Investigating the Prevalence of Intestinal Parasites in Leafy Vegetables from Key Markets in Buea Health District, South West Cameroon

Mahmud I. A. and Tankeu N. V.

Department of Allied Health, School of Health Sciences, Biaka University Institute of Buea, Cameroon.

Corresponding Author:

Mahmud I. A. Department of Allied Health, School of Health Sciences, Biaka University Institute Of Buea, Cameroon.

Email: ibrahimmahmud996@gmail.com

Abstract

Background: Leafy vegetables are a global source of nutrition, but they can also carry a public health threat when infected with intestinal parasites. This is especially worrisome in the Buea Health District of South West Cameroon, where farming methods and environmental factors may increase the risk of infection. This study fills the gap in local research on parasitic infection in this region.
Objective: To examine the occurrence of intestinal parasites in leafy vegetables sold in major markets of the Buea Health District, revealing regional patterns of contamination and factors that affect them.
Methodology: A descriptive cross-sectional survey sampled vegetables from five main markets in the Buea Health District. Standard parasitological techniques were used to analyze 75 vegetable samples. The study used stratified random sampling to account for different vegetable types.
Results: The vegetable samples had an intestinal parasite prevalence of 2.7%. The parasites were distributed differently among various vegetable types and market locations, showing the impact of certain environmental and agricultural factors.
Conclusion: The study found a fairly low occurrence of intestinal parasites in the vegetables sampled, indicating that the current agricultural and hygiene practices in the region are working well. However, differences in contamination among different markets and vegetable kinds highlight the importance of specific public health actions and ongoing surveillance.
Keywords: Intestinal Parasites, Leafy Vegetables, Buea Health District, Foodborne Infections, Agricultural Practices.

Introduction

Leafy vegetables are a crucial part of diets worldwide, prized for their nutritional content. However, their frequent consumption in raw or minimally processed forms raises significant concerns regarding foodborne parasitic infections, a notable public health issue in regions like the Buea Health District, South West Cameroon. This area, characterized by agricultural practices involving potentially contaminated water sources, presents a heightened risk of parasitic contamination in vegetables[1].

Intestinal parasites, including protozoans, cestodes, nematodes, and trematodes, found in vegetables, pose a severe health risk. The prevalence of diseases such as ascariasis, amoebiasis, and giardiasis, particularly in tropical regions where water contamination is prevalent, underscores the critical nature of this issue[2,3]. Moreover, the economic reliance on these crops in regions like Cameroon intensifies the need for comprehensive safety measures.

Studies have shown varying prevalence rates of intestinal parasites in leafy vegetables across different regions[4,5]. These studies, however, have limitations in their scope and often do not account for the unique environmental and agricultural practices in specific regions like Buea. Additionally, the literature suggests a gap in understanding the full spectrum of parasitic risks associated with different vegetable types and market conditions[6,7].

Despite the global recognition of this issue, there is a distinct lack of focused research on the parasitic contamination of vegetables specifically within the Buea Health District. This gap hinders the development of targeted public health strategies and an understanding of the region-specific risk factors[8].

The study is guided by a theoretical framework that integrates environmental health perspectives with agricultural practices, focusing on how local environmental conditions influence food safety. This research is poised to contribute methodologically by employing advanced parasitological analysis techniques and offering new insights into region-specific contamination patterns. Additionally, it has the potential for practical applications in developing localized public health interventions and agricultural best practices[9,10].

The study, while comprehensive, acknowledges limitations in its scope,

primarily focusing on key markets within the Buea Health District. These limitations set realistic expectations for the research outcomes, aiming to provide a foundational understanding for further studies.

Aim of the Study

This research aims to investigate the prevalence of intestinal parasites in leafy vegetables sold in key markets within the Buea Health District. By doing so, it seeks to offer a localized perspective on this global health concern, addressing the specific environmental and agricultural practices of the region.

Methodology

Study Design:

This research employed a descriptive cross-sectional survey design, specifically chosen for its effectiveness in assessing and describing the prevalence of a condition (intestinal parasites in this case) within a specific population at a single point in time. The study systematically sampled leafy vegetables from selected markets in the Buea Health District, utilizing random sampling to ensure a representative sample. The detection of intestinal parasites was carried out using standard parasitological techniques, including microscopy and molecular methods, to ensure accurate identification and quantification of parasites present.

