

New research perspectives on the ecoepidemiology of neglected intestinal helminthiasis in urban-marginal and rural areas of the province of Guayas

Nuevas perspectivas de Investigación sobre Ecoepidemiología de las helmintiasis intestinales desatendidas en zonas urbanomarginales y rurales de la provincia del Guayas

Roberto Darwin Coello-Peralta¹

Abstract: Neglected intestinal helminthiasis are very prevalent worldwide and represent a serious problem of: environmental contamination (presence of feces with infective parasitic forms dispersed in the soil), animal health and public health. This paper explains new research perspectives on the ecoepidemiology of neglected intestinal helminthiasis in urban-marginal and rural areas of the province of Guayas (Ecuador). By means of an applied study with a qualitative, quantitative, field, descriptive-prospective-analytical-transversal approach, fecal samples from humans and their domestic dogs from the indicated areas will be analyzed, in order to provide information: The relationship between the environment-helminths-and hosts, prevalence of neglected intestinal helminthiasis, zoonotic association, characterization of environmental variables, specification of social determinants of health and generate scientific production.

Keywords: Ecoepidemiology, social determinants, environmental parameters, epidemiological indicators, zoonotic association.

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Correspondence author

roberto.coellope@ug.edu.ec

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¹ Director del Proyecto FCI sobre Ecoepidemiología de las helmintiasis intestinales desatendidas en zonas urbanomarginales y rurales de la provincia del Guayas, Facultad de Medicina Veterinaria, Universidad de Guayaquil (UG), Guayaquil, Ecuador, roberto.coellope@ug.edu.ec, <https://orcid.org/0000-0001-5152-2843>

Resumen: Las Helmintiasis Intestinales Desatendidas son muy prevalentes a nivel mundial y representan un serio problema de: contaminación ambiental (presencia de heces fecales con formas parasitarias infectivas dispersas en el suelo), salud animal y salud pública. El presente explica, sobre las nuevas perspectivas de investigación sobre la ecoepidemiología de las helmintiasis intestinales desatendidas en zonas urbanomarginales y rurales de la provincia del Guayas (Ecuador). Mediante un estudio aplicado con enfoque cualitativo, cuantitativo, de campo, descriptivo-prospectivo-analítico-transversal, se analizarán muestras fecales de humanos y de sus perros domésticos de las zonas señaladas, con el fin de dar a conocer: La relación entre el medio ambiente-helminios-y hospederos, prevalencia de las helmintiasis intestinales desatendidas, asociación zoonótica, caracterización de variables ambientales, especificación de determinantes sociales de salud y generar producción científica.

Palabras clave: Ecoepidemiología, determinantes sociales, parámetros ambientales, indicadores epidemiológicos, asociación zoonótica.

Introduction

Worldwide, corn (*Zea mays L.*) is a cereal of great economic and nutritional importance. The main producers of this grass, according to FAO (2017) are: United States of America with approximately 370 million tons per year, followed by Continental China with 259 million T/year, Brazil ranks third with 97 million T/year, and lastly Argentina with 4 million T/year. It is considered a representative cereal that creates economic sources within the food agroindustry.

The production of this grass is one of the most important agricultural activities on the Ecuadorian coast, as it is the raw material for the production of balanced products for the animal industry. In 2017, it was estimated that the planted area of this species was 388,534 Ha with an average yield of 4Tm/Ha. On the other hand, 79.26% of the planted area is registered in the provinces of Los Ríos, Manabí and Guayas (National Institute of Statistics and Geography). (Instituto Nacional de Estadística y Censos (INEC), 2017)..

At present, on the Ecuadorian coast it is one of the most important socioeconomic crops, due to the work it provides to farmers in large rural areas. The Central Bank of Ecuador (2018) in its report describes that nowadays, farmers adopt new technologies such as the use of certified seeds that has become daily in agricultural fields. The planting of hybrids is a fundamental factor to increase yields, however, it is not

the only factor that has an impact on production, Ortiz (2014) refers that there are other factors such as: the zone, climatic conditions, management and agricultural work (weed management, fertilization, integrated pest and disease management), the type of investment and the type of farmer (Roca et al., 2013)..

The release of high-yielding hybrids tolerant to adverse biotic and abiotic factors will contribute to minimize losses of this grass. Therefore, the present research work on the adaptability of new maize (*Zea mays* L.) hybrids in Ecuador was carried out to determine the yield in two zones of the Ecuadorian coast.

Materials and methods

Type and Design of research:

This is an applied study with a qualitative, quantitative, field, descriptive-prospective-analytical-cross-sectional approach.

Study site:

There will be 2 urban-marginal sectors of Guayaquil: Balerio Estacio and La Ladrillera; as well as 2 rural sectors of the Province of Guayas which are: Loma Larga (Nobol canton) and Santa Rosa (Daule canton).

