entrosur
e-ISSN:2706-6800

INSTITUTO TECNOLÓGICO CORPORATIVO
EDWARDS DEMING®

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

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

Roberto Darwin Coello-Peralta[1]

Abstract: Neglected intestinal helminthiases 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 of 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 helminthiases, 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.

Published
Instituto Tecnológico Superior Edwards Deming. Quito – Ecuador

Periodicity
April - June
Vol. 2, Num. 2, 2023

Dates of receipt
Received: December 29, 2022
Approved: March 30, 2023

http://centrosuragraria.com/index.php/revista
vol. 1. Num. 17. 2023.
pp. 44-51

Correspondence author
roberto.coellope@ug.edu.ec

1 Director of the FCI Project on Ecoepidemiology of Neglected Intestinal Helminthiases in Urban-Marginal and Rural Areas of the Province of Guayas, Faculty of Veterinary Medicine, University of 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-helmintos-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.

1. Introduction

Ecoepidemiology is a branch of ecology, which deals with the synanthropic interaction between the pathogen, various hosts and the environment, which ultimately manifests with the spread of infectious diseases (Banerjee et al., 2017).

Approximately 75% of emerging infectious diseases affecting humans are of animal origin, and 60% of all human pathogens are zoonotic and are a threat to public health worldwide (Bueno et al., 2015). In the case of intestinal helminthiases, these are prevalent worldwide, especially in developing countries with tropical and subtropical climates, and are related to poverty (PAHO/WHO, 2021).

The most frequent intestinal helminths are *A. lumbricoides, Trichuris trichiura*, Hookworm spp. (*Ancylostoma* and *Uncinaria*)*, H. nana, E. vermicularis, S. stercoralis* and *Taenia* species. Infections with these parasites generally lead to nutritional deficiency, poor immunity, gastrointestinal problems, mucosal leakage, lymphatic leakage and local hemorrhages (Liyih et al., 2021); in the case of *Ancylostoma caninum* it enters humans percutaneously and produces a pathology called Larva migrans cutanea (Coello et al., 2019); and in the case of *Toxocara canis* it produces 3 syndromes: visceral larva migrans (associated with digestive, respiratory and nervous pathologies), ocular larva migrans (associated with ocular pathology) and covert

toxocariasis (associated with mild symptomatology) (Roldán et al., 2010).

In Ecuador there are no studies on Ecoepidemiology of Neglected Intestinal Helminthiasis in rural and urban marginal areas; therefore, it is of great importance to carry out this study that will be of great contribution for the epidemiological surveillance systems and for the FCI 029 project approved by the University of Guayaquil, called: Ecoepidemiology of Neglected Intestinal Helminthiasis in urban marginal and rural areas of the province of Guayas.

The urban-marginal sectors under investigation have a population that is in permanent contact with marshes, ditches, sports fields, markets, schools, garbage dumps, dirt roads and backyard animals. The population of the rural sectors mentioned above is in contact with rivers, marshes, ditches, dykes, ditches, dams (where freshwater parasites can develop), rice fields, garbage dumps, forestry, and domestic and wild animals; however, in both sectors, most of the houses have little infrastructure, the roads are made of dirt and there is no sewage or potable water.

It is important to highlight that this is a multidisciplinary study, where a problem that could be hidden is that due to the current pandemic of Covid-19, humans and their domestic dogs in their homes, being in intimate contact with each other due to confinement, it is likely to increase the contagion and transmission of these parasitosis inside their homes.

2. Materials and methods

Type and Design of research:

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

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

entrosur e-ISSN:2706-6800
INSTITUTO TECNOLÓGICO CORPORATIVO EDWARDS DEMING

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 obtained through data provided by environmental programs such as: Weather Spark (2022), Weather Atlas (2022), Meteored (2022), Instituto Nacional de Meteorología e Hidrología (INAMHI) (2023); as well as through observation and soil studies,

Epidemiological indicators (Prevalence, Morbidity, Mortality) will be determined by laboratory analysis and surveys.

3. Result

1) The Ecoepidemiology of neglected intestinal helminthiasis in urban-marginal and rural areas of the Guayas Province will be evaluated.

2) 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) Identify intestinal helminths in humans and their domestic dogs present in the study areas.

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 for 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.

4. 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

entrosur e-ISSN:2706-6800
INSTITUTO TECNOLÓGICO CORPORATIVO EDWARDS DEMING

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 with the purpose of joining 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).

References

Banerjee M, Perasso A, Venturino E. (2017). Epidemiology and Ecoepidemiology: Introduction tothe Special Issue. *Math. Model. Nat. Phenom*, *12*(2): 1-3.

