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Original article

ADVANCING POULTRY FARMING IN KAZAKHSTAN: THE ROLE OF PROBIOTICS AND BIOPREPARATIONS

Tekebayeva Zh.B., Begakhmet A.M., Temirbekova A.Zh.*, Yevneyeva D.O., Temirkhanov A.Zh., Abzhalelov A.B.
"The Republican Collection of Microorganisms" LLP, Astana, Kazakhstan

*Corresponding Temirbekova A.Zh., atemirbekova94@gmail.com

ABSTRACT

This review critically evaluates the integration of probiotics in poultry farming within Kazakhstan, set against the backdrop of increasing global demand for poultry meat. Probiotics are increasingly viewed as essential alternatives to antibiotics, which have long been used to enhance growth and prevent disease in poultry. The review identifies significant challenges within Kazakhstan, such as reliance on imported breeding stock, infrastructural constraints, and local disease profiles that complicate widespread probiotic adoption. However, it also highlights substantial opportunities driven by government initiatives like the «2018-2027 Program for the Development of Poultry Farming,» which emphasize the reduction of antibiotic use and enhancement of food security. The development of local biopreparations, including «Polylactovit» and «Bentobak», underscores Kazakhstan's emerging role in agricultural biotechnology and its potential for self-sufficiency. The comparison with global practices reveals the need for Kazakhstan to adopt more advanced probiotic strains, aligning its poultry industry with international standards and enhancing its competitiveness. The findings suggest that leveraging government support, improving local production capabilities, and adopting global best practices could transform Kazakhstan into a regional leader in sustainable poultry farming.

Keywords: *probiotics, poultry, biopreparations, antibiotic alternatives, microorganisms.*

1. INTRODUCTION

Poultry farming represents a vital component of the global agricultural sector, contributing significantly to the supply of protein and playing an essential role in ensuring food security. As the demand for poultry products continues to escalate, there is a growing emphasis on enhancing production efficiency while simultaneously safeguarding animal health and welfare. Historically, antibiotics have been extensively utilised in poultry feed to mitigate diseases and stimulate growth. However, the excessive use of antibiotics has precipitated the development of antibiotic-resistant bacteria, which poses considerable risks to both animal and human health [1, 2].

Recent global research underscores the growing concern of antimicrobial resistance (AMR) in both organic and conventional farming systems. The prevalence of AMR on conventional poultry farms has been recorded at 22%, in contrast to 13.5% on organic farms. Furthermore, between 2001 and 2020, there has been a notable increase in AMR across all farming systems, with rates rising from 10% to 24% on organic farms and from 18% to 37% on conventional farms [3]. This significant rise highlights the pressing need for more effective and sustainable farming practices.

In response to these challenges, international regulatory bodies have introduced stricter controls on the use of antibiotics in livestock. The European Union notably banned the use of antimicrobial growth promoters (AGPs) in 2006, with similar measures being adopted in the United States in 2017. However, these well-intentioned policies have sometimes had unintended consequences, as they have led to the reclassification of AGPs as 'prophylactic therapeutics, thereby permitting their continued use under a different label. This regulatory landscape highlights the complexity of addressing AMR in poultry farming [4, 5].

As these challenges persist, there has been a marked increase in the exploration of alternative solutions, with probiotics emerging as a particularly promising option. Probiotics, which are live microorganisms that provide health benefits to the host when administered in sufficient quantities, have attracted significant attention for their potential to enhance gut health, improve nutrient absorption, and strengthen the immune system of poultry. The global market for probiotics in animal feed is expanding rapidly, fueled by growing awareness of the advantages offered by these natural additives [1, 2].

The global market for probiotics in animal feed is expected to reach USD 9.18 billion by 2030, with a compound annual growth rate (CAGR) of 8.6% from 2024 to 2030. This expansion is primarily driven by the growing awareness among consumers of the benefits that probiotics offer, particularly in enhancing gut health, improving feed efficiency, and bolstering the immune system of livestock, especially poultry. As the global demand for protein-rich diets continues to rise, major industry players are increasingly focusing on scaling up the production of probiotics as a natural alternative to antibiotics.

