Strongyloidiasis in children five years and below

***H. O. Dada-Adegbola and R. A. Bakare**
Department Of Medical Microbiology and Parasitology, University College Hospital, Ibadan, Oyo State, Nigeria.
E-mail: dadaadegbola@yahoo.com

Summary

Introduction: **Strongyloidiasis is one of the major human intestinal infections caused by a minute nematode, *Strongyloides stercoralis*. It is a soil-transmitted nematode of worldwide distribution, which resides in the small intestines of humans and is acquired by tissue penetration by the infective stage, filariform larva, of the worm. In the immunocompetent hosts, *Strongyloides stercoralis* infects only the mucosal of the small intestines and persists as an asymptomatic often chronic infection. In contrast, in the presence of immune suppression it has ability to multiply within the human host, known as hyperinfection. Its occurrence has been reported more commonly among adults.**

Aim/Objective: **This study was undertaken to find the occurrence of *Strongyloides stercoralis* among children 0-5years who presented with diarrhea and then relate it to their nutritional status.**

Materials and Method: **Following ethical approval, two hundred and twenty seven children, 118 boys and 109 girls, with complaints of diarrhoea, were randomly selected. A structured questionnaire was completed for each child. Anthropometric measurement was taken. Clinical assessment/diagnosis by the attending physician was also recorded. Stool specimen was collected and examined by wet preparation and formol-ether concentration methods. Infected children were treated.**

Results: **Twelve (5.3%) of all the children with diarrhoea were found to have *Strongyloides stercoralis*. All the infected children were malnourished while none of the normal nourished children had *Strongyloides stercoralis* (p=0.001).**

Conclusion: **Strongyloidiasis is a possible complication of Malnutrition in children who presented with diarrhoea.**

Keywords: ***Strongyloidiasis, Diarrhoea, Children, Malnutrition***

Résumé

Introduction:- La strongyloidose est l'une des infections intestinale majeure de l'homme causée par un trop petit ver de la classe des nématodes strongyloides stercoralis. C'est une nématodes transmit à travers du sol d'une répartition dans le monde entire qui réside dans l'intestine grêle de l'homme et acquis par la pénétration du tissu pendant une étape de l'infection, larva filariform du ver. Dans le hôtes immunocompetent, les strongyloides stercoralis transmise une maladie seulement au mucosal de l'intestin grêle et persiste comme un asymptomatique surtout une infection chronique. Par contraste, en présence de la suppression immenisée il a une capacité de multiplier à l'intérieur de l'hôte homme, appelé hyperinfection. Le cas de ce phénomène a été rapporté le plus souvent chez des adultes.

Objectif/but:- Cette étude a été effectuée afin de décider la fréquence des strongyloides stercoralis chez des enfants âgés de 0 - 5 ans que étaient atteints de diarrhée et puis le rattache a leur statut nutritionnel.

Matériel et méthodes:- A la suite d'approbation éthique, deux cents vingt sept enfants, 118 garçons et 109 filles, atteints de la diarrhée ont été selectionnés au hazard. Un questionnaire structuré a été rempli pour chaque enfant. La mesure anthropométrique a été prise. Evaluation clinique et le diagnostic ont été par le médecin traitant. Un prélèvement des fèces a été fait et examiné à travers une préparation wet et une méthode concentration formol-ether. Des enfants atteints de cette maladie ont été traités.

Résultats:- Douze soit 5,3% de tous les enfants atteints de la diarrhée étaient notés d'avoir strongyloide stercoralis. Tous les enfants infectés avaient les traits caracteristiques de la sous alimentation tandis qu'aucun des enfants bien nourri n'avaient pas le strongyloides stercoralis (P = 0,001).

Conclusion:- La strongyloidose est une complication possible de la sous-alimentation chez des enfants atteints de la diarrhée.

Introduction

Strongyloidiasis is one of the major human intestinal infections caused by a minute nematode, *Strongyloides stercoralis*. It is a soil-transmitted nematode of worldwide distribution, which resides in the small intestines of humans and is acquired by tissue penetration by the infective stage of the worm, the filariform larva[1].

