

REVIEW • PEER-REVIEWED • OPEN ACCESS • **SERIES C** • HAC/OAK 16.00.00 — VETERINARY SCIENCES •  
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# Modern strategies for the control of helminth infections in farm animals

**Qishloq xo'jalik hayvonlari gelmintozlariga qarshi kurashishning zamonaviy strategiyalari****Современные стратегии борьбы с гельминтозами сельскохозяйственных животных****AKRAMOV Komiljon<sup>1,\*</sup> , JUMOBOYEV Tokhir<sup>2</sup>**<sup>1</sup> Scientific-Research Institute of Veterinary, Samarkand, Uzbekistan<sup>2</sup> Veterinary station of Qangli Citizens' Assembly, Amudarya District, Republic of Karakalpakstan, Uzbekistan\* Corresponding author: [komiljonshuhratovich@gmail.com](mailto:komiljonshuhratovich@gmail.com)**ARTICLE INFO****ARTICLE TYPE**

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**AUTHOR, TITLE AND ABSTRACT METADATA (EN / UZ / RU)****ENGLISH****AKRAMOV Komiljon<sup>1,\*</sup> , JUMOBOYEV Tokhir<sup>2</sup>**<sup>1</sup> Scientific-Research Institute of Veterinary, Samarkand, Uzbekistan<sup>2</sup> Veterinary station of Qangli Citizens' Assembly, Amudarya District, Republic of Karakalpakstan, Uzbekistan

**Abstract.** Helminth infections of farm animals are of major economic importance in livestock production due to their adverse effects on animal health and welfare, reduction in productivity, and increased veterinary costs. For many years, helminth control programs have relied primarily on routine and group-based deworming. However, frequent use of anthelmintic drugs without diagnostic testing and without adequate consideration of the epizootic situation is contributing to the development and spread of anthelmintic resistance in helminths. This review article aims to systematically analyze modern strategies for controlling the major helminth infections affecting cattle, sheep, and goats and to propose an integrated control model applicable to the conditions of Uzbekistan. The literature review covers the control of nematodes, trematodes, and cestodes; the rational use of anthelmintic drugs; anthelmintic resistance; fecal egg count-based diagnostics; pasture management; biological control; genetic resistance of animals; and modern diagnostic approaches.

**Keywords:** helminth infection; nematodosis; trematodosis; cestodosis; farm animals; anthelmintic resistance; integrated control

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**Annotatsiya.** Qishloq xo'jalik hayvonlarining gelmintozlari chorvachilikda hayvonlar salomatligi va farovonligiga salbiy ta'sir ko'rsatish, mahsuldorlikni pasaytirish hamda veterinariya xarajatlarini oshirish orqali katta iqtisodiy ahamiyat kasb etadi. Gelmintozlarga qarshi uzoq yillar davomida asosan muntazam va guruhli degelmintizatsiyaga tayangan nazorat tizimlari qo'llanib kelgan. Biroq antelmintik preparatlarning tez-tez, diagnostik tekshiruvlarsiz va epizootik vaziyat yetarli hisobga olinmasdan qo'llanilishi gelmintlarda antelmintik rezistentlikning shakllanishi va tarqalishiga olib kelmoqda. Mazkur sharh maqolasida qoramol, qo'y va echkilarda uchraydigan asosiy gelmintozlarga qarshi kurashishning zamonaviy strategiyalarini tizimli ravishda tahlil qilish hamda O'zbekiston sharoitida integratsiyalashgan nazorat modelini taklif etishdan iborat. Ilmiy adabiyotlar tahlilida nematodalar, trematodalar va sestodalarni nazorat qilish; antelmintik preparatlardan oqilona foydalanish; antelmintik rezistentlik; tezak namunasidagi tuxumlar sonini aniqlash; yaylovlarni boshqarish; biologik nazorat; hayvonlarning genetik rezistentligi va zamonaviy diagnostik yondashuvlar haqida ma'lumotlar aks ettirilgan.