Bacterial probiotics, including strains such as Lactobacillus, Bacillus, and Streptococcus, have been shown in recent studies to significantly improve the health and productivity of poultry. These probiotics have been extensively researched and are now widely utilized across various regions. The Asia-Pacific region, in particular, leads in the adoption of probiotics due to its large poultry population and the ris-

ing demand for high-quality, antibiotic-free poultry products. Countries such as China and India have witnessed considerable growth in the use of probiotics in poultry farming, driven by the need to enhance gut health and overall productivity in response to consumer preferences for safer and more natural poultry products [6].

In Kazakhstan, poultry farming represents a vital segment of the agricultural sector, with continuous efforts being made to enhance productivity and ensure the sustainability of the industry. The poultry sector in Kazakhstan encounters challenges akin to those observed on a global scale, particularly the imperative to reduce antibiotic use while upholding stringent animal health standards. Despite these challenges, the adoption of probiotics within the Kazakh poultry industry remains in its nascent stages, presenting considerable opportunities for growth and advancement [7, 8].

Given the global transition towards alternatives to antibiotics, the development and implementation of locally produced probiotic biopreparations in Kazakhstan could offer a sustainable approach to boosting poultry production and ensuring food safety. The aim of this review is to examine the current trends and advancements in the application of probiotics in poultry farming, with a particular emphasis on the opportunities and challenges associated with promoting local production within Kazakhstan.

2. OVERVIEW OF CURRENT PRACTICES.

The integration of probiotics into poultry farming is increasingly recognized as a viable alternative to antibiotics, which have traditionally been indispensable for promoting growth and preventing disease. Research consistently demonstrates that the strategic inclusion of probiotics in poultry feed can significantly improve overall health, enhance immune response, and increase feed utilization efficiency. For example, a study conducted in 2021 revealed that supplementing the diet of laying hens with *Bacillus subtilis* significantly enhanced productivity and bird safety, particularly under challenging conditions such as high temperatures [1]. Additional studies have highlighted the role of probiotics in modulating gut microbiota, strengthening the intestinal barrier, and improving nutrient absorption. Specifically, *Bifidobacterium bifidum* and *B. longum* have been shown to increase populations of beneficial bacteria while reducing harmful pathogens like *E. coli*, thereby improving growth performance [9, 10]. Probiotics also play a crucial role in enhancing the gut's mucosal barrier, which is vital for preventing pathogenic invasion and ensuring nutrient absorption. *Lactic acid bacteria*, in particular, have been shown to stimulate mucin production, thereby fortifying this barrier and supporting overall gut health [11]. Furthermore, probiotics contribute to food safety by reducing the prevalence of pathogens such as *Salmonella* and *E. coli* in poultry, which are significant concerns in foodborne illnesses [12, 13]. These benefits position probiotics as essential components of sustainable poultry farming, offering natural protection against infections while maintaining productivity under stress conditions.

Market analyses further support the growing importance of probiotics in poultry farming. The Markets and Markets report projects that the global probiotics in animal feed market will reach USD 6.2 billion by 2026, with a compound annual growth rate (CAGR) of 7.7% from 2021. The Asia-Pacific region is expected to lead this growth, particularly driven by increased consumer demand for antibiotic-free poultry and supportive government policies in countries like China and India. Europe also remains a significant market, influenced by stringent regulations on antibiotic use and a strong emphasis on sustainable farming practices [14].

3. GLOBAL COMPARISON

Kazakhstan's reliance on a limited selection of probiotic products, such as "Subtilis™-S" and the "Vetom" series, both imported from Russia, contrasts sharply with the more diverse and advanced biopreparations developed and adopted in leading poultry-producing countries like the USA and Germany. These countries not only utilize these probiotics domestically but also export them, demonstrating their global influence and high demand. In the USA, for example, PoultryStar, produced by ME BIOMIN GmbH, is a widely recognized probiotic used in poultry farming. Similarly, Protexin, manufactured by Probiotics International Ltd. in the UK, is another well-known probiotic that is extensively exported. Germany's Norel Animal Nutrition produces Ecobiol, a probiotic that has gained international acclaim for its role in enhancing poultry health, particularly in optimizing gut microbiota [15, 16].

