RESEARCH ARTICLE

Association between intestinal helminthic infections and anaemia status in preschool children in the district Skardu of Pakistan

Muhammad Faisal Afridi[1], Kulsoom Farhat[2], Zaheer Ahmed[3], Hajra Ahmed[4], Shabana Ali[5], Mehwish Nawaz Qaisrani[6]

Abstract

Objective: To evaluate the frequency of parasitic infections and to assess the relation between intestinal helminth infection and the anaemia status of pre-school children.

Method: The community-based cross-sectional study was conducted in Skardu, Pakistan, from August 2016 to January 2017, and comprised pre-school children of either gender. Demographical data was collected using a structured questionnaire. Stool samples were collected and examined for the presence and differentiation of ova / larvae of different intestinal helminths under microscope at the pathology department of a local healthcare facility. Blood haemoglobin was measured from blood samples and anaemia was defined as blood Hb <11g/dL. Data was analysed using SPSS 22.

Results: Of the 300 paediatric subjects, 169 (56.3%) were males and 131 (43.7%) females. The overall mean age of the sample was 36±16 months. Of the total, 161(53.67%) were found infected. Among the infected, 93(31%) were males and 68(22.67%) were females (p=0.10). Among those who were infection-free, 46(15.3%) children were anaemic.

Conclusion: Prevalence of helminthic infections in pre-school children in Skardu was found to be high. The public health problem needs to be addressed for the healthy development of children.

Keywords: Intestinal parasites, Preschool children, Helminthes, Ascaris lumbricoides, Cryptosporidium, Hymenolepis nana, Giardia, Anaemia, Stool R/E. (JPMA 71: 2309; 2021) **DOI: https://doi.org/10.47391/JPMA.03-327**

Introduction

Across the globe anaemia is one major public health issue. The World Health Organisation (WHO) states that some 2 billion people suffer from it.[1] Its peak prevalence, however is in the developing countries which may be due to nutritional deficiencies or due to infectious diseases.[2] Among the nutritional deficiencies, the deficiency of iron is said to be the most common.[3] It is mainly due to parasitic infections which badly affect children compared to other age groups.[4] The reason for children having this high susceptibility is said to be their diminished immune response along with poor sanitary and environmental conditions. All this ultimately leads to infecting children who then suffer from decreased physical and mental performance and many immune problems.[2]

Many hook-worms are known to cause anaemia and thus induce iron deficit.[5] These hook-worms include ascaris lumbricoides, cryptosporidium, hymenolepis nana and giardia. However, this has not always been the case as no significant association could be found between parasitic infections and anaemia in a 2010 study.[6] The current study was planned to determine the prevalence of parasitic infections in pre-school children, and to assess the association between intestinal helminthiasis and anaemia status.

[1]Department of Community Medicine, CIMS, Multan, Pakistan; [2,5]Department of Pharmacology, Army Medical College, Rawalpindi, Pakistan; [3]Department of Environmental, Nutritional and Health Sciences, Allama Iqbal Open University, Islamabad, Pakistan; [4]Department of Home and Health Sciences, Allama Iqbal Open University, Islamabad, Pakistan; [6]Department of Pharmacology, Foundation University Medical College, Rawalpindi, Pakistan.

Correspondence: Muhammad Faisal Afridi. E-mail: fafidi@gmail.com

Subjects and Methods

The community-based cross-sectional study was conducted from August 2016 to January 2017 in the remote areas of Skardu, Baltistian in Pakistan. After approval from the ethics review committee of a secondary-care hospital in Skardu, the sample size was calculated using online Raosoft calculator[7] at 95% confidence level. The sample was raised using non-probability convenience sampling technique from among pre-school children of either gender. All the children of pre-school age group who could be approached were included. Team visited the localities to approach families with pre-school children in the household, and children coming to hospital and fulfilling the inclusion criteria were also approached. All those with diagnosed health issues or congenital anomalies and those whose parents were not willing to participate were excluded. Although there is no standard definition of pre-school age group, in the cultural setup of Baltistan, children are usually not sent to school before 5 years of age. Therefore, the upper cut-off point of children's age was set at 5 years.

After taking informed consent from the parents of the enrolled children, demographic data, including socio-economic strata (SES) was obtained using a structured

questionnaire which was filled by the parents. Data regarding dietary patterns were not recorded as it was beyond the purview of the study. Anthropometric data of height, weight and body mass index (BMI) was calculated and the findings were plotted on growth charts to categorise the subjects using WHO classification:[8] Underweight = weight-for-age <-2 standard deviation (SD) of the growth standards median; Stunted = height-for-age <-2SD of growth standards median; and Wasted - BMI-for-age <-2SD of growth standards median.

