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COMMENTARY / COMENTARIO

BUILDING ACADEMIC BRIDGES: INTEGRATION OF COUNTRIES FOR THE TEACHING OF PARASITIC ZOONOSES A ONE HEALTH FRAMEWORK

CONSTRUYENDO PUENTES ACADÉMICOS: INTEGRACIÓN DE PAÍSES PARA LA ENSEÑANZA DE ZOONOSIS PARASITARIAS EN CLAVE ONE HEALTH

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Running Head: Teaching of parasitic zoonoses in a One Health framework

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ABSTRACT

The workshop “Parasitic Zoonoses in the Context and Approach of One Health” was held within the framework of the International Congress of Neotropical Parasitology in 2024, an event that brought together multiple specialized symposia dedicated to the region’s health challenges. The purpose of the workshop was to strengthen the comprehensive understanding of parasitic zoonoses from the “One Health” paradigm, which recognizes the interdependence among human, animal, and

environmental health as a single, dynamic, and deeply interconnected system. This article aims to disseminate an integrative disciplinary experience developed by the academic community under the One Health approach to parasitic zoonoses. The participation of specialists from Peru, Mexico, Colombia, Uruguay, and Brazil enriched the regional perspective and enabled the discussion of parasitological issues from diverse socio-ecological contexts of the Neotropics. The program was structured around five thematic axes: (1) conceptual foundations of the One Health approach; (2) parasitic zoonoses transmitted by companion animals and their relevance in urban environments; (3) parasitic zoonotic diseases of livestock importance; (4) parasitic ichthyozoonoses; and (5) parasites in aquaculture, where the main health challenges in production units were analyzed, along with transmission risks between farmed and wild environments, and the need to implement preventive strategies under the One Health framework to strengthen aquaculture sustainability. This last axis was reinforced through a specialized workshop led by Brazilian experts, providing updated knowledge on applied parasitology in Neotropical aquaculture systems. The development of the workshop was integrated with academic spaces of the congress, such as the II One Health Symposium, the V Neotropical Ichthyoparasitology Symposium, the II Leishmaniasis Symposium, the II Neotropical Chagas Disease Symposium, and the I Neotropical Plant Health Symposium, which allowed for deep interdisciplinary exchange by integrating perspectives from human, veterinary, environmental, agricultural, fisheries, and aquaculture parasitology. The outcomes of this academic experience highlight the urgency of strengthening local and regional capacities, promoting international collaboration, and consolidating coordinated strategies for surveillance, prevention, and control of parasitic zoonoses, particularly those associated with expanding productive systems such as aquaculture. Overall, the workshop reaffirms the value of the One Health approach as an essential tool for addressing emerging and persistent challenges that impact human, animal, and environmental health in the Neotropical region.

Keywords: aquaculture – ichthyozoonoses – Neotropical region – One Health – parasitic zoonoses

RESUMEN

El taller “Zoonosis parasitarias en el contexto y enfoque de One Health-Una Salud” se desarrolló en el marco del Congreso Internacional de Parasitología Neotropical en el 2024, un evento que reunió múltiples simposios especializados dedicados a los desafíos sanitarios de la región. El propósito del taller fue fortalecer la comprensión integral de las zoonosis parasitarias desde el paradigma “One Health”, el cual reconoce la interdependencia entre la salud humana, animal y ambiental como un sistema único, dinámico y profundamente interconectado. Este artículo pretende difundir una experiencia integradora disciplinar de la comunidad académica bajo el enfoque One Health de las zoonosis parasitarias. La participación de especialistas de Perú, México, Colombia, Uruguay y Brasil enriqueció la perspectiva regional y permitió abordar las problemáticas parasitológicas desde diversos contextos socioecológicos del Neotrópico. El programa se estructuró en cinco ejes temáticos: (1) fundamentos conceptuales del enfoque One Health; (2) zoonosis parasitarias transmitidas por animales de compañía y su relevancia en entornos urbanos; (3) enfermedades zoonóticas parasitarias de importancia pecuaria; (4) ictiozoonosis parasitarias y (5) parásitos en la acuicultura, donde se analizaron los principales desafíos sanitarios en unidades de producción, los riesgos de transmisión entre ambientes cultivados y silvestres, y la necesidad de implementar estrategias preventivas bajo el enfoque Una Salud para fortalecer la sostenibilidad acuícola. Este último eje se reforzó mediante un taller especializado impartido por expertos brasileños, aportando conocimientos actualizados sobre parasitología aplicada a sistemas acuícolas neotropicales. El desarrollo del taller se articuló con espacios académicos del congreso como el II Simposio One Health-Una Salud, el V Simposio de Ictioparasitología Neotropical, el II Simposio de Leishmaniasis, el II Simposio Neotropical de la Enfermedad de Chagas y el I Simposio de Fitosanidad Neotropical lo que permitió un intercambio interdisciplinario profundo, integrando perspectivas de la parasitología humana, veterinaria, ambiental, agropecuaria, pesquera y acuícola. Los resultados de esta experiencia académica subrayan la urgencia de fortalecer capacidades locales y regionales, impulsar la cooperación internacional y consolidar estrategias coordinadas de