Strongyloides stercoralis causes infection in any age group but found more commonly in adult and in both sexes, although male appears to be more predisposed [2,3]. The infection is usually mild or asymptomatic in normal immunocompetent individuals [3], but could be very severe, and even fatal in individuals who are immunocompromised [3-5]. The immunosuppression could be as a result of various causes such as steroid therapy [5-6], protein-calorie malnutrition [6,7] malignancies [6,7] and a host of others [8]. In the immunocompetent hosts, *Strongyloides stercoralis* usually infects only the mucosa of the small intestines and persists as an asymptomatic, often chronic infection [1,2]. In contrast, in the presence of a defective T-cell function, the parasite may multiply massively [3]. *Strongyloides stercoralis* is thus an opportunistic parasite of increasing importance in immunocompromised host and because of its unique ability to multiply within the human host, known as hyperinfection. However, infection can be clinically important because the hyperinfection syndrome (disseminated strongyloidiasis) develops in some infected patients with resultant 50%-70% mortality [8,10].

Although, *Strongyloides stercoralis* is of worldwide distribution, it is more prevalent in tropical and subtropical regions where soil and climatic factors are optimal for its spread [4]. The socio-cultural behaviour of people, largely determined by poverty and illiteracy, for example, walking

* *Correspondence*

barefoot, indiscriminate defecation in open fields, also encourage its spread.

Hyperinfection with *Strongyloides stercoralis*, a frequently fatal but potentially preventable opportunistic infection, could be considered as a possible complication in children with malnutrition [10]. It is therefore necessary to be aware of the possibility of strongyloidiasis complicating malnutrition especially in children.

This study is therefore designed to find the prevalence of strongyloidiasis among children 5 years and below who presented with diarrhoea and relate it to their nutritional status.

Materials and method

This is a prospective study in which two hundred and twenty-seven children aged 5years and below who had diarrhoea were randomly selected from three Hospitals and one Home (Institution for motherless children).

Following the Ethical approval and informed oral consent by the parent or guardian. A questionnaire was completed for each patient to specify the age, sex, clinic/wards, hospital/centre etc. History and duration of diarrhoea, and the nature of present illness were included. The nutritional status was assessed using the anthropometric measurements (weight and height for age and mid upper arm circumference) and the clinical diagnosis of the attending physician/paediatrician was also recorded.

Fresh stool specimen was collected for each child with the assistance of the parents, guardians and nurses on the morning of the assessment day. The specimens were promptly transported to the laboratory for processing. Then microscopically using saline and iodine preparations the stools were examined for adult worm, larvae, ova and cysts of parasites. The saline preparation allows living larvae to be examined with their characteristics 'snake-like' movements under the microscope. To increase the yield for *Strongyloides stercoralis* and other parasites, the specimens were also concentrated using Formol-ether concentration method. Any other parasites found in the stools were also noted so that adequate treatment could be given to such children. The remaining portions of any stool specimens that contain numerous pus cells were also inoculated in Selenite F and deoxycholate citrate agar (DCA), and incubated at 37°C aerobically overnight. Further bacteriological studies including serodiagnosis were carried out only when necessary.

The results were subjected to statistical analysis using EPI-INFO.

Result

Two hundred and twenty seven children were recruited into this study. This consists of One hundred and eighteen males and One hundred and nine females. Ninety-two of these children were from children's wards, staff clinic, general out patient department and children outpatient (CHOP) all of University College Hospital Ibadan. While 117 were from Oni Memorial children's Hospital and St. Mary's Catholic Hospital, Eleta and 18 were from Motherless Babies home. The clinical diagnosis was mainly diarrhoea, of unknown cause, and other clinical diagnoses in these children include acute malaria, Septicaemia, meningitis, and bronchopneumonia.

Table 1 Age distribution of all patients and frequency of strongyloidiasis

Age in months	No. recruited	No. infected	Percentage infected	Percentage occurrence in the age groups.
0 – 12	78	1	1.3	8.38
13 – 24	55	2	3.6	16.76
25 – 36	36	2	5.5	16.76
37- 48	41	3	7.3	25.0
49 – 60	17	4	23.5	33.3
TOTAL	227	12	5.3%	100%

Table 2 Relationship of age, sex and frequency of Strongyloidiasis

Age (Months)	Male examined	Male infected	Female examined	Female infected
0 – 12	41	0	37	1
13 - 24	29	1	26	1
25- 36	12	2	24	0
37 - 48	29	2	12	1
49 - 60	7	2	10	2
TOTAL	118	7(58.3%)	109	5(41.7%)

Table 3 Nutritional Status and frequency of Strongyloidiasis

Nutritional status	No of children (%)	No of infected children (%)
Normal nourished	99(43.6)	Nil (0)
Underweight	52(22.9)	Nil (0)
Marasmus	52(22.9)	10 (19.2)
Kwashiorkor	14(6.2)	1 (7.1)
Marasmic-Kwashiorkor	10(4.4)	1 (10.0)
TOTAL	227(100)	12 (5.3)

The Nutritional assessment of the children, defined according to Wellcome classification,[11] revealed that 99 (43.6%) had normal nutrition, 52 (22.9%) were underweight (stunted), while there were 52 (22.9%) cases of marasmus, 14 (6.2%) cases of Kwashiorkwor and 10 (4.4%) cases of Marasmic–Kwashiorkwor (Table 3).

