



### Research Article

# Association between Environmental Risk Factors and the Prevalence of Intestinal Worms among Butchers in Port Harcourt Metropolis

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### Article Info

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### Abstract

**Background:** The environmental conditions of butchers are critical factors in the prevalence of intestinal worms. **Aim:** To determine the relationship between butchers environmental risk factor and the prevalence of intestinal worms within the metropolis of Port Harcourt Nigeria. **Methodology:** This study used a cross-sectional descriptive design, and the target group consisted of male and female butchers who worked in the selected Port Harcourt metropolitan abattoirs. Butchers who are at least 18 years old and employed in registered abattoirs in the Port Harcourt metropolitan area met the inclusion requirements; however, those who had received anti-helminthic medication three months before the study and those who had not worked at the abattoir for at least six months were excluded. Multi-stage sampling was adopted in this research work and primary data sourced through observations, measurements, structured surveys, interviews, and samples that were taken with the assistance of 4 trained research assistants, were employed in this study. The study lasted for about two months, and each questionnaire, physical examination, and measurement took roughly forty minutes. The tools gathered data on environmental risk factors, such as the type of toilet, the quantity of restrooms and toilets at the slaughterhouse, contact with animals at home, the number of pets, hand washing habits, water sources for drinking and bathing, the habit of wearing shoes, the consumption of raw fruits and vegetables, and the existence of waste disposal. The University of Port Harcourt's Ethics and Committee granted the study ethical permission. Additionally, the head of each visited cluster in the slaughterhouse gave permission to conduct the study. **Results:** chi square test for association revealed that the availability of bathroom and their number were significantly associated ( $p < 0.05$ ) with the prevalence of intestinal worms, however, other environmental risk factors were not significantly associated. **Conclusion:** Significant association exists between butchers' environmental risk factor and the prevalence of intestinal worms with respect to bathroom facilities and the number of available bathrooms. This underscores the importance of proper sanitation and hygiene in preventing infections, thus suggests that overcrowded or inadequately equipped restroom facilities may contribute to the spread of intestinal worms.

## 1. Introduction

The environmental conditions of butchers are critical factors in the prevalence of intestinal worms. Butchers are routinely exposed to potentially contaminated meat and work environments that may harbor parasitic organisms. The nature of their job involves handling raw meat, which can be a vector for various zoonotic pathogens, including those that cause intestinal worm infections [1]. The risk is compounded by the fact that butchering is often performed in environments that may not adhere to stringent sanitary regulations. This can lead to the contamination of meat products with faecal matter, where worm eggs or larvae may be present. Additionally, the lack of personal protective equipment and proper hygiene practices can increase the risk of transmission [2–4]. Furthermore, the environmental aspect, such as the location of slaughterhouses and the disposal of animal waste, plays a significant role in the lifecycle of these parasites. Inadequate waste management can lead to the contamination of soil and water sources, creating a breeding ground for intestinal worms and facilitating their transmission to humans [1].

Abattoirs are vital for ensuring safe, quality meat for people, with approvals from authorities. They handle critical functions like sanitary slaughter, inspection, processing, preserving, and storing meat to protect public health [5]. Urban abattoirs face a major challenge due to rural-to-urban migration, leading to a rise in their numbers. This can result in sanitation and environmental issues, increasing disease risks. New abattoirs must minimize such risks [6–8]. Nigeria's abattoirs are a major public health concern, known for poor cleanliness and handling practices, posing serious health risks [9].

Helminths are known as parasitic worms. They are invertebrates with elongated, flat or circular bodies. Helminths are bisexual and hermaphrodite species. They can be grouped according to their general outward shape and the host organ they occupy. The internal and exterior morphology of the egg, larval, and adult stages serve as the basis for the main classification [10]. Flukes and tapeworms are considered flatworms, while nematodes are roundworms [10]. According to Castro [10], other types of tapeworms and flukes that affect people are hermaphrodites.