Specimen containers along with all the relevant instructions were given to children and their parents, and stool samples were collected the next morning. The samples were examined for the presence and differentiation of ova / larvae of different intestinal parasites under microscope. Blood samples were collected and transported to the laboratory the same day. For this purpose, manpower and equipment of the pathology department of the healthcare facility in Skardu were used. Children having low haemoglobin (Hb) level from lower cut-off values for their respective age groups were marked as anaemic. The levels above the lower cut-off value was categorised as Normal. The cut-off values were: from birth to 48 months 11g/dL; and from 49 to 60 months 11.5g/dL.[8]

Data was analysed using SPSS 22, and was expressed as frequencies and percentages before using Fisher exact test to assess correlation between anaemia and parasitic infection. P<0.05 was considered significant.

Results

Of the 300 paediatric subjects included, 169 (56.3%) were males and 131 (43.7%) were females. The overall mean age of the sample was 36±16 months. Of the total, 161(53.67%) were found infected. Among the infected, 93(31%) were males and 68(22.67%) were females (p=0.10).

Children with low SES background had the highest frequency of parasitic infestations compared to middle and lower middle SES (p<0.001) (Table 1).

The different parasites identified were ascaris lumbricoides, cryptosporidium, hymenolepis nana and giardia (Table 2).

A total of 194(67.4%) children were found to be anaemic. Among them, 148(49.3%) were infested with some parasite, while 46(15.3%) were infection-free and yet anaemic.

In relation to nutritional status, 37(12.3%) children were Underweight; all of them being infested with parasites. Out of the 81(27%) Stunted children, 77(25.7%) were infested with intestinal parasites. Of the 47(15.7%) Wasted children, 35(11.7%) were infested with parasites (p<0.001) (Table 3).

Table-1: Distribution of socioeconomic status (SES).

SES Group	Status of Parasitic Infection		Total
	Yes	No	
Low Class	99	104	203
Low Middle	22	49	71
Middle Class	13	07	20
Upper Middle	05	01	06
Total	139	161	300

p-value < 0.001

Table-2: Anaemia and parasitic infestation.

Name of Parasite	Anaemia n (%)	No Anaemia n (%)
No Infestation	46 (15.3)	93 (31.0)
Ascaris Lumbricoides	60 (20.0)	7 (2.3)*
Hymenolepis Nana	23 (7.70)	5 (1.7)*
Cryptosporidium	41 (13.7)	1 (0.3)*
Giardia	24 (8.0)	0 (0.0)*
Total	194 (64.7)	106 (35.3)

*p-value < 0.001

Table-3: Anthropometric measurements and parasitic infestation.

Parasitic Infestation	Weight for Age		Height for Age		Weight for Height	
	Normal wt	Under wt	Normal ht	Stunted	No Wasting	Wasting
No	139	0	135	04	127	12
Yes	136	37	84	77	126	35
Total [n (%)]	263 (87.7)	37 (12.3)	219 (73.0)	81 (27.0)	253 (84.3)	47 (15.7)

p-value < 0.001; wt: weight; ht: height.

Discussion

The current study observed a high prevalence of helminthic infestations and identified it as a major public health problem, which is in line with earlier studies.[9-11] This was even higher compared to the prevalence of infection in a village Budhni near Peshawar, Pakistan.[12] The current sample had the high percentage (22.33%) of ascaris lumbricoides, moderate percentage (14%) of cryptosporidium and low percentages (9.3% and 8.0%) for hymenolepis nana and giardia. These findings are consistent with earlier findings.[13] However, one study reported 53% prevalence of ascaris lumbricoides in Pakistan.[14] Another study in 2018 also showed highest prevalence of ascaris lumbricoides (38.4%) in children aged 1-12 years.[15] The prevalence of intestinal parasites, like cryptosporidium and giardia, in the current study is comparable to earlier reports as well.[16] A study in 2016 reported cryptosporidiosis having a prevalence of 20.8% in children of Skardu.[17] In a study in the district of Bunir, the prevalence of cryptosporidium was 29.88%.[14] The current study found it to be 15.7%.