Study Area:

The study was conducted in the Buea Health District, located in the South West region of Cameroon. This region is characterized by diverse agricultural practices and a range of environmental conditions due to its location on the slopes of Mount Cameroon. These factors are critical as they influence the types of irrigation used and potentially affect the contamination levels of leafy vegetables with intestinal parasites. The selected markets for this study, including Muea, Buea Town, Central Market, Mile 16, and O.I.C/Great Soppo, are representative of the various

agricultural zones within the district. This selection provides a comprehensive overview of the parasitic contamination risk across different agricultural settings within the district.

Sample Size:

Based on the raosoft scientific calculator, considering a 95% confidence interval with a 11.3% margin of error, the minimum sample size is 75[11].

Sample Technique:

A stratified random sampling technique was employed to select the vegetable samples. Each of the five markets (Muea, Buea Town, Central Market, Mile 16, and O.I.C/Great Soppo) was considered a stratum, and 15 samples were randomly selected from each, ensuring representation across different types of leafy vegetables. The selected vegetables included Desmocline infortune (Green leaf), Garden Huckebery (Njama Njama), Vernonia amygdalina (Bitter leaf), Talinum triangulare (Water leaf), and Talfairia occidentalis (Ugwu/Okorobong). This selection aimed to reflect the variety of leafy vegetables commonly consumed in the Buea Health District, thereby providing a comprehensive overview of the parasitic contamination risk.

Data Collection:

Upon securing the necessary research authorization from Biaka University Institute of Buea (BUIB) management and the delegation of Public Health, and obtaining verbal approval from the Head of Market, the data collection commenced. Vegetables were collected from selected markets within the Buea Health District over a specified period (from April to May 2023), ensuring that the sampling times captured potential variations in parasitic prevalence. Careful attention was given to the handling and transportation of the samples to maintain their integrity for accurate laboratory analysis.

Sample Technique:

The sampling approach employed a stratified random method to select a variety of vegetables from five major markets in the Buea Health District: Muea, Buea Town, Central Market, Mile 16, and O.I.C/Great Soppo. These markets were chosen based on their prominence as central hubs for vegetable distribution in the region and their diverse supplier base. In each market, vegetables including Desmocline infortune (Green leaf), Garden Huckebery (Njama Njama), Vernonia amygdalina (Bitter leaf), Talinum triangulare (Water leaf), and Talfairia occidentalis (Ugwu/Okorobong) were purchased in bundles of three from various vendors to ensure a representative sample. Each sample was carefully labeled and placed in sterile polythene bags for transportation to the laboratory of the School of Health Sciences at Biaka University Institute of Buea, ensuring that the samples remained uncontaminated and preserved for accurate parasitological examination.

Materials:

The study utilized the following materials: clean grease-free microscope slides, normal saline, a precision weighing balance, Lugol's iodine solution, a high-resolution microscope (specific model), vegetable samples, cover slips, test tubes, sterile polythene bags, and specimen bottles.

Processing of Samples - Macroscopic Examination:

Each vegetable sample underwent a thorough macroscopic examination. This process involved visually inspecting each sample under adequate lighting conditions to identify visible segments of cestodes and adult nematodes. The handling of samples was done using sterilized instruments to avoid cross-contamination.

Procedure for Washing Vegetable Samples:

For the washing procedure, each vegetable sample, weighing 50g, was placed in a plastic container and washed with 10ml of physiological saline solution (0.95% NaCl). This concentration was chosen to mimic the osmolarity of natural conditions where parasites thrive. The washing solution was left to settle for 5 hours to allow for sedimentation. After sedimentation, the supernatant was carefully decanted, and the sediment was transferred to a test tube for centrifugation at 2000 rpm for 20 minutes[5]. The centrifugation parameters were selected to optimize the separation of parasitic elements from the vegetable matter. Following centrifugation, the supernatant was discarded into a disinfectant solution, and the sediment was resuspended for microscopic examination. A drop of this suspension, along with a drop of Lugol's iodine, was placed on a clean slide, covered with a coverslip, and examined under a microscope at 10x and 40x magnifications for identification of parasites[8].