The World Burden of Disease (GBD) Project's most recent forecasts for 2016 state that there are approximately 800 million instances of ascariasis, 450 million incidents of hookworm, 435 million cases of trichuriasis, 190 million occurrences of schistosomiasis, and 75 million cases of food-borne trematodiasis globally. Both lymphatic filariasis (29 million cases) and onchocerciasis (15 million cases) are less common today as a result of substantial control measures implemented over the preceding three to four decades. Ascariasis, hookworm, and trichuriasis are among the Soil-Transmitted Helminths (STH) that are most common in tropical countries. Together, they are estimated to cause about 135,000 deaths annually [11]. The following countries have high rates of hookworm infections: Papua New Guinea (60.6%), Nepal (30.7%), Bangladesh (22.3%), and Malaysia (21.0%). Sub-Saharan Africa still has a high prevalence of these conditions. Across contrast to common assumption, hookworm infections are nonexistent across much of Central Asia and North Africa, with the exception of Egypt (6.0%) [11]. *Ascaris lumbricoides* has the widest distribution among the three STH infections, with higher transmission rates in Nigeria (25.4%), Cameroon (30.8%), and northwestern Central sub-Saharan Africa (38.8% in Equatorial Guinea to 32.2% in Congo) [11]. In a certain study, higher prevalence rate of *A. lumbricoides* was recorded in pupils of 9-11 years and 12-14 years in Bori, Port Harcourt, a situation attributed to the unhygienic toilet and source of drinking water [12].

The purpose of this study is to ascertain how the environmental risk factors of butchers relate to the prevalence of intestinal worms in Port Harcourt, Nigeria.

## 2. Methodology

### Location of Study

Rivers State is home to the Port Harcourt metropolis, which is located between latitudes 4°55'N, 6°55'E, and 7°05'E. It is a city in the Niger Delta region of Nigeria. The economy of the rapidly developing, multilingual, multiethnic Port-Harcourt metropolis is reliant on crude oil [13]. It is situated at the mouth of the River Bonny and located 25 kilometers from the Atlantic Ocean between the Dockyard Creek/Bonny River and the Amadi Creek [14]. The local government areas (LGAs) of Obio-Akpor and Port Harcourt make up Port Harcourt metropolitan region, as shown by Figure 1 below [15].

There are numerous licensed abattoirs in Port-Harcourt metropolis. Among them are Rumuodumaya, Trans-Amadi (School Road), Mile III, Okuru, Iwofe, Woji, Borikiri, and so forth. Every day, an average of 80 animals are killed at each of these abattoirs, which employ 100 people on average, amongst whom are butchers, cleaners, and herdsman [13].

Source: Adapted from Google Earth (2020).

### Design of Study

This investigation used a cross-sectional descriptive study design. Using basic random selection, nine abattoirs—five from Obio-Akpor Local Government Areas and four from Port Harcourt Local Government Areas—were chosen from the two local government areas in the Port Harcourt metropolis. Until the required sample size was attained, eligible and willing volunteers were progressively gathered.

### Research Population

Abattoir butchers, both male and female, who were employed in any of the designated Port Harcourt metropolis abattoirs and who were at least 18 years old, comprised the study's target group.

### Criteria for Inclusion

Butchers who work in registered abattoirs within the Port Harcourt metropolis and are at least 18 years old.