The population of the Urbano Estacio Cooperative is 32,000 inhabitants, that of the Ladrillera sector is 1607 inhabitants (Department of Appraisal and Cadastre of the Municipality of Guayaquil, 2022), that of Loma Larga is 1000 inhabitants (Department of Appraisal and Cadastre of the Municipality of Nobol, 2022) and that of Santa Rosa 1450 inhabitants (According to the Department of Appraisal and Cadastre of the Municipality of Daule, 2022). The total population in the four zones is 36,057 inhabitants, housed in 7,212 dwellings/households. For the calculation of the sample size, the WinEpi (2023) program was used with a confidence level of 95%, population size 7212 (households) and a minimum expected prevalence of 5% (Cooper et al., 1993; Moncayo et al., 2018), giving a result of 59 dwellings, where 2 samples of domestic dogs and 1 of humans will be taken (118 samples of canines and 59 samples of humans per sector).

For the statistical treatment of the data, summaries of the quantitative variables will be used, which will be made using the measures of central

tendency and the measures of dispersion with their corresponding graphs.

Summaries of qualitative variables will be presented using ratios, proportions and rates; and risk estimation will be performed using the odds ratio. Statistical analysis will be performed using R version 1.2.5033 (Venables et al., 2022) and RStudio (RStudio Team, 2022).

Fecal samples from humans and their domestic dogs will be analyzed to determine intestinal helminths by direct coproparasitic methods (Fabián et al., 2003), flotation (Willis, 1921), and sedimentation using saline solution (Fabián et al., 2003; CDC, 2021). To differentiate *Strongyloides stercoralis* and *Ancylostoma caninum* larvae, the modified Baermann method (Coello et al., 2019) and PCR will be performed to confirm the presence of helminths (Avila et al., 2021). A standardization technique for a molecular diagnostic test for *Ancylostoma caninum* in canines will also be performed.

Social determinants (Number of family members, Ages of family members, Occupation, Presence of skin, eye and other diseases, Household infrastructure, Presence of sewerage and type of water supply, Health system, Excreta disposal and Animal ownership) will be measured through surveys.

Environmental parameters (Temperature, Humidity, Precipitation, Solar Radiation, Soil Texture, Vegetation Type, Deforestation and Fauna) will be determined through data provided by environmental programs such as: Weather Spark (2022), Weather Atlas (2022), Meteored (2022), National Institute of Meteorology and Hydrology (INAMHI) (2023); as well as through observation and soil studies Epidemiological Indicators (Prevalence, Morbidity will be determined through laboratory analysis and surveys.

Result

- 1) The Ecoepidemiology of neglected intestinal helminthiasis in urban-marginal and rural areas of the Guayas Province will be evaluated.
- 2) The environmental variables in the selected study localities will be characterized.
- 3) The social determinants of health present in the sampling units will be specified.

- 4) Intestinal helminths in humans and their domestic dogs present in the study areas will be identified.
- 5) Epidemiological indicators in the study areas will be estimated.
- 6) Scientific production will be generated through scientific articles, presentations, participation in national and international events and a doctoral proposal on the Ecoepidemiology of *Ancylostoma caninum* in urban-marginal and rural areas of the Ecuadorian Coast.
- 7) Development of new methodologies, processes and techniques applicable to biomedical parasitology.
- 8) Generate other research.
- 9) Prevent outbreaks or epidemics, through talks and awareness-raising.
- 10) To strengthen the study of neglected parasitosis in third, fourth and fifth level students.
- 11) Graduate: 3 students of Veterinary Medicine and Zootechnics of the University of Guayaquil and Doctorate (in 5 years).
- 12) Holding of an International Microbiology Congress.

Conclusions

This is a project of the Competitive Research Fund (FCI) that was approved by the Research Council of the Faculty of Veterinary Medicine and Animal Husbandry, also by the Directorate of Research, both of the University of Guayaquil, lacking the approval of the Ethics Committee of Human Research CEISH (in process). The results obtained will be of valuable information for the epidemiological surveillance systems of wildlife, animal health and public health, which will serve to establish control and prevention programs of intestinal Helminthiasis, and avoid the spread of these parasitosis to other areas since the areas to investigate have all the conditions for the various biological cycles of transmission.

However, Dr. Ana Lucia Ruano Nieto, presented to SENESCYT in 2013, the *National Program for the multidisciplinary approach to neglected Parasitosis in Ecuador (PROPAD)*, which was developed on

a national scale and made early and accurate diagnoses of the different types of parasites in Ecuador.

On the other hand, PAHO's Regional Program for Neglected Diseases promotes a comprehensive approach that includes both interprogrammatic strategies and intersectoral actions. In this context, the guide for the formulation and implementation of Comprehensive Plans for the Control or Elimination of Neglected Diseases was developed to join efforts for the planning, implementation, monitoring and evaluation of interventions and programs for the prevention, control and elimination of Neglected Infectious Diseases in the health sector.

With the above described, it is worthwhile to investigate the: Ecoepidemiology of neglected intestinal helminthiasis in urban-marginal and rural areas of the province of Guayas (Ecuador).

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