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STUDY OF ASSOCIATION BETWEEN ANAEMIA AND INTESTINAL PARASITIC INFESTATION AMONG THE TEA ESTATES WORKERS IN ILAM DISTRICT, EASTERN REGION OF NEPAL

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Anaemia, intestinal parasitic infestation, tea Estates workers, Ilam, Nepal.

Abstract

Introduction: Intestinal parasitic infections associated with anemia have direct negative impact on the health of human beings.

Objectives: To find the association between anaemia and intestinal parasitic infestation among the tea garden workers in Ilam district of Nepal.

Materials and Methods: A Community based cross-sectional study was conducted among tea garden workers in Ilam district of Nepal. Out of 4 tea estates in Ilam District, 2 tea estates were selected randomly. Semi-structured questionnaire was administered to the study subjects and Microscopic Examination of Stool was done. Haemoglobin level was determined by cyanmethemoglobin method. The Chi- square test was used to find the association between anaemia and intestinal parasitic infestation.

Results: The prevalence of anaemia was seen lower among the study population infected with parasite (37.5%) than parasite negative (48.3%) (P>0.05). Mild anaemia was seen significantly higher among parasite positive (60%) in comparison to moderate anemia (40%) (P<0.05). The prevalence of anaemia was seen significantly higher those infected with hookworm (90%) than Ascaris lumbricoides (40%), Entamoeba histolytica (20%) and Giardia lamblia (16.7%) (P<0.05).

Conclusions: This study did not show the association between anemia and intestinal parasitic infestations.The prevalence of anemia was seen higher those infected with hookworm than other intestinal parasites.

INTRODUCTION

Anaemia is a global public health problem that affects both developing and developed countries with major consequences for human health. Anaemia can be defined as a reduction of hemoglobin concentration per unit volume of peripheral blood below the normal level (12g/dL).[1] The World Health Organization (WHO) Global Database on Anemia for 1993-2005 showed that 25% or 1.62 billion people globally suffer from anemia with the

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highest number of 315.4 million in South-East Asia region.[2] The most common causes of anaemia are deficiency of iron, mal-nutrition and parasitic infestation.[3] WHO (1994) estimated that approximately 1.4 billion, 1.2 billion and 1 billion persons are currently infected with various species of intestinal helminthes such as round worm (Ascaris lumbricoides), hookworm (Ancylostoma duodenale/ Necator americanus) and whip worm (Trichuris trichiura) respectively.[4] Blood loss caused by gastrointestinal parasites, such as hookworm, is considered to be an important contributing factor in the development of poor iron status leading to iron deficiency anemia.[5] More recently, another common infection, Helicobacter pylori, has been discussed in the etiology of anemia and IDA.[6] The frequent occurrence of infectious diseases and parasitic infestation among developing countries further increases requirements for iron and increases the chances of negative iron status and iron deficiency anaemia.[7] Therefore current study was designed to find the association between anaemia and intestinal parasitic infestation among the tea garden workers in Ilam district of Nepal.

MATERIALS & METHODS

A Community based cross-sectional study was conducted from 13th December 2015 to 27th December 2015 in tea garden workers in Ilam district of Nepal. This was a two weeks study to fulfill epidemiological management carried out by students of MBBS 3rd year Batch 2013 of B. P. Koirala Institute of Health Sciences, Dharan, Nepal. This research was based on random selection of the study area Ilam District. Four tea estates under Nepal Tea Development Cooperation (NTDC) at Ilam District are Ilam Municipality, Kanyam, Soktim and Chilimkot. Out of 4 tea estates of Ilam District, 2 tea estates (Ilam Municipality and Kanyam) were selected randomly. Out of total 150 tea workers (30 in Ilam Municipality and 120 in Kanyam), 98 workers participated in the study.

Ethical clearance was taken by Institutional Review Committee of B P Koirala Institute of Health Sciences, Dharan, Nepal. Written permission was taken from each incharge of Nepal Tea Development Cooperation (NTDC) at Ilam Municipality, Kanyam, and participants. Tea garden workers of both sexes, aged 18 years and above, having working experience of minimum 6 months and those who gave written consent were included in the study.

Semi-structured questionnaire was administered to the study subjects and Microscopic Examination of Stool was done. In each visit more than 15 workers was enrolled & same number of plastic bottles was given for stool collection and collected next day morning. Side by side blood samples were taken for the estimation of their hemoglobin level. Microscopic examination of stool was done by preparing slide using Normal Saline and Lugol's Iodine to observe the ova of different intestinal parasitic infestation. First we used low power lens and afterwards the high power lens. Then we observed ova of different intestinal parasites.[8] Haemoglobin level was determined by cyanmethemoglobin method. When a measured quantity of blood (20 µl) was diluted in 5 ml of Drabkin's solution, the haemoglobin was converted to cyanmethemoglobin. The haemoglobin content was then determined by spectrophotometer (540 nm).[9] The confidentiality and privacy of the study was maintained; name of the individuals or participating group was not disclose after the study.