Data Analysis:

The collected data was meticulously analyzed to determine the prevalence of intestinal parasites in the vegetable samples. Initially, the data was organized and preliminarily assessed using Microsoft Excel. For more sophisticated statistical analysis, the data was then exported to SPSS version 24. In SPSS, we conducted descriptive statistics to calculate the overall prevalence of parasites in the samples and the differences in parasite recovery rates between various types of vegetables and the markets they were procured from. The results of these analyses will be presented in a comprehensive manner, using charts and tables for clearer visualization and interpretation of the data, thereby facilitating a more straightforward understanding of the prevalence patterns of intestinal parasites in the vegetables from the Buea Health District markets.

Results

Distribution of Vegetables per Market

Figure 1 illustrates the distribution of the sampled vegetables across the markets in the Buea Health District. Each market (Muea, Buea Town, Central Market, O.I.C, and Mile 16) contributed an equal number of samples, with 15 (20%) samples from each market, summing up to 75 (100%) vegetables in total.

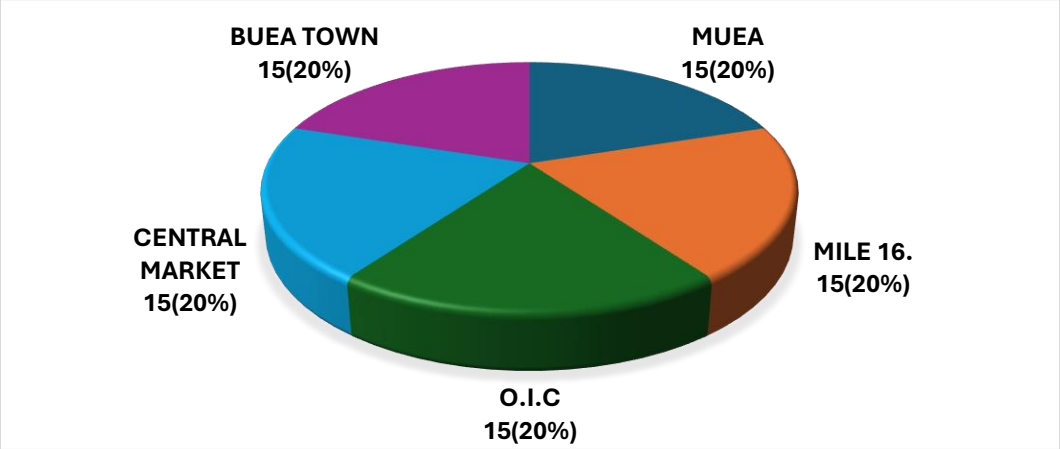

Fig 1: Distribution of Vegetables per Market

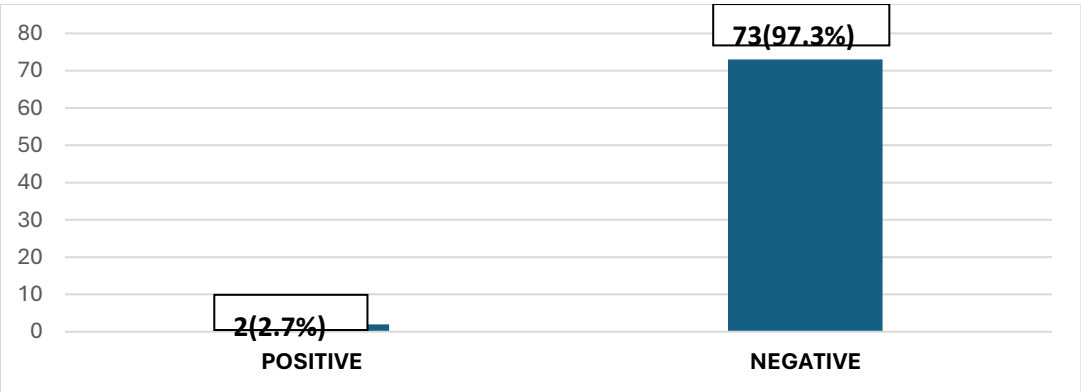

Fig. 2: Prevalence of Intestinal Parasites by Vegetable Type

Table 1: The distribution of intestinal parasites in relation to the type of vegetables