vigilancia, prevención y control de las zoonosis parasitarias, particularmente aquellas vinculadas a sistemas productivos en expansión como la acuicultura. En conjunto, el taller reafirma el valor del enfoque Una Salud como herramienta esencial para enfrentar los retos emergentes y persistentes que afectan la salud humana, animal y ambiental en la región neotropical.

Palabras clave: acuicultura – ictiozoonosis – One Health – región neotropical – zoonosis parasitarias

INTRODUCTION

The *One Health* approach is considered a strategy for addressing various health related situations within the context of the interface and interactions among humans, animals, and the environment (Agrawal *et al.*, 2024; Behravesh *et al.*, 2024). This approach is grounded in the concept that the health of the three components humans, animals, and ecosystems is interconnected and interdependent (One Health High-Level Expert Panel, 2023). In this sense, effectively addressing these complex challenges requires holistic, integrated, and collaborative actions involving multiple disciplines at different levels (Manterola *et al.*, 2024).

This approach is particularly applicable and essential for addressing parasitic zoonoses, as it considers the circulation of parasites between human and animal hosts and the influence of environmental factors on transmission dynamics. Consequently, it encompasses key aspects of global health, including the prevention, promotion, diagnosis, and treatment of zoonotic parasitic agents, with actions directed at the community level or from a broader, global perspective (Mettenleiter *et al.*, 2023).

Within the framework of the One Health philosophy, the XII International Congress of Neotropical Parasitology, organized by the Peruvian Association of Helminthology and Related Invertebrates (APHIA) and the San Martín University Foundation, Faculty of Health Sciences, held in Bogotá, Colombia, from October 28 to November 1, 2024, adopted the theme “One Health: Challenges of

Parasitology in the 21st Century under the One Health Approach". In this context, a course workshop entitled *Parasitic Zoonoses in the Context and Approach of One Health* was proposed and conducted. Its purpose was to strengthen a comprehensive understanding of parasitic zoonoses from the One Health paradigm, which recognizes the interdependence of human, animal, and environmental health as a single, dynamic, and deeply interconnected system. Accordingly, this article aims to disseminate an integrative and multidisciplinary academic experience focused on parasitic zoonoses under the One Health approach.

The participating countries in the initiative were Brazil, Colombia, Mexico, Peru, and Uruguay. In line with the characteristics of the One Health paradigm, the implementation of this activity required collaboration, communication, and coordination among the professionals who planned and carried out the course workshop.

Nominal list of course workshop speakers

The course workshop brought together specialists from several countries with extensive experience in parasitology and the One Health approach. José Iannacone Oliver from Peru is a specialist in general parasitology, ecotoxicology, and the One Health framework. María Amparo Rodríguez Santiago from Mexico specializes in fish parasitology, environmental parasitology, and public health. Zully María Hernández Russo from Uruguay is a professor of Parasitology and Parasitic Diseases, with a focus on animal production and parasitic zoonoses. Julio César Giraldo Forero from Colombia is an expert in clinical parasitology and public health, addressing topics according to the workshop program. Reinaldo José da Silva from Brazil specializes in fish parasites and aquaculture, with emphasis on tilapia production systems.