Bueno R, Gouveia A, Navarro J (2015). Emerging zoonoses: Eco-epidemiology, involved mechanisms and Public Health Implications. *Front Public Health*, *3*(1): 1-2.

WHO / PAHO. (2021). Neglected, tropical and vector-borne diseases. Available at: https://www.paho.org/es/temas/enfermedades-desatendidas-tropicales-transmitidas-por-vectores.

Liyih M, Damtie D, Tegen D. (2022). Prevalence and Associated Risk Factors of Human Intestinal Helminths Parasitic Infections in Ethiopia: A Systematic Review and Meta-Analysis. *Scientific World Journal*: 3905963. doi: 10.1155/2022/3905963.

Coello R, Pazmiño B, Reyes E, Rodríguez E, Rodas E, Rodas K, et al. (2019). A Case of Cutaneous Larva Migrans in a Child from Vinces, Ecuador. *Am J Case Rep*, *20*(1): 1402-1406.

Roldán W, Espinoza Y, Huapaya P, Jiménez S. (2010). Diagnosis of human toxocarosis. *Rev Peru Med Exp Salud Publica*, 27(4): 613-20.

Department of Appraisal and Cadastre of the Municipality of Guayaquil. Population and number of families of the Urbano Estacio Cooperative and the Brickyard of the City of Guayaquil. 2022.

Department of Appraisal and Cadastre of the Municipality of Nobol. Population and number of families in the Loma Larga sector. 2022.

Department of Appraisal and Cadastre of the Municipality of Daule. Population and number of families of Santa Rosa sector. 2022.

WinEpi (2022). Working in Epidemiology. Available at: http://www.winepi.net/.

Cooper P, Guevara A, Guderian R (1993). Intestinal helminthiases in Ecuador: the relationship between prevalence, genetic, and socioeconomic factors. *Rev Soc Bras Med Trop*, *26*(3): 175-80.

Moncayo A, Lovato R, Cooper P (2018). Soil-transmitted helminth infections and nutritional status in Ecuador: findings from a national survey and implications for control strategies. *BMJ Open*, 8(1): 1-9.

Venables W, Smith D, Core Team R. (2022). An introduction to R. Notes on R: A Programming Environment for Data Analysis and Graphics. Version 4.2.0, p. 99. Available at: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf.

RStudio Team (2022). RStudio: Integrated Development for R. RStudio, PBC: Boston, MA. Available at: http://www.rstudio.com/.

Willis H. (1921). A simple levitation method for the detection of hookworm ova. *Med J Aust*, *2*(18): 375-76.

Fabián E, Tello R, Náquira C. (2003). Manual of laboratory procedures for the diagnosis of intestinal parasites in man. *National Institute of Health of Peru*, *37*(1): 18-22.

Center for Disease Control and Prevention (CDC). (2021). DPDx - Laboratory Identification of Parasites of Public Health Concern. Stool Specimens - Specimen Processing.

Avila HG, Risso MG, Cabrera M, Ruybal P, Repetto SA, Butti MJ, et al. (2021). Development of a New LAMP Assay for the Detection

entrosur e-ISSN:2706-6800

INSTITUTO TECNOLÓGICO CORPORATIVO EDWARDS DEMING

of Ancylostoma caninum DNA (Copro-LAMPAc) in Dog Fecal Samples. *Front. Vet. Sci. 8*:770508. doi: 10.3389/fvets.2021.770508.

Weather Spark (2022). Weather all year round anywhere in the world. Weather reports with weather by month, day and even hour. Available at: https://es.weatherspark.com/

Weather Atlas (2022). Weather forecasts and weather forecast information. Available at: https://www.weather-atlas.com/es.

Meteored (2022). 14-day weather forecast. Available at: https://www.meteored.com.ec/.

Institute of Meteorology and Hydrology (INAMHI) (2023). Weather forecast. Available at: http://www.inamhi.gob.ec/.

National Program for the Multidisciplinary Approach to Neglected Parasitosis in Ecuador (PROPAD) (2013). Prometeo Ana Ruano presented a plan to address parasitosis in Ecuador. Senescyt. Available at: https://www.educacionsuperior.gob.ec/prometeo-ana-ruano-presento-un-plan-para-abordar-la-parasitosis-en-el-ecuador/

Pan American Health Organization. (PAHO). (2011). Integrated Action Plans for the Prevention, Control and Elimination of Neglected Infectious Diseases. p. 1-101. Available at: file:///C:/Users/Univ.%20de%20Guayaquil/Downloads/Informe-taller-EID-spa%20(1).pdf.