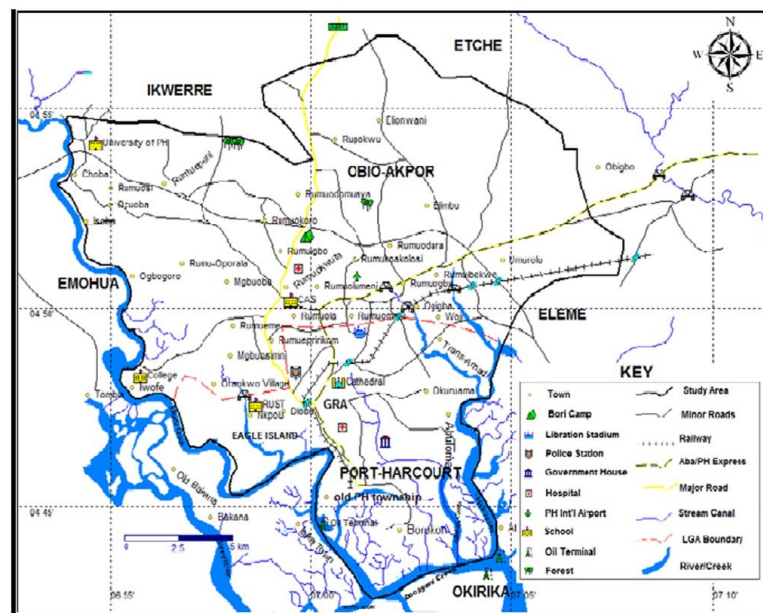


Figure 1: Map of Port Harcourt metropolis [15]

### Criteria for Exclusion

Butchers who have been administered anti-helminthic treatment three months prior to the study. Butchers who have not been employed at the abattoir for at least six months.

## 3. Sample and Sampling Technique

### Sample size Determination

The minimum sample size of 467 was calculated using sample size calculation formula [16] and the participants were recruited via multi-stage sampling.

### Data Gathering and Tools

A pretested structured interviewer-administered questionnaire was created and used for this investigation. The tool gathered data on environmental risk factors, such as the type of toilet, the quantity of restrooms and toilets at the slaughterhouse, contact with animals at home, the number of pets, hand washing habits, water sources for drinking and bathing, the habit of wearing shoes, the consumption of raw fruits and vegetables, and the existence of waste disposal.

### Data Collection procedure

Four research assistants were hired and trained for this project. The study was conducted over a two-month period, and each questionnaire, physical examination, and measurement took roughly forty minutes. After receiving instruction, participants were given a sterile bottle to collect faeces aseptically the following day. One study assistant completes the questionnaire while the other takes measurements and performs a physical examination during each visit to the abattoir.

### Examination of Parasites

Samples of stools were obtained within an hour of collection and placed in plastic containers with screw caps and labels for parasitological analysis. Using the formal ether concentration method, which is thought to be the most sensitive method for most intestinal helminths, all stool samples were reexamined microscopically [17].

### Data Quality Assurance

Preliminary testing was conducted to determine the reliability of the questionnaire, and questionnaires were pretested on 10% of the sample size at an abattoir other than the ones selected for the main study. Furthermore, before beginning the primary task, face validation was utilized to assess the validity of the questionnaire. We looked up the expiration dates on every reagent. The lead investigator provided close oversight.

## Statistical Analysis

Data fetched from the participants were statistically evaluation using Chi-square tool by means of Statistical Package for Social Science (SPSS) version 25. The tests were considered significant at significant level of 0.05.

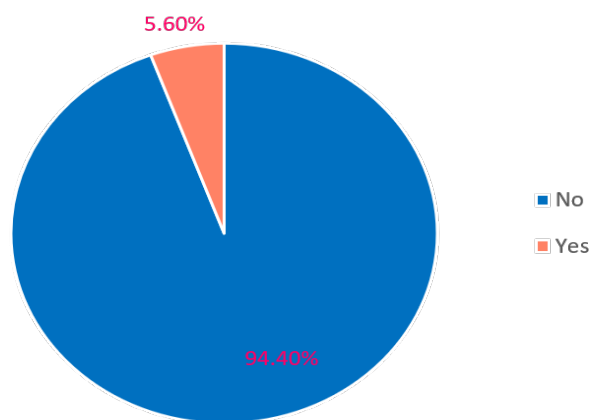
## Ethical Consideration

The University of Port Harcourt's Ethics and Committee granted the study ethical permission. Additionally, the head of each visited cluster in the slaughterhouse gave permission to conduct the study.