Course workshop program: Parasitic zoonoses in the context and approach of One Health

The course workshop program was structured around five thematic axes. These included the conceptual foundations of the One Health approach, parasitic zoonoses transmitted by companion

animals and their relevance in urban environments, parasitic zoonotic diseases of importance in livestock production, parasitic ichthyozoonoses, and parasites in aquaculture. Within the aquaculture axis, the main sanitary challenges in production units were analyzed, including transmission risks between cultured and wild environments and the need to implement preventive strategies under the One Health approach to strengthen aquaculture sustainability. This axis was reinforced through a specialized workshop delivered by Brazilian experts, providing updated knowledge on parasitology applied to Neotropical aquaculture systems.

The development of the workshop was articulated with academic spaces of the congress, such as the Second One Health Symposium, the Fifth Neotropical Ichthyoparasitology Symposium, the Second Neotropical Symposium on Leishmaniasis, the Second Neotropical Symposium on Chagas Disease, and the First Neotropical Symposium on Phytosanitary Health. This integration enabled a deep interdisciplinary exchange, incorporating perspectives from human, veterinary, environmental, agricultural, fisheries, and aquaculture parasitology.

Thematic axes and conceptual foundations of the One Health approach

The One Health approach represents a fundamental concept that emphasizes the intrinsic interdependence among human health, animal health, and environmental or ecosystem health. It is defined as an integrated and unifying framework aimed at achieving sustainable balance and optimizing the health of people, animals, and ecosystems. The central premise of One Health recognizes that human well being is closely linked to the health of other species and to the shared environment of planet Earth.

Conceptually, One Health advocates a collaborative, multisectoral, and interdisciplinary or transdisciplinary strategy to achieve optimal health outcomes. Its core foundations include interaction, harmonization, teamwork, and capacity building among the human, animal, and environmental health sectors, together with other relevant stakeholders.

Historically, the concept evolved from the idea of One Medicine, introduced in 1964 by Dr. C. Schwabe, who is recognized as its initial visionary. While One Medicine focused on integrating human and veterinary medicine to address zoonoses, the critical innovation of One Health was the incorporation of ecosystem health, including wildlife. Today, One Health is considered a broader and more comprehensive concept, capable of encompassing comparative and translational medicine, public health, and ecology.

Health under this framework is analyzed at three distinct levels: individual health in humans and animals, population health including public health and herd health, and ecosystem health. The approach is also supported by fundamental principles of collaboration, including equity, parity, responsible stewardship, and socioecological balance.

One Health is essential for addressing complex global health challenges that arise at the human animal environment interface, including emerging and re emerging zoonoses, antimicrobial resistance, neglected tropical diseases, sustainable food security, and the impact of climate change on disease transmission. It is also applicable to non communicable and chronic diseases linked to exposure to multiple stressors, including toxic stress and modern lifestyles.

For this approach to be operational and sustainable, it is crucial to overcome interdisciplinary barriers separating human and veterinary medicine from ecological, evolutionary, and environmental sciences. Integrating One Health principles into public health policy is indispensable for building a resilient health system capable of responding to the complex interactions that shape well being in an interconnected world.

Parasitic zoonoses transmitted by companion animals and their relevance in urban environments

Parasitic zoonoses associated with transmission from companion animals are based on the premise that the relationship between humans and animals is as ancient as humanity itself. At present, pet

ownership within households is widespread and is associated with factors such as emotional attachment, companionship, and security. Among the most common companion animals are dogs (*Canis lupus familiaris* Linnaeus, 1758) and cats (*Felis catus* Linnaeus, 1758), which maintain a close relationship with humans and other domestic animals.