Vegetables	*Desmocline infortune* (Green Leaf)	*Garden Huckebery* (Njama Njama)	*Vernonia amygdalina* (Bitter leaf)	*Talinum triangulare* (Water Leaf)	*Talfairia occidentalis* (Ugwu/ Okohobong)	Parasitic Load	Positive (%)
Parasites							
Gardia/Amblia	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)		0 (0%)
E.histolytica	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)		0 (0%)
Balantidim coli	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)		0 (0%)
Hookworm	1 (1.33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 counted	1(1.33%)
E. coli	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)		0 (0%)
Ascaris Lumbricoides	0 (0%)	1 (1.33%)	0 (0%)	0 (0%)	0 (0%)	5 counted	1(1.33%)
Total	**1 (1.33%)**	**1 (1.33%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**		**2(2.66%)**

Note: For parasitic load: 7 was counted (few) for Rhabditiform Larvae of Hookworm, while for Ascaris lumbricoides, 5 was counted (scanty).

Prevalence of Intestinal Parasites by Vegetable Type

As shown in Figure 2, out of the 75 vegetable samples, 2 (2.7%) tested positive for intestinal parasites, while the remaining 73 (97.3%) were negative. This indicates a low prevalence of intestinal parasites in the sampled vegetables.

Distribution of Intestinal Parasites Among Different Vegetables

Table 1 presents the distribution of intestinal parasites concerning the type of vegetables. Desmodium intortum (Green leaf) and Garden huckleberry (Njama Njama) each recorded a 1.33% prevalence of parasites. Specifically, Rhabditiform Larvae of hookworm was identified in the Green leaf

(1.33%, 7 counted as few), and Ascaris lumbricoides in Njama Njama (1.33%, 5 counted as scanty). The other vegetables, including Vernonia amygdalina (Bitter leaf), Talinum fruiticosum (Water leaf), and Telfaria occidentalis (Ugwu/Okorobong), showed no presence of intestinal parasites.

Distribution of Intestinal Parasites Among Vegetables by Market

Table 2 details the distribution of intestinal parasites in vegetables across different markets. Vegetables from Mile 16 and O.I.C (Great Soppo) showed the presence of intestinal parasites, with Ascaris lumbricoides found in Garden Huckleberry from Mile 16 (1.33%, 5 counted as scanty) and Rhabditiform Larvae of hookworm in Green Leaf from O.I.C (1.33%, 7 counted as few). In contrast, Central Market, Buea Town, and Muea Market showed no prevalence of intestinal parasites.

Discussion

Prevalence of Intestinal Parasites in Market-Sold Vegetables

This study, encompassing five diverse markets in Buea Health District, revealed a 2.7% prevalence of intestinal parasites in the examined vegetable samples. This rate is notably lower than the 13.12% reported by Judith et al. [12]) in Buea, Cameroon. Potential factors contributing to this discrepancy include improved vegetable washing techniques, such as the adoption of boreholes over river/stream water, and heightened public awareness and education on hygienic practices. These changes, coupled with environmental factors like rainfall patterns that may naturally reduce parasitic loads, highlight the dynamic nature of foodborne parasite prevalence.

Distribution of Parasites Among Different Vegetables

Our findings underscore the role of fecal contamination in water sources used for irrigation as a key driver of parasite

Table 2: The distribution of intestinal parasite on vegetable sold in some selected market in Buea Health District

Location	Number Examined	Muea	Buea Town	Central Market	Mile 16	OIC	Parasitic Load	No. Positive(%)
Vegetables								
Desmocline infortune (Green Leaf)	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1(1.33%)	7 counted	1(1.33%)
Garden Huckebery (Njama Njama)	15	0 (0%)	0 (0%)	0 (0%)	1(1.33%)	0 (0%)	5 counted	1(1.33%)
Bitter leaf	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)		0(0.00%)
Water Leaf	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)		0(0.00%)
Okohobong/Ugwu	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)		0(0.00%)
Total	75	0(0.00%)	0(0.00%)	0(0.00%)	1(1.33%)	1(1.33%)		2(2.66%)

transmission in vegetables. The presence of Hookworm and Ascaris lumbricoides in certain vegetables points to specific risk factors associated with these crops, such as surface texture and exposure to contaminated water. The observed 2.7% prevalence contrasts with the higher rates reported in other studies [6,13], suggesting that local farming practices, the type of vegetables, and environmental conditions significantly influence parasite epidemiology.