The age and sex distribution of affected children is as shown on Tables 1 and 2. The youngest child with strongyloidiasis was 9 months old. Twelve of all the malnourished children had *Strongyloidies stercoralis* infection. This consists of 10 (83%) marasmic and 1 (8.3%) each of the other two groups while none of the normal nourished and underweight children had this problem (p= 0.001).

All the children with strongyloidiasis were treated with Thiabendazole (Mintezol^{R}) 25mg/kg orally twice daily for two days. Other children were treated according to the clinical diagnosis and laboratory findings.

Discussion

The mode of acquisition of *Strongyloides stercoralis* is by tissue penetration [1, 12] and therefore observed more commonly among individuals in the low socio-economic class who are more likely to walk barefoot. Also in an area with poor environmental sanitation, indiscriminate disposal of human waste and refuse in open field result in high risk of soil

contamination.

In this study 12 (5.3%) of all children aged 0-5years who had diarrhoea had strongyloidiasis, and it was observed that all the infected children were malnourished while none of the children who had normal nutrition had infection with *Strongyloides stercoralis* this is statistically significant (p=0.001). The infected children constitute 15.8% of all the malnourished children (Table 3).

It has been documented that protein energy malnutrition (PEM) is a major predisposing factor to strongyloidiasis [2 - 4, 10, 12-14]. The hyperinfection is said to be associated with defective cell mediated immunity, which has been found in malnutrition and lymphoma [3, 7, 15-19]. That protein energy malnutrition predisposes to *Strongyloides stercoralis* infection has been postulated and confirmed [2, 8, 20-21]. In malnourished children, *Strongyloides stercoralis* present a significantly unique problem because it worsens the nutritional status of a child who was already malnourished [22] and causes intestinal malabsorption [23].

The occurrence of strongyloidiasis in a 9 month old baby indicates that the parasite can be acquired very early in life, even before the child starts to walk. She was from an institution (Home for Motherless babies) and also an abandoned baby that was found in a bush. The source of her infection could not be ascertained; however four other children from the same home had infection with *Strongyloides stercoralis*, and all of them were marasmic whereas non of the well fed babies who had diarrhoea had *Strongyloides stercoralis*. Therefore, the probability of the child acquiring the parasite from the other children in the home is very high. Institutionalized individuals are said to be more predisposed to cross-infection from a contaminated person [23].

There was no significant difference in the sex distribution of children with strongyloidiasis (7 boys and 5girls); but a rise in frequency was observed with increasing age (Tables 1& 2).

The major presenting complaints in all the affected children were fever and diarrhoea (passage of watery or loose stool four or more times in 24hours), which in most cases was not severe enough to require hospitalization or use of intravenous fluid. Most reported cases presented with diarrhoea [4, 24-26]. However there are many diseases that can present with diarrhoea in children and especially in the tropics where malaria is endemic coupled with other causes of infantile diarrhoea, thus making diarrhoea an unspecific symptom of strongyloidiasis. Strongyloidiasis therefore, does not have specific symptoms that may be a pointer to its diagnosis clinically and thus presenting a need for dependence on the laboratory for its diagnosis.

In conclusion, this study found a 5.3% prevalence of strongyloidiasis in children 0-5 years that had diarrhoea, but 15.8% prevalence in those who had diarrhoea and one form of malnutrition or the other this is statistically significant (p= 0.001). Malnutrition is a condition known to cause immune suppression; this could allow hyperinfection with *Strongyloides stercoralis* in such children.

This study also confirms that symptoms and physical findings are grossly inadequate in making the correct diagnosis thereby justifying a high dependence on the laboratory for the diagnosis of strongyloidiasis.

Acknowledgement

We wish to acknowledge the efforts of Professor B.A.Onile and Prof. Wura Shokunbi who painstakingly read through the manuscripts several times.

