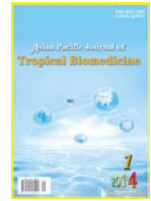


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Prevalence of hookworm infection: a retrospective study in Kumasi

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PEER REVIEW

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Comments

This is a well-written manuscript on the prevalence and risky factors of hookworm infection in Kumasi. The results are interesting and suggest that the trend of infection could be different based on gender and month. And with the programme conducted by the public health authorities in Ghana, the infection seems to be decreased year by year.

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ABSTRACT

Objective: To establish the prevalence of hookworm infection among patients who reported at the parasitology laboratory of the Komfo Anokye Teaching Hospital for intestinal parasitic investigation.

Method: This retrospective study covered available data from January 2001 to December 2011. Records of patients referred to the parasitology laboratory of the hospital were manually reviewed for hookworm infection. Data on age, sex and status of hookworm infection (either present or absent) were retrieved and analyzed by using Microsoft Excel 2007 statistical package.

Results: A total of 47 147 patients was reported at the laboratory for intestinal parasitic investigation. Among these patients, 158 patient were positive, representing an overall prevalence of 0.3% (158/47 147). Among the positive cases, the study revealed that the proportion of individuals in age groups <1, 1 to 9, 10 to 19, 20 to 29 and 30 to 39 years were 1.3% (2), 10.8% (17), 16.5% (26), 27.2% (43) and 23.4% (37) respectively. Furthermore, people in age group 40 to 49, 50 to 59 and ≥60 years were infected in the proportion of 8.7% (14), 5.7% (9) and 7.0% (11) respectively. Among the infected patients, the number of females was 62.7% (99) while that of males was 37.3% (59). The yearly prevalence rate dropped consistently from 0.84% in 2001 to 0.11% in 2005. However it increased marginally in 2006 (0.27%) and dropped to 0.00% in 2011.

Conclusion: Hookworm infestation was found to be generally high between April and August. However the overall prevalence was relatively low among the study population.

KEYWORDS

Hookworm, Infection, Parasitic

1. Introduction

Hookworm is a parasitic nematode that lives in the small intestines of most mammals as its hosts, such as dogs, cats, and human. Two species of hookworm commonly infect human: *Ancylostoma duodenale* (*A. duodenale*) and *Necator americanus* (*N. americanus*). They are voracious blood-thirsty hookworm in the nematode world^[1,2].

The most serious consequence of hookworm infection is anaemia, secondary to loss of iron and protein of gut^[3]. It has been estimated that a single *A. duodenale* ingests about 150 µL blood per day while *N. americanus* sucks about 30 µL^[4]. However, the blood loss through this channel cannot be

visualized by the naked eyes. In a situation where the worm burden is significantly high in an individual, infection is normally severe with iron deficiency anaemia, particularly in people with inadequate iron reserves or intake. In most developing countries, for instance, anaemia in pregnancy has been associated with worm infestation, especially hookworm^[5].

Worldwide, *N. americanus* is the predominant aetiology of human hookworm infection, whereas *A. duodenale* is somehow restricted geographically^[6,7]. Most infected individuals are concentrated in sub-Saharan Africa and Eastern Asia/the Pacific Islands with each region having estimates of 198 million and 149 million infected individuals respectively^[8,9]. Majority of these infected individuals live in poverty-stricken

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areas with poor environmental sanitation^[10]. It is estimated that about 3000 to 65000 deaths occur from hookworm related diseases annually worldwide^[11,12].

In Ghana, the Ministry of Health and the Ghana Health Service with the help of development partners put in place of Neglected Tropical Diseases Control Programme (NTDCP). The ultimate objective of the programme was to reduce Neglected Tropical Diseases (NTD) of which hookworm is no exception to a level that they will no longer be of public health significance by the year 2015^[13]. The target groups have generally been school children, young people and pregnant women. The current study focused on using available data at the parasitology laboratory of the Komfo Anokye Teaching Hospital to estimate the prevalence of intestinal parasitic infection, particularly hookworm in Kumasi.