Parasite Distribution by Location

The prevalence of parasites varied across the studied locations, with some markets showing a higher incidence than others. This variation might be attributed to factors like proximity to animal husbandry operations, local climatic conditions, water sources for irrigation, and vegetable handling practices during transportation and marketing. For instance, vegetables with smoother surfaces may be less likely to retain parasitic elements, contributing to the observed differences in contamination rates.

Study Limitations

This study's scope did not extend to examining the effects of seasonal variation on parasitic contamination or the intensity of washing practices among vendors. The lack of testing on water and soil samples from local farms and markets is a significant limitation, as these are potential sources of contamination. Additionally, the cross-sectional nature of the study limits our ability to establish causal relationships. These factors must be considered when interpreting the study's findings and their implications for public health strategies.

Conclusion

This research investigating intestinal parasites in leafy vegetables from Buea Health District, South West Cameroon, reveals a 2.7% prevalence rate, suggesting relatively low contamination possibly due to improved agricultural practices, public health awareness, and environmental factors like rainfall. However, variations in contamination across different vegetables and markets highlight the impact of specific environmental conditions and practices on parasite transmission risks. Despite the low overall prevalence, the study emphasizes the need for ongoing monitoring, public health strategies, and further research into seasonal variations, washing practices, and water sources to mitigate contamination risks. Therefore, while current practices seem effective, continuous improvement and vigilance are essential for enhancing food safety and developing tailored public health interventions in the region.

References

1. World Health Organization. Health guidelines for the use of wastewater in agriculture. WHO, Geneva, Technical Report Series, No. 778, 2022.

2. Ghazali KH, Hadi RS., Mohammed Z. Automated System for Diagnosis Intestinal Parasites by Computerized Image Analysis. Modern Applied Science, 2013, 7(5). DOI: 10.5539/mas.v7n5p98

3. Doyle M.E. Food Borne Parasites: A review of the Scientific Literature. Food Research Institute, University of Wisconsin, Madison, 2003.

4. Allanana W.A. Prevalence of intestinal parasites in leafy vegetables in Riyadh, Chad. Int J Trop Med, 2007, 5(2):20-23.

5. Al-Megrin, WAI. Prevalence of intestinal parasites in leafy vegetables in Riyadh, Saudi Arabia. Int. J. Zool. Res., 2010, (6): 190-195.

6. Damen J. G., Banwat, E. B., Egah, D. Z and Allanana, J.A. Parasitic contamination of vegetable in Jos, Nigeria. Ann of Af. Med., 2007, 6,(3):115-118.

7. Eni, A.O., Oluwawemitan I.A. and Solomon O.U. Microbial quality of fruits and vegetables sold in Sango Ota, Nigeria. African Journal of Food Science, 2010, 4(5):291-296.

8. Odejumoke, M.O. Intestinal parasites associated with human and animal waste stabilization in Kebbi, Jos, and Barkin Ladi areas of Plateau State, Nigeria. Ph.D Thesis, University of Jos, Plateau State, 2019.

9. Ozlem, E and Sener, H. The contamination of various fruit and vegetable with Enterobiusvermicularis, Ascaris eggs, Entamoeba histolytica cysts and Giardia lambliacysts. J. Food Cont., 2018, (16):557-560.

10. Uneke, C.J. Potential for geohelminth parasite transmission by raw fruits and vegetables in Nigeria: Implication for a risk profile. Journal of Nutritional & Environmental Medicine, 2007, 16(1):59-68.

11. Raosoft sample size calculator 2004. Available from: http://www.raosoft.com/samplesize.html?nosurvey.

12. Judith L.N., Chrisantus A.A., Ngum C.N., Desdemona N.N. Parasitic helminths of medical importance and yeast infection on fruits sold in the markets and streets of Buea, Fako division, south west region, Cameroon, World J. Pharm. Med. Res., 2018; 4(6):257-263.

13. Idahosa OT. “Parasitic contamination of fresh vegetables sold in Jos Markets”, Global Journal of Medical Research; 2011; 11(1) 20-25.

Funding: Nil

Conflict of Interest: Nil