Companion animals are exposed to numerous microorganisms, including viruses, bacteria, fungi, and parasites. Gastrointestinal parasitic infections are the most frequent and are generally associated with zoonotic protozoa responsible for diseases such as giardiasis caused by *Giardia* spp. and coccidiosis, with relevant genera including *Cystoisospora* spp., *Cryptosporidium* spp., and *Toxoplasma gondii* (Nicolle y Manceaux, 1908). Helminth infections are mainly related to nematodes such as *Ancylostoma caninum* (Ercolani, 1859) Hall, 1913, *Ancylostoma brasiliensis* Gomes de Faria, 1910, *Strongyloides stercoralis* (Bavay, 1876) Stiles & Hassall, 1902, and *Toxocara canis* (Werner, 1782) Stiles, 1905, as well as cestode infections caused by *Dipylidium caninum* (Linnaeus, 1758). These parasitoses are generally diagnosed through direct examinations based on microscopic observation of cysts, oocysts, eggs, or larvae in fecal samples, using concentration techniques or, in some cases, macroscopic visualization of adult helminth stages.

The growth of companion animal populations in urban areas, together with inadequate practices for fecal waste disposal in public spaces, reports of antiparasitic resistance, and the capacity of parasites to adapt to different ecosystems and climatic factors, favors human infection.

Currently, gastrointestinal parasitic zoonoses in companion animals are frequently neglected or underdiagnosed, limiting recognition of their importance in public health and their role as emerging epidemiological concerns. Additionally, parasitic infections in companion animals are not subject to mandatory notification, resulting in limited information regarding the dynamics of pet populations carrying parasitic infections. This situation constitutes one of the main public health challenges within the One Health framework.

Parasitic zoonoses related to animal production

This section addresses the main parasitic zoonotic diseases that also have a significant impact on animal production, particularly in species of major importance in Uruguay such as cattle, sheep, and pigs. Epidemiological aspects, production losses in their respective hosts, the role of the environment as a source of infection, and the implications for human health were discussed for toxoplasmosis, fasciolosis, and cystic echinococcosis. These diseases occur in different regions with varying relevance depending on geographic and environmental conditions, production systems, management practices, and cultural factors. In this context, the human, animal, and environmental triad was examined for each parasitic zoonosis, highlighting their interactions and interdependence. This analysis underscores that epidemiological surveillance, health promotion, prevention, and control measures must be implemented from a global perspective to achieve an effective and sustainable long-term approach.

Parasitic ichthyozoonoses

This section presents an integrated overview of the main parasitic ichthyozoonoses and their relevance to public health from a One Health perspective, which recognizes the close interdependence between human, animal, and environmental health. The most important groups of zoonotic helminths are described, including trematodes, cestodes, and nematodes, emphasizing that although approximately fifty species are capable of infecting humans, only about ten represent a significant sanitary risk. Ecological, environmental, and sociocultural conditions that favor transmission are analyzed, particularly the consumption of raw or undercooked fish, as well as the role of aquatic ecosystems in maintaining parasitic life cycles. Species of global relevance such as *Clonorchis sinensis* (Cobbold, 1875) Looss, 1907, *Heterophyes* spp., *Diphyllobothrium* spp., *Anisakis* spp., and *Gnathostoma* spp. are examined, highlighting their geographic distribution,

clinical manifestations, and the main strategies for diagnosis, control, and prevention. Finally, the influence of environmental change, fishing practices, and globalization on the emergence and re emergence of these diseases is emphasized, underscoring the need for integrated surveillance, consumer education, and coordinated preventive actions within the One Health framework.

Parasites of tilapia (*Oreochromis niloticus*) in aquaculture in Brazil

This section analyzes the main parasites affecting fish, the introduction of parasitic species through aquaculture systems, their spread to native species, and the presence of zoonotic species in cultured fish. Fish can be parasitized by a wide diversity of metazoans, including myxozoans, trematodes, monopisthocotyleans, polyopisthocotyleans, cestodes, acanthocephalans, leeches, nematodes, copepods, argulids, and isopods. The occurrence of parasites from these groups in tilapia reared in aquaculture systems is highlighted, together with aspects related to their morphology, life cycles, pathogenicity, control, and treatment.