## Informed Consent

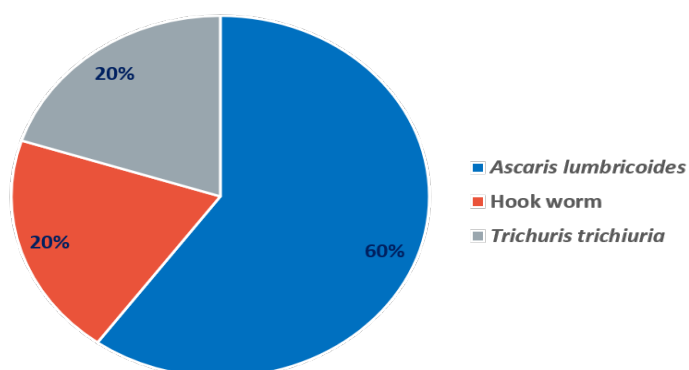
After providing sufficient information about the study and its procedures, each participant signed a written informed consent form to confirm their consent. To ensure accurate translation, the informed consent form was translated into Pidgin and then back into English.

## 4. Results



**Figure 2:** Prevalence of Intestinal Worms.

Figure 2 above shows that the general prevalence of intestinal worm is 5.60%



**Figure 3:** Prevalence of intestinal worms by types.

Figure 3 above shows the prevalence of intestinal worms by types. *Ascaris lumbricoides* have the highest prevalence of 60% while Hook worm and *Trichuris trichiuria* have the least prevalence of 20% each.

## Chi-Square of Association Between Butchers Environmental Risk Factor and the Prevalence of Intestinal Worms

Chi square test for association revealed that bathroom and number of bathrooms are significantly associated ( $p < 0.05$ ) with the prevalence of intestinal worms, however, other environmental risk factors are not significantly associated.

**Table 1:** Association between Butchers Environmental Risk Factor and the Prevalence of Intestinal Worms.

	Status	Prevalence of Intestinal Worms				Chi-Square (p-value)
		No Frequency	Percentage (%)	yes Frequency	Percentage (%)	
Defecate in Open Space	No	220	61.8	8	2.2	1.33 (0.249)
	Yes	116	32.6	12	3.4	
Toilet Type at Home	B	24	9.0	0	0.0	0.523 (0.469)
	WC	304	85.4	20	5.6	
Toilet Type at Abattoirs	R/WS	56	15.7	8	2.2	4.561 (0.207)
	L	40	11.2	0	0.0	
	WC	120	33.7	12	3.4	
	R/WS	120	33.7	0	0.0	
No of Toilets	0	180	50.6	8	2.2	2.160 (0.540)
	1-3	104	29.2	12	3.4	
	4-6	48	13.5	0	0.0	
	>7	4	1.1	0	0.0	
Bath Room	No	280	78.7	8	2.2	5.735 (0.017)*
	yes	56	15.7	12	3.4	
No of Bath room	0	276	77.5	8	2.2	5.195 (0.023)*
Pets at Home	No	248	92.1	20	5.6	0.122 (0.727)
	Yes	8	2.2	0	0.0	
Number of Pets	0	248	92.1	20	5.6	0.122 (0.727)
	1 above	8	2.2	0	0.0	
Wear Shoe in Abattoir	No	112	31.5	12	3.4	1.478 (0.224)
	Yes	224	62.9	8	2.2	
Fruits and Vegetable	Yes	336	94.4	20	5.6	
Wash Before Eat	Yes	336	94.4	20	5.6	
Wash Hands before Eat	Yes	336	94.4	20	5.6	
Wash After Defecation	Yes	336	94.4	20	5.6	
Refuse Dispersal	No	332	93.3	20	5.6	0.060 (0.806)
	Yes	4	1.1	0	0.0	
Source of Drinking Water	BW	32	9.0	4	1.1	6.785 (0.079)
	PW	180	50.6	8	2.2	
	PW/TP	96	27.0	0	0.0	
	TP	28	7.9	8	2.2	