These countries have successfully integrated probiotics into their poultry farming practices, addressing challenges such as high-density farming, disease management, and feed efficiency. The global popularity of these probiotics underscores their effectiveness, with widespread adoption and export to various regions.

4. CHALLENGES AND OPPORTUNITIES IN KAZAKHSTAN.

Kazakhstan's poultry industry, despite its considerable potential, faces several significant challenges that may hinder the widespread adoption of probiotics. A primary issue is the heavy reliance on imported breeding stock due to insufficient local breeding facilities, which complicates the sustainable growth of the industry. This dependence particularly affects the integration of probiotics, as these may require specific genetic traits in locally adapted breeds to be fully effective. Furthermore, managing mixed intestinal infections remains a persistent challenge, and the existing probiotic formulations may not adequately address these unique disease profiles, underscoring the need for specialized probiotics tailored to Kazakhstan's specific conditions [15].

Kazakhstan's poultry industry is supported by 56 poultry farms, with 36 focused on egg production and 20 on meat production. As one of the key steps in developing the country's agriculture, the use of probiotic preparations is becoming increasingly important to ensure the high quality, safety, and competitiveness of animal and poultry products. However, as Table 1 shows, there was a decline in poultry numbers by 1 706 453 birds in 2021 compared to the previous year, largely due to avian influenza A(H5N8) and the coronavirus pandemic. Notably, over 70% of the poultry is raised in agricultural enterprises, indicating a robust and industrialized poultry farming sector in the country [17].

Table 1 – The Number of Poultry in the Republic of Kazakhstan over Five Years

Indicator	2017	2018	2019	2020	2021	Change in 2021 to 2020	
						by the number of birds	%
All Poultry	36 910 021	39 913 459	44 337 924	45 041 416	43 334 963	1706453	96,2%
Including Hens	19 882 340	22 256 967	24 457 394	22 894 474	20 783 218	2111256	90,8%
Agricultural Enterprises (Total)	25 529 067 69,16%	28 732 690 71,99%	32 393 273 73,06%	32 822 068 72,87%	30 777 289 71,02%	2044779	93,8%
Including Hens	12 350 015	14 770 806	16 287 769	14 604 680	12 396 191	2208489	84,9%

In addition to these biological challenges, economic and infrastructural limitations further complicate the adoption of probiotics. While there is growing awareness of their benefits, the infrastructure necessary for widespread adoption and local production is still underdeveloped. This gap in infrastructure represents a significant barrier to realizing the full potential of probiotics in enhancing the health and productivity of Kazakhstan's poultry industry.

Nevertheless, these challenges are accompanied by substantial opportunities. The Kazakhstan government's support, through initiatives like the «2018-2027 Program for the Development of Poultry Farming,» creates a conducive environment for adopting probiotics. This governmental backing emphasizes the importance of improving food security and reducing reliance on antibiotics, thereby laying a strong foundation for integrating probiotics into local practices [18].

This scenario presents a significant opportunity for Kazakhstan to expand its use of biopreparations by incorporating more advanced and diverse probiotic strains that have proven effective in similar climates and production systems worldwide. By adopting these globally recognized probiotics, Kazakhstan could better manage its current poultry health challenges, such as mixed intestinal infections, and align its practices with international standards.

5. FUTURE DIRECTIONS AND STRATEGIC RECOMMENDATIONS

Kazakhstan is currently 96.2% self-sufficient in meeting its annual veterinary drug requirements, demonstrating significant progress in local production capabilities. In 2019, approximately 70% of veterinary drugs purchased were supplied by domestic producers, highlighting strong government support for the national veterinary sector. For example, all drugs required for treating nodular dermatitis were procured from the National Research Institute of Biology and Biotechnology, resulting in cost savings of 2.7 billion KZT compared to the previous year [19].