**Kalit so'zlar:** gelmintoz; nematodoz; trematodoz; sestodoz; qishloq xo'jalik hayvonlari; antelmintik rezistentlik; integratsiyalashgan nazorat

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## РУССКИЙ

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**Аннотация.** Гельминтозы сельскохозяйственных животных имеют большое экономическое значение в животноводстве, поскольку оказывают негативное влияние на здоровье и благополучие животных, снижают продуктивность и приводят к увеличению ветеринарных расходов. На протяжении многих лет системы контроля гельминтозов основывались преимущественно на регулярной и групповой дегельминтизации. Однако частое применение антигельминтных препаратов без проведения диагностических исследований и без достаточного учета эпизоотической ситуации способствует формированию и распространению устойчивости гельминтов к антигельминтным препаратам. Целью настоящей обзорной статьи является систематический анализ современных стратегий борьбы с основными гельминтозами крупного рогатого скота, овец и коз, а также разработка интегрированной модели контроля, адаптированной к условиям Узбекистана. В обзоре научной литературы рассмотрены вопросы контроля нематодозов, трематодозов и цестодозов; рационального применения антигельминтных препаратов; антигельминтной резистентности; диагностики на основе определения количества яиц гельминтов в образцах фекалий; управления пастбищами; биологического контроля; генетической устойчивости животных; и современных диагностических подходов.

**Ключевые слова:** гельминтозы; нематодозы; трематодозы; цестодозы; сельскохозяйственные животные; антигельминтная резистентность; интегрированный контроль

## 1. KIRISH

## Introduction

Qishloq xo'jalik hayvonlarining gelmintozlari dunyoning deyarli barcha chorvachilik hududlarida uchraydigan va veterinariya tibbiyotining dolzarb muammolaridan biri hisoblangan invazion kasalliklardir. Qoramol, qo'y va echkilarda parazitlik qiluvchi nematodalar, trematodalar va sestodalar hayvon organizmida turli patologik jarayonlarni yuzaga keltirib, mahsuldorlik va reproduktiv ko'rsatkichlarning pasayishi, ozuqadan foydalanish samaradorligining yomonlashishi, yosh hayvonlarning o'sishdan qolishi hamda ayrim hollarda nobud bo'lishiga sabab bo'lishi mumkin.

Chorvachilik amaliyotida ayniqsa nematodalar muhim o'rin tutadi. *Haemonchus*, *Ostertagia*, *Trichostrongylus*, *Cooperia*, *Nematodirus* va *Oesophagostomum* avlodlariga mansub parazitlar yaylov sharoitida boqiladigan kavsh qaytaruvchi hayvonlarda keng tarqalgan. Trematodalar orasida *Fasciola spp.*, *Dicrocoelium dendriticum* va paramfistomlar, sestodalar orasida esa *Moniezia spp.* hamda zoonoz ahamiyatga ega *Echinococcus granulosus* alohida epidemiologik ahamiyatga ega.

O'zbekistonning keskin kontinental iqlimi, sug'oriladigan dehqonchilik hududlari, tog'oldi va yaylov ekotizimlari parazitlarning rivojlanishi va transmissiyasi uchun bir-biridan farq qiluvchi sharoitlarni shakllantiradi. Shu sababli gelmintozlarning epizootologiyasi hudud, mavsum, hayvon turi, yoshi, boqish texnologiyasi va yaylovdan foydalanish tizimiga bog'liq holda sezilarli farqlanishi mumkin.

O'zbekistonning Buxoro hududida 2025-yilda olib borilgan zamonaviy gelmintologik tadqiqotlarda qoramollarda 28, qo'ylarda 24 va echkilarda 21 tur gelmint aniqlangan. Qoramollarda aniqlangan gelmint turlarining 48 % nematodalar, 32 % sestodalar va 20 % trematodalar tashkil qilgan. Shu bilan birga, *Echinococcus granulosus*, *Taenia hydatigena* kabi zoonoz va *Fasciola spp.* yoki veterinariya-sanitariya ahamiyatiga ega gelmintlarning aniqlanishi gelmintozlarni "One Health" nuqtayi nazaridan ham baholash zarurligini ko'rsatadi.

Gelmintozlarga qarshi kurashda uzoq yillar davomida benzimidazollar, imidazotiazollar, tetragidropirimidinlar va

makrotsiklik laktonlarga mansub antgelmintik preparatlardan foydalanish asosiy usul bo'lib kelgan. Kimyoviy nazoratning yuqori dastlabki samaradorligi ko'plab xo'jaliklarda "kalendar bo'yicha degelmintizatsiya" modelining shakllanishiga sabab bo'lgan.