All interviewed questionnaires were indexed and kept on file. Data was entered in Microsoft Excel and converted into SPSS (Statistical Package for Social Science) 11.5 version for statistical analysis. Chi-square test was used to measure the association between anaemia and intestinal parasitic infestation. The confidence level was set at 5% in which probability of occurrence by chance is significant if $P < 0.05$ with 95% Confidence Interval.

RESULTS

Table 1: Association between anaemia and intestinal parasitic infestation.

Characteristics	Intestinal parasites		Total	P-Value
	Positive	Negative		

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Anaemia				
Yes	15 (37.5)	28 (48.3)	43(43.9)	0.291
No	25 (62.5)	30 (51.7)	55(56.1)	
Total	40 (40.8)	58 (59.2)	98 (100.0)	
Category of Anemia*				
Mild Anemia	9 (60.0)	28 (100.0)	37(86.0)	<0.001
Moderate Anemia	6 (40.0)	0 (0.0)	6(14.0)	
Total	15 (34.9)	28 (65.1)	43 (100.0)	

**Chi-square with continuity correction*

The prevalence of anaemia was seen lower among the tea garden workers infected with parasite than parasite negative but the difference was not significant. Regarding category of anemia, mild anaemia was seen significantly higher among parasite positive in comparison to moderate anemia (P<0.05) (Table 1).

Table 2: Association between anaemia and different types of intestinal parasitic infestation.

Characteristics	Intestinal Parasites						Total	P-value
	Hookworm	Ascaris lumbricoides	Trichuris trichuria	Hymenole-psis nana	Entamoeba histolytica	Giardia lamblia		
Anaemia								
Yes	9 (90.0)	2 (40.0)	0 (0)	0 (0)	2 (20.0)	2 (16.7)	15 (37.5)	0.004
No	1 (10.0)	3 (60.0)	2 (100.0)	1 (100.0)	8 (80.0)	10 (83.3)	25 (62.5)	
Total	10 (100.0)	5 (100.0)	2 (100.0)	1 (100.0)	10 (100.0)	12 (100.0)	40 (100.0)	

The prevalence of anaemia was seen significantly higher among the tea garden workers infected with hookworm than Ascaris lumbricoides, Entamoeba histolytica and Giardia lamblia and none of the respondents was found to be anaemia those infected with Trichuris trichuria and Hymenolepsis nana (P<0.05) (Table 2).

Table 3: Association between anaemia and intestinal parasitic infestation (hookworm and other parasites).

Characteristics	Parasites		Total	P-Value
	Hookworm	Other parasites		
Anaemia				
Yes	9 (90.0)	6 (20.0)	15 (37.5)	<0.001
No	1 (10.0)	24 (80.0)	25 (62.5)	
Total	10 (25.0)	30 (75.0)	40 (100.0)	

The prevalence of anaemia was seen significantly higher among the tea garden workers infected with hookworm than other parasites including Ascaris lumbricoides, Entamoeba histolytica and Giardia lamblia (P<0.05) (Table 3).

DISCUSSION

Anaemia is a global public health problem affecting both developing and developed countries and is an indicator of poor nutrition and health with major consequences for health, social and economic development of a population. Worldwide, at any given moment, more individuals have iron-deficiency anaemia than any other health problem.[10] It is especially more common in developing countries because of poor nutrition and high prevalence of parasitic infestation.[11] A study by Dreyfuss et al showed the prevalence of anemia to be 73% in the plains of Nepal with 88.9% people infected with helminthes.[12]

A total anaemia among the Tea Estates workers of Ilam District was found to be 43.9 percent. Regarding category of anemia, mild anaemia was seen significantly higher (60%) among parasite positive in comparison to moderate anemia (40%) (P<0.001) (Table 1). The study focused that the percentage of anemia in workers of tea garden of

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Darjeeling and Jalpaiguri Districts of West Bengal was 82.5%. Out of which 39.5% were suffering from mild anemia, 35% were suffering from moderate anemia which was higher than our study.[13] One study by Pandit et al (2005) showed that 77.7% of people were anemic out of which 25.9% people were moderate anemic and 5.2% were severe anemic. This study also focuses that the people are suffering more from moderate and severe anemia.[14] Study conducted in West Bengal by Das et al (2005)[15] and in other developing countries by Shah et al (2002)[16], and Agha et al (1992)[17] have shown a high prevalence of anemia, that is, between 25% to 88%. One study in Madhya Pradesh by Gawarika et al (2006) indicated that overall prevalence of anemia among the study population of weaker economic group is 96.5%.[18] Study of Gawarika et al (2006) also focus that prevalence of severe anemia among the people of weaker income group in Madhya Pradesh is 11%.[18] Bulliyy et al in 2007 found 96.5% prevalence of anemia in three districts of Orissa of which 45.2%, 46.9% and 4.4% had mild, moderate and severe anemia. The result of our study is also consistent with the previous.[19]