The discussion further addresses how the translocation and introduction of fish into non native regions may facilitate the co introduction of invasive parasites, leading to negative effects on native biota. In this context, cases involving the introduction of *Lernaea cyprinacea* Linnaeus, 1758, commonly known as the anchor worm, and *Schyzocotyle acheilognathi* (Yamaguti, 1934), a cestode belonging to the order Bothriocephalidea associated with commercial carp farming, are presented, as well as monopisthocotylean and trichodinid species reported in tilapia fish farms. These parasites affect the health of both native and cultured fish in Brazil. Finally, the presence of zoonotic species associated with the consumption of farmed tilapia [*Oreochromis niloticus* (Linnaeus, 1758)] is addressed, including bacteria, fungi, protozoans, trematodes, and nematodes.

Figure 1 illustrates the five thematic axes of the course workshop, while Figure 2 shows the team of participating instructors and the group of attending students from the San Martín University Foundation, Medicine Program.

Figure 1. Participation of international speakers during the workshop *Parasitic Zoonoses in the Context and Approach of One Health One Health*, held within the framework of the XII International Congress of Neotropical Parasitology. Images show moments from the presentations corresponding to the five thematic axes: foundations of the One Health approach, zoonoses transmitted by companion animals, parasitic zoonotic diseases of importance in livestock production, parasitic ichthyozoonoses, and parasites in aquaculture. The workshop included the participation of specialists from Peru, Mexico, Colombia, Uruguay, and Brazil.

Figure 2. Final photograph of the workshop *Parasitic Zoonoses in the Context and Approach of One Health One Health*, conducted during the XII International Congress of Neotropical Parasitology. The image shows the team of participating instructors and the group of attending students from the San Martín University Foundation, Medicine Program, who successfully completed the training activities focused on the One Health approach to parasitic zoonoses.

Relevance of the One Health approach in the surveillance and control of parasitic zoonoses

The surveillance and control of parasitic zoonoses require an integrated approach that goes beyond the traditional boundaries of human or veterinary health and recognizes the dynamic interdependence among people, animals, and ecosystems, a principle reinforced by recent conceptual advances in the One Health framework (Destoumieux-Garzón *et al.*, 2018; Brown,

2024). In this context, the One Health paradigm constitutes an essential operational framework for the early detection of emerging risks, the understanding of parasitic life cycles involving multiple hosts, and the assessment of environmental factors that influence transmission, such as climate change, ecosystem degradation, and production intensification (Desvars-Larrivé *et al.*, 2024; Deiana, 2024).

Interdisciplinary collaboration integrating parasitology, veterinary medicine, public health, ecology, and environmental sciences has been shown to enhance epidemiological analysis and outbreak response capacity, enabling the development of more effective and adaptive preventive strategies in the face of changing scenarios (Morchón *et al.*, 2025). Furthermore, the One Health approach emphasizes community participation, health education, and multilevel coordination among institutions, which are key elements for reducing human exposure to zoonotic agents, optimizing animal management practices, and strengthening food safety (Lerner & Berg, 2015; Bongono *et al.*, 2025). Overall, this integrated perspective contributes to the construction of more resilient surveillance systems capable of anticipating and responding efficiently to emerging parasitic challenges associated with global change and human mobility.

CONCLUSIONS

The workshop represented a high value training experience for strengthening regional capacity building and cooperation in the study, surveillance, and control of parasitic zoonoses in Latin America. The participation of specialists from Peru, Mexico, Colombia, Uruguay, and Brazil enriched the academic exchange by integrating epidemiological, environmental, and production related perspectives specific to each country, allowing the identification of common features and shared challenges within the Neotropical region. This convergence of knowledge highlights the need to promote regional cooperation strategies that articulate academic institutions, public health sectors, animal production systems, and local communities under the One Health paradigm.

Moreover, the experience confirms that interdisciplinary training, collaborative work, and the creation of exchange networks are essential pillars for effectively addressing emerging and persistent parasitic risks. Taken together, the workshop contributed to consolidating a more integrated and resilient regional vision, capable of confronting health challenges derived from global change, human mobility, and environmental transformations in Latin America.

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