Biroq gelmint populyatsiyalarining evolyutsion moslashuvchanligi va bir xil preparatlarning takroran qo'llanishi natijasida antgelmintik rezistentlik dunyoning ko'plab chorvachilik hududlarida qayd etilmoqda. Ayniqsa nematodalarda bir yoki bir nechta antgelmintik sinflarga rezistentlikning shakllanishi mavjud nazorat tizimlarining barqarorligiga jiddiy xavf tug'dirmoqda.

Shuning uchun zamonaviy parazitologiyada asosiy savol "gelmintlarni qaysi preparat bilan yo'q qilish mumkin?" degan yondashuvdan "qaysi hayvonni, qachon, nima asosida va qaysi preparat bilan davolash kerak?" degan individual va epizootologik yondashuvga o'tmoqda.

## 1.1. Tadqiqotning maqsadi

Qishloq xo'jalik hayvonlari gelmintozlariga qarshi kurashning zamonaviy ilmiy yondashuvlarini tahlil qilish, antgelmintik rezistentlikning asosiy xavf omillarini baholash hamda diagnostika va xo'jalik boshqaruviga asoslangan integratsiyalashgan nazorat modelini O'zbekiston sharoitiga moslashtirish bo'yicha ilmiy konsepsiyani shakllantirish.

## 2. TADQIQOTNING MATERIAL VA METODLARI

## Materials and methods

Mazkur tadqiqot analitik ilmiy adabiyotlar sharhi shaklida bajarilgan bo'lib, tahlilda veterinariya parazitologiyasi, gelmintologiya, antgelmintik rezistentlik, diagnostika va integratsiyalashgan parazit nazoratiga bag'ishlangan xalqaro ilmiy maqolalar, meta-tahlillar va metodik tavsiyalar o'rganilgan.

Ilmiy manbalarni tahlil qilishda quyidagi mezonlar asos qilib olindi: 1) gelmintlarning epizootologik va iqtisodiy ahamiyati; 2) antgelmintik preparatlar samaradorligi; 3) rezistentlikning rivojlanish mexanizmlari va xavf omillari; 4) diagnostik monitoring; 5) yaylov boshqaruvi; 6) biologik va genetik nazorat.

Tadqiqotda gelmintlarga qarshi dorilar (antgelmintiklar) qanchalik yaxshi ishlayotganini va parazitlar doriga chidamli bo'lib qolgan-qolmaganini aniqlash uchun xalqaro tashkilotning tavsiyalaridan foydalanilgan.

### 3. NATIJALAR

#### Results

#### 3.1. Gelmintozlarni nazorat qilish asoslari

Adabiyotlar tahlili shuni ko'rsatadiki, qishloq xo'jalik hayvonlarida gelmintozlarga qarshi kurashish yondashuvlari so'nggi yillarda sezilarli darajada o'zgarib borgan. Ilgari gelmintozlarning oldini olish va ularga qarshi kurashishda asosiy e'tibor hayvonlarni ma'lum muddatlarda ommaviy ravishda degelmintizatsiya qilishga qaratilgan. Bunday yondashuvda hayvonlarda gelmintoz mavjudligi yoki mavjud emasligidan qat'i nazar, butun guruhga bir xil tartibda antgelmintik preparatlar qo'llanilgan.

An'anaviy yondashuvni "gelmintoz → guruhli degelmintizatsiya → takroriy degelmintizatsiya" ketma-ketligi orqali ifodalash mumkin. Ushbu usulning asosiy maqsadi hayvon organizmidagi gelmintlarni imkon qadar tez va keng miqyosda kamaytirishdan iborat bo'lgan. Biroq preparatlarni tez-tez va barcha hayvonlarga bir xil tartibda qo'llash ularning ortiqcha sarflanishiga hamda gelmintlarda preparatlarga chidamlilikning shakllanish xavfi oshishiga olib kelishi mumkin.

Zamonaviy yondashuvda esa gelmintozlarni nazorat qilish faqat dori vositalaridan foydalanish bilan cheklanmaydi. Avvalo xo'jalikdagi epidemiologik holat o'rganiladi, gelmintoz xavfi baholanadi va zarur hollarda laboratoriya-dagnostik tekshiruvlar o'tkaziladi. Olingan natijalarga asosan, hayvonlarni davolash zarurati aniqlanadi va davolashga ehtiyoji yuqori bo'lgan hayvonlarga selektiv tarzda antgelmintik preparatlar qo'llaniladi. Shundan so'ng davolash samaradorligi qayta tekshiriladi va xo'jalikdagi epidemiologik vaziyat yana baholanadi.