\*Statistically Significant ( $p < 0.05$ )

B-Bush, WC- water closet, L- Latrine, R/WS- River/ Waterside, BW – Bottle water, PW- pure water, TP- Tap water

## 5. Discussion

The present study revealed that bathroom and the number of bathrooms were significantly associated ( $p < 0.05$ ) with the prevalence of intestinal worms, however, other environmental risk factors are not significantly associated. The significant association between bathroom facilities and the burden of intestinal worms underscores the importance of proper sanitation and hygiene in preventing infections. The association between the number of bathrooms and intestinal worm prevalence suggests that overcrowded or inadequately equipped restroom facilities may contribute to the spread of intestinal worms. This is in agreement with the work of Vaz Nery et al. [18] which reported that poor hygienic and sanitized environment fosters the spread of parasitic worms. With respect to the significant association noted in the number of bathrooms, it could be that the absence of sufficient bathrooms led to overcrowding, consequently rendering the available ones unhygienic, which could also facilitate the quick transmission of the helminths among the butchers. Both inadequate bathrooms and limited number of bathroom has been revealed as one of the main causes of helminth transmission according to [19]. The lack of significant association between other environmental risk factors and intestinal worms in this study does not necessarily mean these factors are irrelevant. Further studies could expose the significances that may not be captured in this research due to its limitation to Port Harcourt metropolis only.

## 6. Conclusion

The results of this study provide insight into the intestinal worm prevalence among Port Harcourt metropolis butchers. Sanitation proves paramount. Adequate bathroom facilities are linked to lower infection rates, emphasizing the need for improved workplace hygiene. Overcrowded or subpar restroom conditions heighten the risk. While other environmental factors didn't show significant association, they warrant ongoing attention. Occupational health practitioners should emphasize the need for clean and hygienic bathroom facilities in workplaces. Ensuring that employees have access to well-maintained and sanitary restrooms can significantly reduce the risk of intestinal worm infections.

