations [19]. Moreover, the hosts' immune response is critical in shaping the epizootic process. The immune response to helminth infections can be both robust and transient, with significant increases in serum antibodies observed shortly after infection [20]. This immune response can influence the survival and reproductive success of helminths, thereby affecting their transmission dynamics. Furthermore, immune-mediated facilitation among co-infecting helminths can enhance their fitness, suggesting that the immune interactions between different helminth species can have profound implications for their epidemiology [21]. Environmental factors also significantly impact the epizootic process. Giraudoux et al. highlighted the intricate linkages between environmental conditions, socio-economic factors, and the transmission dynamics of helminth infections [22]. The physical environment can influence the life stages of helminths, their intermediate hosts, and vectors, thereby shaping the overall epidemiological landscape. Additionally, the impact of anthropogenic changes, such as urbanization and agricultural practices, can alter the habitats and behaviors of both hosts and parasites, further complicating the dynamics of helminth transmission. Furthermore, the zoonotic potential of helminths is an essential consideration in the context of the epizootic process. Certain helminths, particularly those associated with domestic animals, have a higher likelihood of infecting humans, raising significant public health concerns [23]. The increasing overlap between human and animal habitats, driven by factors such as climate change and urban expansion, can facilitate the spillover of helminth infections from animals to humans, necessitating a One Health approach to disease management. In conclusion, the epizootic process in helminth infections is influenced by a complex interplay of host-parasite interactions, immune responses, environmental factors, and zoonotic potential. A comprehensive understanding of these dynamics is crucial for developing effective strategies to control and prevent helminth infections in both animal and human populations.

Conclusion. The results of this study confirm the importance of regular epizootological monitoring and zoning of the territory to detect and prevent the spread of helminthic diseases among saigas and farm animals. The highest probability of contact between these groups of animals, especially in migration areas, requires special attention to the epizootic situation, as it is directly related to the threat of spreading dangerous diseases.

Data collected from 2021 to 2024 show the stability of disease foci and allow the identification of high-risk areas. Using geographic information systems (GIS) to map and analyze the spread of infestations dramatically improves the accuracy and effectiveness of anti-epizootic measures. It is important to note that the highest number of unfavorable points for helminth infestations was recorded in 2021, which requires a careful approach to monitoring in the future.

Developing and implementing effective saiga population management mechanisms and preventive measures are crucial to preventing epidemiological threats. Epizootological data must serve as a basis for planning measures to reduce the risk of disease spread among both wild and farm animals, especially in areas with high animal densities.

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ТҮЙІН

Зерттеу Батыс Қазақстан облысындағы киіктердің гельминтозына байланысты эпизоотиялық жағдайды талдауға, әсіресе фермерлік шаруашылықтардың аумақтарымен қиылысатын көші-қон жолдары жолдарына бағытталған. Киіктер санының өсуі және ауылшаруашылық жануарларының тығыздығы барысында жабайы фауна және үй жануарларына әсер етуі мүмкін инвазияның таралуын болдырмау үшін мұқият бақылау қажет. Зерттеу 2021 жылдан 2024 жылға дейінгі кезеңді қамтиды, сонымен қатар зерттеу жұмысының мақсаты ең көп таралған гельминтоздарды анықтау, сондай-ақ геоақпараттық жүйелерді (ГАЖ) қоса алғанда, заманауи талдау әдістерін пайдалана отырып, эпизоотиялық процесті бағалау болып табылады.

Батыс Қазақстан облысының Казталов және Жәнібек аудандарындағы киіктердің көші-қон жолдарына басты назар аударылды, онда гельминттермен жұқтыру туралы деректер жиналды және қолайсыз нүктелер тіркелді. Нәтижелер паразиттердің белгілі бір түрлерінің басым болуымен залалданудың тұрақтылығын көрсетті. Алдын алу және эпизоотияға қарсы іс-шараларды тиімді жоспарлауға мүмкіндік беретін қауіптілік дәрежесі бойынша аумақтарды аймақтарға бөлуге ерекше назар аударылды. Ауыл шаруашылығы жануарларының тығыздығы және ауру жұқтыру деңгейі арасында байланыс бар. Бұл жабайы және үй жануарларының санын бақылау мен реттеуге кешенді көзқарастың қажеттілігін растайды.

РЕЗЮМЕ

Исследование фокусируется на анализе эпизоотической ситуации, связанной с гельминтозами сайгаков в Западно-Казахстанской области, особенно в контексте миграционных путей, пересекающихся с территориями фермерских хозяйств. В условиях роста численности сайгаков и плотности сельскохозяйственных животных, необходим тщательный мониторинг для предотвращения распространения инвазии, которые могут затронуть как дикую, так и домашнюю фауна. Исследование охватывает период с 2021 по 2024 годы, а целью является выявление наиболее распространенных гельминтозов, а также оценка эпизоотического процесса с использованием современных методов анализа, включая геоинформационные системы (ГИС).

Основное внимание уделено миграционным путям сайгаков в Казталовском и Жанибекском районах Западно-Казахстанской области, где были собраны данные о заражении гельминтами и зарегистрированы неблагоприятные точки. Результаты показали стабильность заболеваемости с преобладанием определенных видов паразитов. Особое внимание было уделено зонированию территорий по степени опасности, что позволяет эффективно планировать профилактические и противоэпизоотические мероприятия. Установлена зависимость между плотностью сельскохозяйственных животных и уровнем заражения, что подтверждает необходимость комплексного подхода к контролю и регулированию численности как диких, так и домашних животных.

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EPIZOOTIC SITUATION AND ECONOMIC DAMAGE FROM BOVINE THEILERIOSIS IN THE SOUTH OF KAZAKHSTAN

ANNOTATION

Blood-parasitic diseases of cattle in the region of southern Kazakhstan have long attracted the attention of researchers, who made an invaluable contribution to the study and development of measures to combat piroplasmidosis. As a result, the species affiliation of cattle piroplasmidosis pathogens was determined, which turned out to be Th.annulata, P.bigeminum, Babesia bovis. As for vectors of pyroplasmids, three species of ticks of genus Hyalomma (H.anatolicum, H.detritum, H.asiaticum) - vectors of the causative agent of theileriosis of cattle and genus Boophilus (B.calcaratus) - vector of