Shu nuqtayi nazardan, zamonaviy nazorat tizimini "monitoring → xavfni baholash → diagnostika → davolash zaruratini aniqlash → selektiv davolash → samaradorlikni baholash → qayta monitoring" ketma-ketligida ifodalash mumkin. Bunday yondashuvning muhim afzalligi shundaki, antgelmintik preparatlar faqat zarur hollarda qo'llaniladi va ularning samaradorligi muntazam nazorat qilinadi.

Gelmintozlarni nazorat qilish tizimining bunday o'zgarishida antgelmintik rezistentlik muammosi muhim o'rin tutadi. Preparatlar bir xil tartibda va tez-tez qo'llanilganda, ularga sezgir parazitlar nobud bo'lishi, preparat ta'siriga chidamli parazitlar esa saqlanib qolishi va ko'payishi mumkin. Natijada vaqt o'tishi bilan ilgari samarali bo'lgan preparatning ta'siri pasayishi ehtimoli ortadi. Shu sababli antgelmintik preparatlarni tanlash va qo'llashda ularning

amaldagi samaradorligini muntazam baholab borish muhim hisoblanadi.

Zamonaviy yondashuvda gelmintozlarni nazorat qilishning asosiy maqsadi barcha parazitlarni har qanday sharoitda mutlaq yo'q qilish emas, balki ularning hayvon salomatligi va mahsuldorligiga sezilarli zarar yetkazmaydigan darajada saqlanishini ta'minlashdan iborat. Bunda hayvonlarning klinik holati, mahsuldorligi, parazitlar bilan zararlanish darajasi va qo'llanilayotgan preparatlarning samaradorligi birgalikda hisobga olinadi.

Gelmintozlarga qarshi kurashishda "ko'proq va tez-tez davolash" tamoyilidan "aniq tashxisga va xavfni baholashga asoslangan davolash" tamoyiliga o'tish kuzatilmoqda. Ushbu yondashuv antgelmintik preparatlardan oqilona foydalanish, keraksiz davolashlarni kamaytirish va preparatlarga rezistentlik rivojlanishining oldini olishga qaratilgan kompleks nazorat tizimini shakllantirish imkonini beradi.

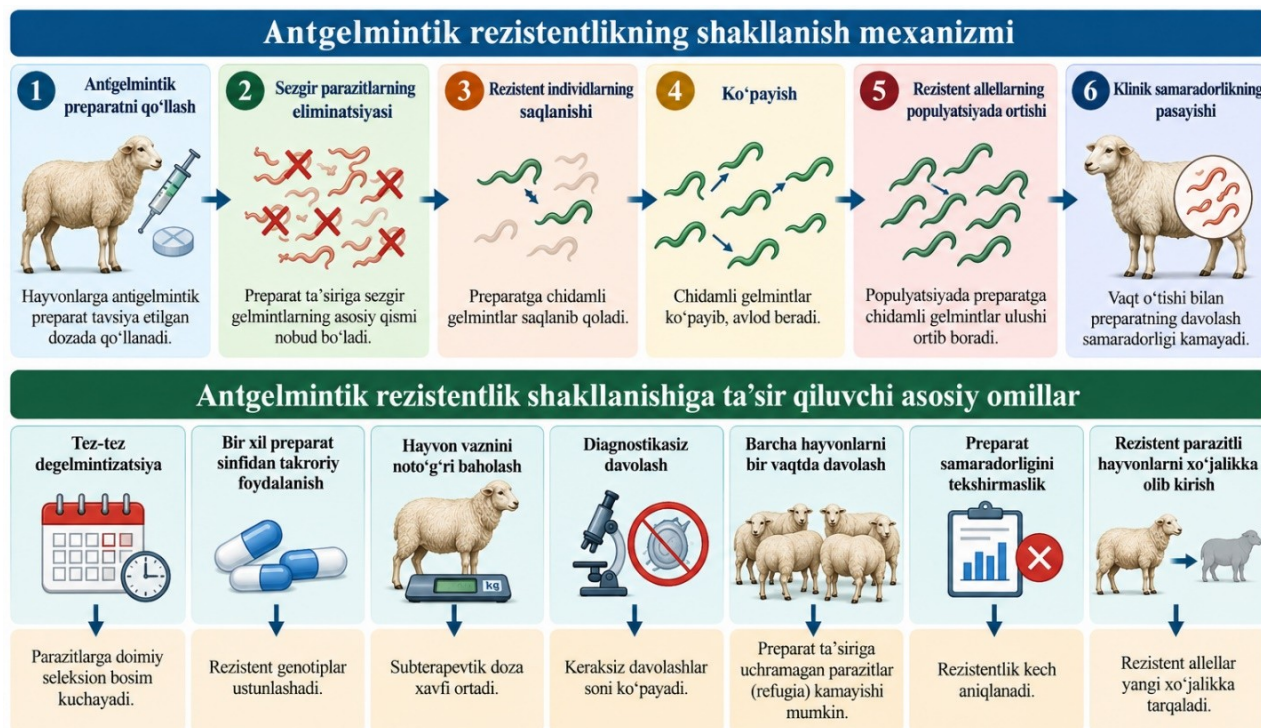
#### 3.2. Antgelmintik rezistentlikning shakllanishi