The current study observed that 53.67% of the sample had

parasitic infections, with male children (31%) presenting more with worm infestation compared to female (22.6%) children. As in any other developing country, possible causes of infestation in children include playing in contaminated soil, poor sanitary and hygiene conditions, and inadequate hand-washing. Intestinal parasitic infestation is indicator of deep-rooted poverty, inadequacy of clean water, sanitary facilities and healthcare requirements.[18] Furthermore, it was observed that amid different age groups, boys aged >2 years had the most infections. This means that when a child starts eating by himself, the chances of acquiring these infections are multiplied.

Many illnesses of children, including anaemia, and repeated gastrointestinal and respiratory tract infections, are the direct results of worm infestations. Among these, anaemia is one important presentation of these parasitic infections.[19] It is responsible for high morbidity and mortality among infants and children. The magnitude of this problem is huge in the developing countries and it becomes more serious when seen in the context of children.[20] In a country like Pakistan, it is no less than a worrying public health problem. These parasitic infestations contribute significantly to the overall anaemia burden within the Third World. And this occurs when the Hb concentrations become less than the predicted values in the blood for a specific age and gender. This low Hb level is the most appropriate indicator of biochemical screening tests to determine iron deficiency anaemia. The determination of Hb or haematocrit (Hct) as a public health measure has remained an important tool for monitoring the prevalence of anaemia and assessing the effectiveness of interventions.[21]

The current study also found a correlation of anaemia with different types of parasitic infestations. The study found that 15.3% pre-school children with no parasite infestation were also anaemic, indicating the other possible causes of anaemia; the most common being dietary deficiencies of micronutrients, like iron, vitamin B12 and folic acid.[22] The other causes may include chronic infections, particularly malaria, malabsorption syndromes, hereditary haemoglobinopathies, to name a few. We found 22.33% ascaris prevalence, which is in line with many studies.[23,24] It occurs more commonly in a setting of unhygienic living conditions. The infestations caused by ascarias do affect the nutritional status,[25] but its bearings on anaemia were less clear. A significant association between ascariasis and anaemia was observed in a study where height, weight and Hb concentrations were used as indices to assess the nutritional status of parasite-infected children and children treated for parasites.[26] There was a remarkable improvement in Hb status in children treated with iron supplements.[27]

It is worth highlighting that anaemia induced by parasitic infection in less developed world hamper physical and cognitive development. This happens as there is an impairment with the absorption of vitamins, or due to loss of appetite.

In the current study, children found infested with intestinal helminths were provided with anti-helminthic drugs in the prescribed doses. Health education regarding hygiene and diet was also extended to the mothers.

In the light of the findings, it is highly recommended that parents should pay due attention to sanitation and personal hygiene of their children to prevent the spread and development of intestinal parasitic infections. Further large-scale studies are needed to estimate the magnitude of this public health problem. More factors may be explored to find out the possible associations of anaemia in children. Public health interventions, including health education, food fortification, anti-helminthic treatment, provision of safe drinking water and sanitation are few of the steps to decrease the prevalence of intestinal parasitic infections and anaemia.

Conclusion

Prevalence of helminthic infections in pre-school children in Skardu was found to be high. The public health problem needs to be addressed for the healthy development of children.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

References

1. Tegegne Y, Wondmagegn T, Worku L, Zeleke AJ. Prevalence of Intestinal Parasites and Associated Factors among Pulmonary Tuberculosis Suspected Patients Attending University of Gondar Hospital, Gondar, Northwest Ethiopia. J Parasitol Res 2018; 2018: 9372145.
2. Espinosa Aranzales AF, Radon K, Froeschl G, PinzónRondón ÁM, Delius M. Prevalence and risk factors for intestinal parasitic infections in pregnant women residing in three districts of Bogotá, Colombia. BMC Public Health 2018; 18: 1071.
3. Mirisho R, Neizer ML, Sarfo B. Prevalence of Intestinal Helminths Infestation in Children Attending Princess Marie Louise Children's Hospital in Accra, Ghana. J Parasitol Res 2017; 2017: 8524985.
4. Salam N, Azam A. Prevalence and distribution of soil-transmitted helminth infections in India. BMC Public Health 2017; 17: 201.
5. Adriko M, Tinkitina B, Arinaitwe M, Kabatereine NB, Nanyunja M, M Tukahebwa E. Impact of a national deworming campaign on the prevalence of soil-transmitted helminthiasis in Uganda (2004-2016): Implications for national control programs. PLoS Negl Trop Dis 2018; 12: e0006520.