The country undertakes annual veterinary prophylactic measures against 19 particularly dangerous diseases affecting animals and poultry, funded by the state budget. This underscores the critical role of government involvement in supporting the veterinary sector, including the use of biopreparations. Kazakhstan has 19 enterprises dedicated to producing veterinary drugs, four of which are certified according to GMP standards, indicating a growing infrastructure and the potential to produce high-quality biopreparations, including probiotics. The Kazakh Research Institute of Veterinary Medicine is actively engaged in developing competitive biopreparations aimed at achieving independence from foreign imports and advancing biotechnology within the country. The institute has established international collaborations and is negotiating joint projects with leading research centers globally, which will facilitate the introduction of advanced technologies in Kazakhstan. Quality control of biopreparations remains under constant government oversight. In 2019, the National Reference Center for Veterinary Medicine received authorization to work with microorganisms and helminths of Groups II-IV, enabling more comprehensive research and quality checks. This reinforces the national system for veterinary drug quality control, ensuring that Kazakhstan's veterinary sector continues to develop in line with international standards [20].

Kazakhstan has made significant progress in developing its own biopreparations to improve the productivity and health of poultry. The biological products of our country are a striking example of those produced by Industrial Microbiology LLC (Almaty). «Polylactovit» is a liquid probiotic based on an association of lactic acid and propionic acid bacteria, which is intended for the prevention and treatment of various mixed intestinal infections in young farm animals and birds, stabilization of intestinal microflora, improvement of the digestion process, and «Bentobak» is a dry feed additive based on cellulolytic and propionic acid bacteria, which promotes significant absorption of roughage and increased productivity in farm animals and birds [21]. The Kazakh Research Institute of Processing and Food Industry (Almaty) has developed a probiotic preparation for animal husbandry based on domestic active strains of lactic acid bacteria «Biokons», which has an antibacterial effect and can be used as a preventive and therapeutic agent for bird infections. The use of the biopreparation for 10 days contributes to: a decrease in mortality in lambs and calves by 30%; improved digestion of dry matter in calves by 1.8–2.19%, protein by 7.3–9.54%, fiber by 2.9–5.01%; an increase in weight gain in calves by 4.5–11.9%, in chickens by 18–23% [22].

These achievements not only expand Kazakhstan's domestic production capabilities, but could also make the country a regional leader in agricultural biotechnology. This leadership role paves the way for future innovations that could significantly strengthen the competitiveness and resilience of Ka-

zakhstan's poultry farming industry.

CONCLUSION

Kazakhstan's poultry industry is at a critical point where the integration of probiotics can greatly improve productivity, health, and sustainability. Despite facing challenges such as dependence on imported breeding stock, infrastructural limitations, and unique disease profiles in local poultry, there are significant opportunities for growth. The government's proactive support, through initiatives like the «2018-2027 Program for the Development of Poultry Farming,» provides a favorable environment for the adoption of probiotics, with a focus on reducing antibiotic reliance and enhancing food security.

The development of local biopreparations, such as «Polylactovit» and «Bentobak», highlights Kazakhstan's potential to advance its agricultural biotechnology sector. The success of these domestic efforts not only supports national self-sufficiency but also positions Kazakhstan as a regional leader in sustainable poultry farming.

Furthermore, the comparison with global practices underscores the need for Kazakhstan to expand its range of biopreparations by incorporating more advanced probiotic strains. This strategic expansion could bring Kazakhstan's poultry industry in line with international standards, addressing current health challenges and boosting its global competitiveness.

In conclusion, while challenges persist, the way forward for Kazakhstan involves leveraging government support, enhancing local production capabilities, and adopting global best practices. By doing so, Kazakhstan can develop a resilient, productive, and sustainable poultry industry that contributes significantly to national food security and economic growth.

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CONFLICT OF INTEREST

There are no conflicts of interest to declare.