Adabiyotlar tahlili shuni ko'rsatadiki, gelmintozlarni davolashda antgelmintik preparatlardan uzoq vaqt davomida va takroran foydalanish parazitlarda ushbu preparatlarga chidamlilikning shakllanishiga olib kelishi mumkin. Antgelmintik rezistentlik deganda, ilgari samarali ta'sir ko'rsatgan preparat tavsiya etilgan dozada qo'llanganda ham ayrim parazitlarning saqlanib qolishi va keyinchalik ularning ko'payishi natijasida preparatga chidamli parazitlar ulushining ortib borishi tushuniladi (1-rasm).

Rezistentlikning shakllanishi oddiy biologik jarayon hisoblanadi. Antgelmintik preparat qo'llanganda unga sezgir parazitlarning asosiy qismi nobud bo'ladi, preparat ta'siriga chidamli bo'lgan ayrim parazitlar esa saqlanib qoladi. Ushbu parazitlar keyinchalik ko'payib, o'z xususiyatlarini keyingi avlodlarga o'tkazadi. Natijada populyatsiyada preparatga chidamli parazitlar soni ortib, vaqt o'tishi bilan preparatning davolash samaradorligi pasayishi mumkin.

Antgelmintik rezistentlikning shakllanishiga bir qator omillar ta'sir ko'rsatadi. Jumladan, preparatlarni juda tez-tez qo'llash, bir xil ta'sir mexanizmiga ega preparatlarni takroran ishlatish, hayvon vaznini noto'g'ri aniqlash va natijada preparatning yetarli bo'lmagan dozasini qo'llash muhim xavf omillari hisoblanadi.

Shuningdek, diagnostik tekshiruvsiz davolash ham muammoni kuchaytirishi mumkin. Chunki gelmintoz mavjudligi va uning darajasi aniqlanmasdan barcha hayvonlarni muntazam davolash antgelmintik preparatlardan keragidan ortiq foydalanishga olib keladi. Barcha hayvonlarni bir vaqtda davolash esa preparat ta'siriga uchramagan parazitlar sonini kamaytirishi mumkin. Natijada populyatsiyada preparatga chidamli parazitlarning saqlanib qolish ehtimoli ortadi.



**1-rasm.** Antelmintik rezistentlik shakllanish mexanizmi va unga ta'sir qiluvchi asosiy omillar / **Fig. 1.** Mechanism of anthelmintic resistance development and the main factors influencing it

Yana bir muhim omil preparat samaradorligini muntazam tekshirib bormaslikdir. Agar davolashdan keyin parazitlar miqdori yetarli darajada kamaymasa, bu holat o'z vaqtida aniqlanmay qolishi va xo'jalikda samarasiz preparatdan qayta foydalanishga sabab bo'lishi mumkin. Shuningdek, boshqa xo'jaliklardan antelmintiklarga chidamli parazitlar bilan zararlangan hayvonlarning olib kelinishi ham rezistentlikning yangi hududga tarqalishiga sabab bo'lishi mumkin.

Shu sababli antelmintik rezistentlikka qarshi kurashishda faqat preparatni almashtirish yetarli emas. Eng muhimi, preparatni qachon, qaysi hayvonga, qanday dozada va qanday asosda qo'llash masalasiga ilmiy yondashishdir. Bunda diagnostik tekshiruvlar, davolash zaruratini aniqlash, preparat samaradorligini nazorat qilish va muntazam monitoringni birgalikda olib borish muhim ahamiyatga ega.