6. Osazuwa F, Ayo OM. Contribution of malnutrition and anaemia to anaemia status in children in rural communities in Edo state, Nigeria. North Am J Med Sci 2010; 2: 532–6.
7. Sample size calculator. [online] [Cited 2016 September 5]. Available from: URL: www.raosoft.com/samplesize.html
8. World Health Organization (WHO), Multicenter growth reference study group. WHO Child Growth Standards:weight-for-length, weight-for-height, length/height-for-age and Body Mass Index (BMI) -forage:Methods and development. Geneva: WHO; 2006.
9. Domellöf M, Dewey KG, Lönnerdal B, Cohen RJ, Hernell O. The diagnostic criteria for iron deficiency in infants should be reevaluated. J Nutr 2002; 132: 3680-6.
10. Minetti C, Chalmers RM, Beeching NJ, Probert C, Lamden K. Giardiasis. BMJ 2016; 355.
11. Pullan RL, Brooker SJ. The global limits and population at risk of soil-transmitted helminth infections in 2010. Parasites Vectors 2012; 5: 81.
12. Ramana K. Intestinal parasitic infections: An overview. Ann Trop Med Public Health 2012; 5: 279-81.
13. Haider J, Mohammad N, Nazli R, Fatima S, Akhtar T. Prevalence of parasitic infestation in children of a rural community of Peshawar. KMUJ 2018; 10: 14-8.
14. Nishiura H, Imai H, Nakao H, Tsukino H, Changazi MA, Hussain GA, et al. Ascaris lumbricoides among children in rural communities in the Northern Area, Pakistan: prevalence, intensity, and associated socio-cultural and behavioral risk factors. Acta Tropica 2002; 83: 223-1.
15. Khan A, Shams S, Khan S, Khan MI, Khan S, Ali A. Evaluation of prevalence and risk factors associated with Cryptosporidium infection in rural population of district Buner, Pakistan. PLoS ONE 2019; 14: e0209188.
16. Galgamuwa LS, Iddawela D, Dharmaratne SD. Prevalence and intensity of Ascaris lumbricoides infections in relation to undernutrition among children in a tea plantation community, Sri Lanka: a cross-sectional study. BMC Pediatr 2018; 18: 13.
17. Kimosop RJ, Mulambalah CS, Ngeiywa MM. Prevalence of enteric parasitic diseases among patients referred at a teaching hospital in Kenya. J Health Res Rev 2018; 5: 78-85.
18. Khushdil A, Murtaza F, Chattha M N. Cryptosporidiosis Among Children Of District Skardu, Pakistan. J Ayub Med Coll 2016; 28: 575-7.
19. Karshima SN. Prevalence and distribution of soil-transmitted helminth infections in Nigerian children: a systematic review and meta-analysis. Infect Dis Poverty 2018; 7: 69.
20. Gopalakrishnan S, Eashwar VMA, Muthulakshmi M, Geetha A. Intestinal parasitic infestations and anemia among urban female school children in Kancheepuram district, Tamil Nadu. J Family Med Prim Care 2018; 7: 1395-400.
21. Molla E, Mamo, H. Soil-transmitted helminth infections, anaemia and undernutrition among schoolchildren in Yirgacheffee, South Ethiopia. BMC Res Notes 2018; 11: 585.
22. de Gier B, Nga TT, Winichagoon P, Dijkhuizen MA, Khan NC, van de Bor M, et al. Species–specific associations between soil-transmitted helminths and micronutrients in Vietnamese school children. Am J Trop Med Hyg 2016; 95: 77–82.
23. Sodhi JS, Khan MA. Hookworm related obscure overt gastrointestinal bleeding diagnosed by capsule endoscopy. Int J Adv Res 2016; 4: 1156–8.
24. Agbolade OM, Agu NC, Adesanya OO, Odejayi AO, Adigun AA, Adesanlu EB, et al. Intestinal helminthiasis and Schistosomiasis among school children in an urban center and some rural communities in southwest Nigeria. Korean J Parasitol 2007; 45: 233–8.
25. Nmorsi ONG, Isaac C, Aashikpelokhai SI, Ukwandu ND. Geohelminthiasis among Nigerian preschool age children. Int J Med Med Sci 2009; 10: 407–11.
26. da Silva BR, Brooker S, Hotez PJ, Montressor A, Engels D, Savioli L. Soil-transmitted Helminth infections: Updating the global Picture. Trends Parasitol 2003; 27: 547–51.
27. Yimam Y, Degarege A, Erko B. Effect of anthelminthic treatment on helminth infection and related anaemia among school-age children in northwestern Ethiopia. BMC Infect Dis 2016; 16: 613.