References

1. Rojas RAM.: Pathology of Protozoal and Helminthic Diseases. Baltimore, Williams and Wilkins, 1971, p. 713.
2. Huchton P, Horn R.: Strongyloidiasis. Journal of Paediatrics. 1959; 55: 602-608.
3. Purtilo DT, Meyers WM and Connor DH: Fatal Strongyloidiasis in immunosuppressed patients. America Journal of Medicine, 1974; 56: 488-493.
4. Willis AJP and Nwokolo C.: Steroid therapy and Strongyloidiasis.1966; Lancet 1: 1396-1398.
5. Milder J E, Walzer P D, Kilgore G, Rutherford I and Klein M.: Clinical features of *Strongyloides stercoralis* infection in an Endemic Area of the United States Gastroentrology. 1981; 80: 1481-1488.
6. Leipman M: Disseminated *Strongyloides stercoralis*. A complication of immunosuppression. Journal of America Medical Association, 1975; 231: 387-388
7. Igra-Siegman Y, Kapila R, Sen P, Kaminski Z C and Louria D B: Syndrome of hyperinfection with *Strongyloides stercoralis*. 1981; Review of Infectious Diseases. 3, 397-407.
8. Davidson R A, Fletcher RH and Capman LE: Risk factors for strongyloidiasis. Archives of Internal Medicine, 1984; 144, 321-324.
9. Scowden EB, Schaffner W and Stone WJ: Overwhelming Strongyloidiasis: an unappreciated opportunistic infection. Medicine, Baltimore, 1978; 57: 527-544.
10. Smith SB, Schwartzman M, Mencia L F, Blum E B, Krogstad D, Nitzkin J and Healy G R: Fatal disseminated Strongyloidiasis presenting as acute abdominal distress in an urban child. Journal of Paediatrics.1977; 91, 607-609.
11. Wellcome working party. Classification of protein-energy-malnutrition. Lancet 1970; 2: 302-303.
12. Burke JA: Strongyloidiasis in childhood. America Journal Disease Club. 1978; 132: 1130-1136.
13. Powell RW, Moss JP, Nagar Deepak and Melo JC: et al Strongyloidiasis in immunosuppressed Hosts: Presentation as massive lower gastrointestinal bleeding. Arch. Intern. Med. 1980; 140: 1061-1063.
14. Ophuls WA: Fatal case of Strongyloidiasis in man with Autopsy: life cycle of *Strongyloides intestinalis* in man. Archives of Pathology, 1929; 8, 1-8.
15. Gbakima AA and Sahr F.: Intestinal parasitic infections among rural farming communities in Eastern Sierra Leone. Africa Journal of medicine and medical sciences, 1995; 24, 195-200.

16. Seth V and Beotra A.: Malnutrition and immune system. Indian Paediatrics. 1956; 23, 277-302.

17. Crutz T, Reboucas G and Rocha H: Fatal Strongyloidiasis in patient receiving corticosteroids. New England Journal of Medicine, 1966; 275, 1093.

18. Yim Y, Kikkawa Y, Tanowitz H and Wittner M: Fatal Strongyloidiasis in Hodgkin's disease after immunosuppressive therapy. Journal of Tropical Medicine and Hygiene. 1970; 73, 245-249.

19. Bradley SL, Dines DE and Brewer NS: Disseminated *Strongyloides stercoralis* in an immunosuppresed host. Mayo Clinic Proceedings, 1978; 53, 332-335.

20. Bistrain BR, Sherman M, Blackburn GL, Morshall R and Shaw C.: Cellular immunity in adult marasmus. Archives of Internal Medicine, 1977; 137, 1408-1411.

21. Owor R and Wamukota W M: A fatal case of strongyloidiasis with *Strongyloides* larva in the meninges. Transactions of the Royal Society of Tropical Medicine and Hygiene, 1976; 70, 497.

22. Yoeli M. Most H, Berman HH and Scheinesson GP II: The clinical picture and pathology of a massive *Strongyloides* infection in a child. Transactions of Royal Society of Tropical Medicine and Hygiene, 1963; 57, 346-352.

23. O'Brien W.: Intestinal malabsorption in acute infection with *Strongyloides stercoralis*. Transactions of Royal Society of Tropical Medicine and Hygiene, 1975; 69, 11

24. Faust EC: The symptomatology diagnosis and treatment of *Strongyloides stercoralis* infection. Journal of America Medical Association, 1932; 48, 2276.

25. Berkmen YM and Rabinowitz J: Gastrointestinal manifestation of the Strongyloidiasis. American Journal of Roentgenology, 1972; 115; 306-311.

26. Al Samman M, Haque S, Long JD: Strongyloidiasis colitis: a case report and review of the literature. Journal of Clinical Gastroenterology, 1999; 28: 77-80.