## References

- [1] F. O. Omokhodion and A. M. Adebayo. Occupational hazards and self-reported health problems of butchers in ibadan, southwest nigeria. *J Public Health*, 21:131–134, 2013. doi: 10.1007/s10389-012-0528-5.
- [2] D. T. Gebeyehu and H. Tsegaye. Food safety knowledge and practice of abattoir and butcher shop workers: a health risk management perspective. *One Health Outlook*, 4:14, 2022. doi: 10.1186/s42522-022-00070-1.
- [3] H. Shankar, S. Saluja, M. Rawat, G. Singh, M. Tarique, N. Mohammad, and H. Naz. The causal association between occupational, environmental, and lifestyle factors and reproductive cancer risk. *Curr Mol Bio Rep*, 6, (2020):149–160, 2020. doi: 10.1007/s40610-020-00139-8.
- [4] F. Pega, N. C. Momen, L. Bero, and P. Whaley. Towards a framework for systematic reviews of the prevalence of exposure to environmental and occupational risk factors. *Environ Health*, 21:64, 2022. doi: 10.1186/s12940-022-00878-4.
- [5] E. C. Nwadiuto, I. Nnenna, and I. B. Ofureb. Bacteriological and parasitological assessment of water use in selected abattoirs in port harcourt metropolis, rivers state, nigeria. *Microbiology Research Journal International*, pages 19–25, 2021. doi: 10.9734/mrji/2021/v3i1i130288.
- [6] J. A. Alli, Okonko A. F. Kolade, I. O. Nwanze, J. C. Dada, V. K. M. Ogundele, and A. J. Oyewo. Prevalence of intestinal nematode infection among pregnant women attending antenatal clinic at the university college hospital, ibadan, nigeria. *Advances in Applied Science Research*, 2(4):1–13, 2011.
- [7] N. N. Odu, C. O. Akujobi, S. N. Maxwell, and A. R. Nte. Impact of mass deworming of school children in rural communities in rivers state, nigeria: Option for programme sustainability. *Acta Parasitologia*, 2(2):20–24, 2011.
- [8] A. N. Bala, A. E. Garba, and A. J. Yazah. Bacterial and parasitic zoonoses were encountered at slaughter in maiduguri abattoir, northeastern nigeria. *Veterinary World*, 4(10):437–443, 2011. doi: 10.5455/vetworld.2011.437-443.
- [9] W. D. Nafarnda, I. E. Ajayi, J. C. Shawulu, M. S. Kawe, G. K. Omeiza, N. A. Sani, O. Z. Tenuche, D. D. Dantong, and S. Z. Tags. Bacteriological quality of abattoir effluents discharged into water bodies in abuja, nigeria. *ISRN veterinary science*, 9:15–19, 2012.
- [10] G. A. Castro. Helminths: Structure, classification, growth, and development. In S. Baron, editor, *Medical Microbiology*, chapter 86. University of Texas Medical Branch at Galveston, 4th edition. Galveston (TX), 1996.
- [11] M. Riaz, N. Aslam, R. Zainab, Rasool G. Aziz-Ur-Rehman, M. I. Ullah, M. Daniyal, and M. Akram. Prevalence, risk factors, challenges, and the currently available diagnostic tools for the determination of helminths infections in human. *European Journal of Inflammation*, 18, 2020. doi: 10.1177/2058739220959915. SAGE Publications Inc.
- [12] G. Awi-Waadu. The prevalence of gastro-intestinal tract parasites in the inhabitants of bori military cantonment in port harcourt local government area of rivers state, nigeria. *African Journal of Applied Zoology and Environmental Biology*, 7, 2008. doi: 10.4314/ajazeb.v7i1.41148.
- [13] Ovua A Douglas, K.E and Sapira B. Orji, C. Health implications of sanitation in a public abattoir in port harcourt, nigeria. *The Nigerian health journal*, 13(2):91–95, 2013.
- [14] C. V. Izeagu and A. T. Salau. Port harcourt. *Butterworth and Co (Publishers) Ltd*, 85:264–2751, 1985. Article 010014-10. 0 \$03.000.
- [15] T. I. Akukwe and C. Ogbodo. Spatial analysis of vulnerability to flooding in port harcourt metropolis, nigeria. *SAGE Open*, 5(1), 2015. doi: 10.1177/2158244015575558.
- [16] W. G. Cochran. *Sampling techniques*. John Wiley and Sons, New York, 3rd edition, 1977.
- [17] World Health Organization. *Basic Laboratory Methods in Medical Parasitology*. World Health Organization, Geneva, Switzerland, 1991. URL <https://iris.who.int/handle/10665/40793>.
- [18] S. Vaz Nery, A. J. Pickering, E. Abate, A. Asmare, L. Barrett, J. Benjamin-Chung, A. P. D. Bundy, T. Clasen, C. A. A. Clements, M. J. Colford Jr., A. Ercumen, S. Crowley, O. Cumming, C. M. Freeman, R. Haque, B. Mengistu, E. W. Oswald, L. R. Pullan, G. R. Oliveira, E. K. Owen, L. J. Walson, A. Youya, and J. S. Brooker. The role of water, sanitation and hygiene interventions in reducing soil-transmitted helminths: interpreting the evidence and identifying next steps. *Parasites Vectors*, 12(273):2019, 2019. doi: 10.1186/s13071-019-3532-6.
- [19] T. Schmidlin, E. Hürlimann, K. D. Silué, R. B. Yapi, C. Hounghbedji, B. A. Kouadio, C. A. Acka-Douabélé, D. Kouassi, M. Ouattara, F. Zouzou, B. Bonfoh, E. K. N’Goran, J. Utzinger, and G. Raso. Effects of hygiene and defecation behavior on helminths and intestinal protozoa infections in taabo, côte d’ivoire. *PLoS One*, 8(6):e65722, 2013. doi: 10.1371/journal.pone.0065722.