Antelmintik rezistentlikni kamaytirishning asosiy yo'li, antelmintik preparatlardan oqilona foydalanish va davolash strategiyasini diagnostika hamda monitoring natijalariga asoslashdir.

#### 4. MUHOKAMALAR

##### Discussion

O'rganilgan ilmiy ma'lumotlar shuni ko'rsatadiki, gelmintozlarga qarshi kurash samaradorligini faqat hayvonlarga necha marta degelmintizatsiya o'tkazilganligi bilan baholash yetarli emas. Chunki degelmintizatsiya sonining ko'pligi preparatning samarali ishlayotganini yoki gelmintozlar nazorat ostida ekanligini to'liq ko'rsatmaydi.

Shu sababli gelmintozlarni nazorat qilishda bir nechta muhim ko'rsatkichlarni birgalikda baholash zarur. Bular: gelmintlar bilan zararlanish darajasi, hayvonlarning klinik holati, mahsuldorligi, antelmintik preparatlarning samaradorligi, rezistentlik holati va preparatlardan foydalanish miqdori hisoblanadi. Ushbu ko'rsatkichlarning birgalikda tahlil qilinishi xo'jalikdagi gelmintozlar holatini to'g'ri baholash imkonini beradi.

Antelmintik preparat qo'llangandan keyin hayvonlarda kasallik belgilari kamayishi preparatning samarali ekanligini

ko'rsatishi mumkin. Biroq bu natija preparat gelmintlarni yetarli darajada yo'q qilganini har doim ham anglatmaydi. Shuning uchun davolashdan oldingi va keyingi gelmintologik ko'rsatkichlarni taqqoslash, zarur hollarda preparat samaradorligini baholash muhim. Bunday tekshiruv preparat ta'sirining pasayishini erta aniqlashga yordam beradi.

Gelmintozlarni nazorat qilishda barcha xo'jaliklar uchun bir xil tartibni qo'llashdan ko'ra, mahalliy sharoit va xo'jalik xususiyatlariga moslashtirilgan protokollarni ishlab chiqish maqsadga muvofiqdir. Bunday yondashuv antelmintik preparatlardan oqilona foydalanish, keraksiz davolashlarni kamaytirish, hayvonlarning mahsuldorligini saqlash va preparatlarga rezistentlik rivojlanishini sekinlashtirishga xizmat qiladi.

#### 5. XULOSALAR

##### Conclusions

1. Adabiyotlar tahlili shuni ko'rsatdiki, gelmintozlarga qarshi kurashda antelmintik preparatlarni muntazam va asossiz qo'llash parazitlarda preparatlarga chidamlilikning shakllanish xavfini oshiradi. Shu sababli preparatlarni qo'llash diagnostika va zararlanish darajasini hisobga olgan holda amalga oshirilishi kerak.

2. Antelmintik preparatlarning samaradorligini davolashdan oldingi va keyingi parazitologik ko'rsatkichlarni taqqoslash orqali muntazam nazorat qilish gelmintozlarni samarali boshqarishning muhim sharti hisoblanadi.

3. Zamonaviy adabiyotlar tahlili barcha hayvonlarni bir xil tartibda davolash o'rniga, gelmintoz xavfi va hayvonlarning holatiga qarab davolashni tashkil etish maqsadga muvofiqligini ko'rsatadi. Bunday yondashuv keraksiz preparat sarfini kamaytirish va rezistentlik rivojlanishini sekinlashtirishga yordam beradi.

4. Gelmintozlarni uzoq muddat nazorat qilishda faqat antelmintik preparatlarga tayanish yetarli emas. Diagnostika, yaylovlarni to'g'ri boshqarish, hayvonlarning klinik holatini kuzatish va preparat samaradorligini muntazam baholashni birgalikda olib borish barqaror nazorat tizimini shakllantirishning asosiy shartlari hisoblanadi.

## DECLARATIONS

### Declarations

#### Author contributions *CRedit*

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

#### Funding

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#### Ethics approval

The article is a review of published scientific literature. The work involved no experiments on animals and no human participants, and therefore required no separate ethics committee approval.

#### Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

#### Data availability statement

All sources analysed in this review are listed in the reference list of this article.

#### Conflict of interest

The authors declare no conflict of interest.

#### Generative AI disclosure

Generative AI (Claude, Anthropic) was used in the editorial preparation of this article: for language editing, translation of the title, abstract and keywords between Uzbek, Russian and English, preparation of the extended English summary from the authors' text, and formatting of the reference list. No data, results or conclusions were generated by AI. The authors are responsible for the content of the publication.