This study showed the prevalence of anaemia was lower among the tea garden workers infected with parasite (37.5%) than parasite negative (48.3%) but the difference was not significant. This study did not show the association between anaemia and parasitic infestation (Table 1). The prevalence of anaemia was seen significantly higher among the tea garden workers infected with hookworm (90%) than Ascaris lumbricoides (40%), Entamoeba histolytica (20%) and Giardia lamblia (16.7%) and none of the respondents was found to be anaemia those infected with Trichuris trichuria and Hymenolepsis nana (P<0.05) (Table 2). But the study was conducted with 1570 study population in rural (Kamrangirchar and Zinjira), urban (Lalbag and Savar) and slum (Mohammadpur and Mirpur) areas in and around Dhaka city to determine the level of anaemia and gastrointestinal parasitic infestation. Two protozoan parasites (E. histolytica and G. lamblia) and four helminthes parasites (A. lumbricoides, T. trichura, S. stercoralis and Hookworm) were identified during the present investigation.[20,21] It was found that prevalence of intestinal parasite among anaemic cases were higher than non anaemic cases in all study areas. It may be mentioned here in anaemic cases, the highest rate of infection was found 55.3% in Kamrangirchar and the second highest rate 50.7% in Zinjira.[22] Out of total 506 (32.2%) anaemic cases in the study, 59.1% were mildly anaemic, 33.2% were moderately and 7.5% were severely anemic. It was found that prevalence of intestinal parasite among anaemic cases were higher than non anaemic cases in all study areas. It may be mentioned here in anaemic cases, the highest rate of infection was found 55.3% in Kamrangirchar and the second highest rate 50.7% in Zinjira.[22] Fuseini et al (2010) and Ahmed et al. (1998) reported on anaemia and intestinal helminth infections.[23,24]

A study conducted by Banu H et al in Bangladesh in 2014 in which Parasitic infections were higher (39.5%) amongst anaemic cases than the non anaemic cases (30.6%). Anaemia was significantly associated (P<0.001) with parasite infection. Odds Ratio (OR=1.48) showed that exposure (anaemic cases) was positively associated with parasitic infection. Relative Risk (RR=1.29) showed that risk of exposure was 1.29 times higher than non-exposure (not anaemic) to form positive parasitic infection.[22] Other studies reported that parasitic infestation is one of the causes of anaemia (Banu et al. 2011, Banu and Khanum 2013).[20, 21] Shah and Baig (2005)[25] reported that anaemia significantly related with helminth infection. Our results differ with other studies that reported a significant association of intestinal parasites such as, Ascaris[26], Trichuris[26], and hookworm[27], with anemia or low iron status. The results also partly contradict with the previous study conducted in Bangladesh among school children that reported a significant impact of hookworm but not Ascaris on iron status.[27]

The prevalence of anaemia was seen significantly higher among the tea garden workers infected with hookworm (90%) than other parasites (20%) including Ascaris lumbricoides, Entamoeba histolytica and Giardia lamblia (P<0.001) (Table 3). The role of hookworm in causing anaemia is well documented. Hookworms injure their human host by causing intestinal blood loss leading to iron deficiency and protein malnutrition.[28, 29] The parasite induces blood loss directly through mechanical rupture of host capillaries and arterioles followed by the release of a battery of pharmacologically active polypeptides including anticoagulants, antiplatelet agents, and antioxidants.[30, 31] Hookworms subsequently digest host hemoglobin by employing a carefully orchestrated cascade of hemoglobinases that align the brush border membrane of the parasite's alimentary canal.[32,33] Although the threshold might be expected to be well established because of the accurate estimates of blood loss caused by each hookworm species[34], the precise value is actually community dependent because the onset of anaemia is dependent on the iron-status and

reserves of the host[35]. This in turn depends on a number of factors including dietary iron intake and overall level of nutrition.

The present study has limitations that may prevent more robust conclusions from being drawn. Firstly, the small sample size and geographic area studied limited the power of the analysis and affected the generalizability of results. Secondly, we conducted single stool examination for detection of intestinal parasitic infections, which could have underestimated the prevalence, as optimal laboratory diagnosis of intestinal parasitic infections requires the examination of at least three stool specimens collected over several days.[36] Despite limitations, the current data add to the scarce literature about anemia in the Nepal and highlight the need for further research and comprehensive interventions to improve these health indicators.

CONCLUSION

The prevalence of anaemia was seen high among the tea garden workers but this study did not show the association between anaemia and intestinal parasitic infestations.The prevalence of anaemia was seen significantly higher among the tea garden workers infected with hookworm than Ascaris lumbricoides, Entamoeba histolytica and Giardia lamblia but none of the respondents was found to be anaemia those infected with Trichuris trichuria and Hymenolepsis nana. High anaemia prevalence requires urgent attention to avoid preventable morbidities. Implementation of different intervention in an integrated manner was found effective in reducing the burden of anaemia and associated factor.

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