2. Materials and methods

2.1. Study site

This retrospective study was conducted at the parasitology laboratory of the Komfo Anokye Teaching Hospital (KATH). The hospital is located in Kumasi, the traditional and administrative capital of the Ashanti Region. Kumasi is about 170 km northwest of Accra, the national capital. The hospital is also accredited for postgraduate training in surgery, obstetrics and gynaecology, otorhinolaryngology, ophthalmology, radiology and other allied health programmes by the West African College of Surgeons. It currently has a capacity of about 1000 beds and serves as a referral hospital for the Ashanti, Brong–Ahafo and Western regions of Ghana.

2.2. Medical record review

All records of patients referred to the patients in the parasitology laboratory of the Komfo Anokye Teaching Hospital, from January 2001 to December 2011, who were manually reviewed for hookworm infestation. Confirmation of the presence or the absence of intestinal parasite by the laboratory is based on microscopic examination of stool specimen by using the direct wet mount technique as described by Cheesbrough^[14]. Data on age, sex and status of hookworm infection were added in and analysed by using Microsoft Excel 2007 statistical package.

2.3. Ethical issues

The study protocol was approved by the committee for Human Research Publication and Ethics of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology.

3. Results

3.1. Yearly distribution of hookworm cases

In total, 47 147 patients were investigated for various intestinal parasitic agents during the period of review. It was found that 0.3% (158) were infected with hookworm. The highest prevalence was observed in 2001 (0.8%) (45/5 340)

while no positive hookworm infestation case was recorded in 2011 (0.0%) (Table 1).

Table 1

Yearly distribution of positive cases of hookworm infection.

Years	Positive hookworm cases	Total number of cases	Prevalence (%)
2001	45	5 340	0.8
2002	35	5 100	0.7
2003	22	4 840	0.5
2004	11	3 800	0.3
2005	4	3 780	0.1
2006	12	4 520	0.3
2007	12	4 600	0.3
2008	9	3 710	0.2
2009	7	4 107	0.2
2010	1	3 900	0.0
2011	0	3 450	0.0
Total	158	47 147	0.3

3.2. Cumulative monthly distribution of hookworm cases

The cumulative monthly distribution of hookworm cases from 2001 to 2011 revealed that the number of positive hookworm cases was high in April 10.8% (17/158), July 12.0% (19/158) and August 10.1% (16/158). Peak infection can be seen in July. The other months however showed varied distribution of hookworm positivity (Figure 1).

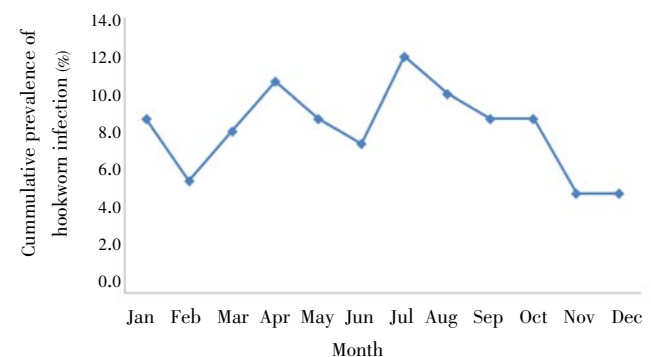


Figure 1. Cumulative monthly distribution of hookworm cases from 2001 to 2011.

3.3. Age and gender distribution of hookworm infection

Among the positive hookworm cases, infection was relatively high in patients at age of 10 to 39. Patient aged 40 years and above recorded prevalence not exceeding 8.9%. However, the least infected group were patients below one year old. Females were infected more than male (Table 2).

Table 2

Age and gender distribution of hookworm infection.

Age (years)	Male [n (%)]	Female [n (%)]	Total [n (%)]
<1	1 (50.0)	1 (50.0)	2 (1.3)
1–9	6 (35.3)	11 (64.7)	17 (10.8)
10–19	12 (46.2)	14 (53.8)	26 (16.5)
20–29	18 (41.9)	25 (58.1)	43 (27.2)
30–39	10 (27.0)	27 (73.0)	37 (23.4)
40–49	4 (28.6)	9 (64.3)	14 (8.9)
50–59	5 (55.6)	4 (44.4)	9 (5.7)
≥60	3 (27.3)	8 (72.7)	11 (7.0)
Total	59 (37.3)	99 (62.7)	158 (100.0)

4. Discussion

The current study focused on the number of hookworm cases recorded annually at the parasitology laboratory of the Komfo Anokye Teaching Hospital over the past decade from 2001 to 2011. During the period of review a total number of 47 147 patients was reported in the parasitology laboratory for intestinal parasitic investigation. The positive hookworm cases recorded were 0.3% (158). The number recorded in yearly prevalence of hookworm infection is relatively low by comparing to studies conducted in Babile, east of Ethiopia and Waikagul, which were recorded 6.7% and 18.5% respectively^[15,16]. There are reports that the disease is predominant among farming communities^[11], but seemingly minimal in urban areas. Hence the generally low prevalence was observed.