## EXTENDED SUMMARY IN ENGLISH

*Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке*

### Purpose and research problem

Helminth infections of farm animals occur in almost all livestock regions of the world and are among the pressing problems of veterinary medicine. Nematodes, trematodes and cestodes parasitising cattle, sheep and goats cause pathological processes that reduce productivity and reproductive performance, impair feed utilisation, retard the growth of young animals and sometimes cause death. Nematodes of the genera *Haemonchus*, *Ostertagia*, *Trichostrongylus*, *Cooperia*, *Nematodirus* and *Oesophagostomum* are widespread in grazing ruminants; among trematodes *Fasciola* spp., *Dicrocoelium dendriticum* and paramphistomes, and among cestodes *Moniezia* spp. and the zoonotic *Echinococcus granulosus* are of particular importance. The sharply continental climate of Uzbekistan, irrigated farming areas and foothill and pasture ecosystems create different conditions for parasite development and transmission, and recent studies in the Bukhara region found 28 helminth species in cattle, 24 in sheep and 21 in goats, including zoonotic species, which calls for a One Health perspective. For many years control relied on benzimidazoles, imidazothiazoles, tetrahydropyrimidines and macrocyclic lactones applied by calendar-based deworming, but repeated use of the same drugs has led to anthelmintic resistance in many livestock regions. The aim of the review was to analyse modern approaches to helminth control in farm animals, to assess the main risk factors for anthelmintic resistance and to form a concept of an integrated, diagnosis- and management-based control model adapted to the conditions of Uzbekistan.

### Materials and methods

The study was performed as an analytical review of the scientific literature. International scientific articles, meta-analyses and methodological recommendations on veterinary parasitology, helminthology, anthelmintic resistance, diagnostics and integrated parasite control were examined. The sources were analysed according to the following criteria: the epizootological and economic importance of helminths; the efficacy of anthelmintic drugs; the mechanisms and

risk factors of resistance development; diagnostic monitoring; pasture management; and biological and genetic control. The recommendations of the World Association for the Advancement of Veterinary Parasitology (WAAVP) were used to assess how well anthelmintics work and whether parasites have become resistant to them.

### Results and discussion

The literature shows that approaches to helminth control in farm animals have changed considerably in recent years. Previously, attention was focused on mass deworming of animals at fixed intervals, with the whole group treated in the same way regardless of whether helminths were present. The traditional scheme "helminthosis → group deworming → repeated deworming" is being replaced by a system of "monitoring → risk assessment → diagnosis → targeted treatment → efficacy control", in which control is based not only on drugs but also on diagnostics, pasture management and the clinical state of the animals, and the main goal is not to eliminate all parasites but to keep infection at a level that does not harm health and productivity. Anthelmintic resistance develops when, after repeated use of a previously effective drug at the recommended dose, some parasites survive and multiply, so that the proportion of resistant parasites in the population increases. Its development is promoted by frequent deworming, repeated use of the same drug class, underdosing due to incorrect estimation of body weight, treatment without diagnosis, simultaneous treatment of all animals, which reduces the refugia, failure to check drug efficacy and the introduction of animals carrying resistant parasites from other farms. Replacing one drug with another is therefore not sufficient: the key is a scientific approach to when, which animal, at what dose and on what basis to treat, combined with diagnostic examinations, assessment of the need for treatment, control of drug efficacy and regular monitoring.

### Conclusion and contribution

The effectiveness of helminth control cannot be judged only by the number of dewormings performed; the level of infection, the clinical state and productivity of the animals, the efficacy of anthelmintics, the resistance status and the amount of drugs used should be assessed together, and pre- and post-treatment parasitological indicators should be compared to detect a decline in drug efficacy early. Regular and unjustified use of anthelmintics increases the risk of resistance, so treatment should be based on diagnosis and the level of infection, and drug efficacy should be monitored regularly. Instead of treating all animals in the same way, treatment should be organised according to the risk of helminthosis and the condition of the animals, which reduces unnecessary drug use and slows the development of resistance. Long-term control cannot rely on anthelmintics alone; diagnostics, proper pasture management, observation of the clinical state of animals and regular assessment of drug efficacy are the main conditions of a sustainable control system, and protocols adapted to local conditions and farm characteristics are preferable to a uniform scheme for all farms.

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