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ПРОДВИЖЕНИЕ ПТИЦЕВОДСТВА В КАЗАХСТАНЕ: РОЛЬ ПРОБИОТИКОВ И БИОПРЕПАРАТОВ

Текебаева Ж.Б., Бегахмет А.М., Темирбекова А.Ж.*, Евнеева Д.О., Темирханов А.Ж., Абжалелов А.Б.
ТОО «Республиканская коллекция микроорганизмов», Астана, Казахстан

*Автор-корреспондент, Темирбекова А.Ж., atemirbekova94@gmail.com

АБСТРАКТ

В этом обзоре критически оценивается интеграция пробиотиков в птицеводство Казахстана на фоне растущего мирового спроса на мясо птицы. Пробиотики все чаще рассматриваются как важная альтернатива антибиотикам, которые долгое время использовались для улучшения роста и предотвращения заболеваний у птицы. В обзоре выделяются значительные проблемы, существующие в Казахстане, такие как зависимость от импортного племенного поголовья, инфраструктурные ограничения и местные особенности заболеваний, которые затрудняют широкое внедрение пробиотиков. Однако также подчеркиваются большие возможности, обусловленные государственными инициативами, такими как «Программа развития птицеводства на 2018–2027 годы», которая направлена на сокращение использования антибиотиков и повышение продовольственной безопасности. Разработка местных биопрепаратов, таких как «Полилактовит» и «Бентобак», подчеркивает возрастающую роль Казахстана в области агробиотехнологий и его потенциал для самодостаточности. Сравнение с мировыми практиками показывает необходимость внедрения в Казахстане более продвинутых штаммов пробиотиков, что позволит повысить конкурентоспособность местного птицеводства и привести его в соответствие с международными стандартами. Выводы свидетельствуют о том, что использование государственной поддержки, улучшение местных производственных возможностей и внедрение лучших мировых практик может преобразовать Казахстан в регионального лидера устойчивого птицеводства.

Ключевые слова: *пробиотики, птицеводство, биопрепараты, альтернатива антибиотикам, микроорганизмы.*

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ҚАЗАҚСТАНДАҒЫ ҚҰС ШАРУАШЫЛЫҒЫН ДАМЫТУ: ПРОБИОТИКТЕР МЕН БИОПРЕПАРАТТАРДЫҢ РӨЛІ

Текебаева Ж.Б., Бегахмет А.М., Темирбекова А.Ж.*, Евнеева Д.О., Темірханов А.Ж., Абжалелов А.Б.
«Микроорганизмдердің республикалық коллекциясы» ЖШС, Астана, Қазақстан

*Корреспондент автор, Темирбекова А.Ж., atemirbekova94@gmail.com

АБСТРАКТ

Бұл шолуда Қазақстандағы құс шаруашылығына пробиотиктерді енгізу мәселесі қарастырылған, сонымен қатар әлемдік нарықта құс етіне сұраныстың өсуіне назар аударылған. Пробиотиктер ұзақ уақыт бойы құс шаруашылығында өсу мен аурудың алдын алу үшін қолданылып келген антибиотиктердің орнына маңызды балама ретінде қарастырылады. Шолуда Қазақстандағы проблемалар көрсетілген, мысалы, асыл тұқымды малға тәуелділік, инфрақұрылымдық шектеулер және жергілікті аурулар профилі, бұл пробиотиктерді кеңінен қолдануды қиындатады. Дегенмен, 2018-2027 жылдарға арналған «Құс шаруашылығын дамыту бағдарламасы» сияқты мемлекеттік бастамалардың арқасында антибиотиктерді қолдануды азайту және азық-түлік қауіпсіздігін арттыру бағытында үлкен мүмкіндіктер бар. «Полилактовит» және «Бентобак» сияқты жергілікті биопрепараттардың дамуы Қазақстанның ауыл шаруашылығы биотехнологиясында өсіп келе жатқан рөлін және өзін-өзі қамтамасыз ету әлеуетін көрсетеді. Әлемдік тәжірибемен салыстырғанда, Қазақстанның құс шаруашылығы халықаралық стандарттарға сай болуы және бәсекеге қабілеттілігін арттыру үшін пробиотиктердің жетілдірілген штаммдарын қолдану қажеттілігі анықталды. Зерттеу нәтижелері мемлекеттік қолдауды тиімді пайдалану, жергілікті өндірістік мүмкіндіктерді жақсарту және әлемдік үздік тәжірибелерді қолдану Қазақстанды тұрақты құс шаруашылығы бойынша аймақтық көшбасшыға айналдыра алатынын көрсетеді.

Түйін сөздер: *пробиотиктер, құс шаруашылығы, биопрепараттар, антибиотиктерге балама, микроорганизмдер.*