The cumulative monthly distribution of hookworm cases from 2001 to 2011 revealed that the number of positive hookworm cases was high in April 10.8% (17/158), July 12.0% (19/158) and August 10.1% (16/158). Peak infection can be seen in July. April to August is the period of the year when farming activities are intensive, and individuals especially farmers are at higher risk of being infected^[17]. The ambient condition in this period is conducive for hookworm to hatch eggs and increases the infective forms^[18]. The results confirmed similar works which established the fact that seasonal variations affect the infectivity of hookworm^[19–20].

Prevalence and intensity of hookworm infection have been associated with age and sex^[21]. However there appears to be considerable variation in the age–intensity profile of hookworm infestation in the current study. The study revealed that individuals in age groups of <1, 1 to 9, 10 to 19, 20 to 29 and 30 to 39 years infected were in the proportion of 1.3%(2), 10.8%(17), 16.5% (26), 27.2% (43) and 23.4% (37) respectively. This observation agrees with existing findings that prevalence of hookworm is high among children^[22–24]. The high prevalence seen among individual within the age of 10 to 39 years could be attributed to the fact that they are physically active and are more likely to be involved in activities such as farming which exposes them to the infection^[25,26]. There are, however, reports that suggest that hookworm infection in the elderly could be relatively high^[22,27], as observed in the study.

Even though some studies have reported non–significant association between sex and hookworm infection^[28,29], the findings in this study showed opposite results that more females 62.7% (99) were infected than males 37.3% (56). Meanwhile this confirms were done by Akinbo, *et al.*, who reported high hookworm infection among females^[19]. Cultural and social biases in behaviour and occupation have been established risky factors influencing hookworm infection prevalence rates in males and females^[30,31]. The skewed prevalence rate towards females could result from the bias in the study since a great number of the stool samples came from pregnant women who were reported by the laboratory in routine stool examination.

The study revealed that hookworm infestation among patients who were reported at the parasitology laboratory of the Komfo

Anokye Teaching Hospital from 2001 to 2011 is relatively low, and females were infected more than males. Hookworm cases were relatively high in April and August, and peaked in July. However no positive hookworm case was recorded in 2011.

Conflict of interest statement

We declare that we have no conflict of interest.

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We gratefully thank the polyclinic section of the Komfo Anokye Teaching Hospital, especially staff at the parasitology laboratory of the polyclinic.

Comments

Background

Hookworm is a nematode that lives in the small intestine of most mammals as its hosts, such as dogs, cats and human. The most significant risk of hookworm infection is anemia, secondary to loss of iron and protein in the gut. Majority of these infected individuals live in poverty–stricken areas with poor environmental sanitation. It is estimated that about 3000 to 65000 deaths occurred worldwide for hookworm related diseases annually.

Research frontiers

Retrospective studies are being performed by using available data at the parasitology laboratory of the Komfo Anokye Teaching Hospital to estimate the prevalence of intestinal parasitic infections, particularly hookworm in Kumasi.

Innovations and breakthroughs

This study has showed the efficiency of the programme conducted by the Ministry of Health and the Ghana Health Service to reduce Neglected Tropical Diseases (NTD) of which hookworm is no exception to a level that they will no longer be of public health significance by the year 2015. It proved that in the year of 2011, the prevalence of hookworm was 0%.

Applications

It may be significant to know the distribution of the hookworm infection according to age, gender and month. The results of this scientific study suggest female were more infected than males and peak infection seen in July where farming activities are intensive in this period. Thus, it is important to take an extra precaution during this month to avoid the related infection.

Peer review

This is a well–written manuscript on the prevalence and risky factors of hookworm infection in Kumasi. The results are interesting and suggest that the trend of infection could be

different based on gender and month. And with the programme conducted by the public health authorities in Ghana, the infection seems to be decreased year by year.

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