

Intestinal helminthiasis and nutritional status of children living in orphanages in Benin City, Nigeria

DU Nwaneri, VO Omuemu¹

Institute of Child Health, College of Medicine, ¹Department of Community Health, College of Medicine, University of Benin, Benin City, Edo State Nigeria

Abstract

Background: Intestinal helminths are often associated with poor growth and reduced physical activities, and may worsen already compromised nutritional status of children living in orphanages.

Aims: To determine the relationship between intestinal helminthiasis and nutritional status of children living in orphanages in Benin City, Nigeria.

Setting and Design: A cross sectional study carried out from January to April 2011 in orphanages in Benin City, Nigeria.

Materials and Methods: Fresh stool samples from 140 children (0-17 years) living in 10 orphanages in Benin City, were analyzed using the Kato–Katz technique for the detection of ova of helminths between January and April 2011. Physical growth of the children was classified as stunted, wasted, and under-weight using height for age Z-score, weight for height Z-score, and weight for age Z-score below -2 standard deviation of the reference median, respectively, in the World Health Organization growth chart.

Statistical Analysis: The data obtained was entered into spread sheet using the Microsoft Excel 2007 and the analysis was done using the Statistical Package for Social Sciences (SPSS) software versions 11.0 and 16.0 (SPSS Inc Chicago, IL, USA).

Results: Prevalence of intestinal helminthiasis was 20.7% and was observed highest in children aged 12–17 years. *Ascaris lumbricoides* and *Trichuris trichiura* were the intestinal helminths isolated. Nearly all infected subjects had significant stunted growth ($P = 0.014$) and another one-quarter were significantly under-weight ($P = 0.021$) when compared with noninfected subjects.

Conclusion: Intestinal helminthiasis is associated with under-weight and stunted growth.

Key words: Growth, helminths, nutrition, orphanage

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Introduction

Growth is increase in body size and is usually assessed by measurement of certain body parameters such as weight, height/length, occipito-frontal circumference, and body proportions.^[1] Nutrition is of utmost importance to the growth of children.^[1] Under-nutrition especially in children younger than 5 years^[1] can be deleterious to brain growth and development.^[1-4]

Intestinal helminthiasis have been found to have great

effect on nutritional and cognitive status especially among preschool and school aged children due to increased metabolic rate, anorexia, chronic anemia, and diarrhea associated with heavy worm load.^[2-6] These helminths cause decreased intake or a functional increase in the body's nutrient requirement by their interference with absorptive surfaces, physical obstruction of intestinal lumen, production of proteolytic substances, and consumption

Address for correspondence:

Dr. Damien Nwaneri,
Institute of Child Health, College of Medicine, University of Benin,
Benin City, Edo State, Nigeria.
E-mail: damiannwaneri@yahoo.com

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of nutrients intended for the body.^[7,8] These processes ultimately lead to loss of macro- and micro-nutrient, fluid and electrolyte as well as direct depletion of red blood cells and growth failure.^[7-9]

A study contained in the “The 2008 Situation Assessment and Analysis on Orphans and Vulnerable Children (OVC) in Nigeria” revealed that there were no fewer than 17.5 million children classified as OVC.^[10] Orphans face maternal and emotional deprivation as well as psychological stress.^[10,11] These children experience a fall in their food intake, and have diminished access to health care.^[11] Inadequate access to clean drinking water, health care, poor sanitation, and poor nutritional status characterize most orphanages in developing countries.^[11]

Most authors reported that the most common effect of helminthic infections on health is a subtle and insidious failure of children to achieve their genetic potential for growth.^[5-8] The effect of these two diseases could be deleterious to the general well being of a growing child.^[2,5-7]

Some authors postulated that children in orphanages could be at higher risk of both intestinal helminthiasis and under-nutrition (growth failure) due to the poor level of care offered to these children in the orphanages.^[12] However, the relationship between intestinal helminthiasis and malnutrition is worth investigating in a community where the prevalence of both disorders are high.^[6] Ogbe *et al.*^[13] in 1990 observed that prevalence of intestinal helminthiasis in children living in orphanage in Lagos, south-west Nigeria was 63.6%. The high prevalence was attributed to poor care of the children within the orphanage. Though the nutritional effect of intestinal helminths was not sort for in Ogbe’s study, however, studies by other authors with similar high prevalence of intestinal helminthiasis in children living with their parents in Nigeria had shown that there is a significant relationship between intestinal helminthiasis and nutritional status.^[2-4] Tamramat and Olowu^[2] in 2008 reported that about three-quarter of children infected with intestinal helminthiasis were under-nourished. Meremikwu *et al.* in 2000,^[4] reported that prevalence rates of underweight, wasting, and stunting were higher in infected preschool children than the noninfected ones with intestinal helminthiasis. These findings compared favorably with other studies as documented by previous authors.^[5-7]

There is paucity of published data on intestinal helminthiasis and nutritional status of children living in orphanages in Nigeria. This study was carried out to determine the prevalence of intestinal helminthiasis and describe the relationship (if any) between intestinal helminthiasis on nutritional status (physical growth) of children living in the orphanages. The finding from this study would

provide baseline information on the burden of intestinal helminthiasis and nutritional status of this vulnerable group of children. It will also encourage appropriate health authorities to embark on interventional health programs on nutrition and against intestinal helminthiasis in children living in orphanages.

Materials and Methods

This cross sectional, descriptive study was carried out between January and April 2011 in 10 orphanages in Benin City, Nigeria. There were 15 registered orphanages in Benin City and all the orphanages are privately owned by individuals or corporate bodies. As at the time of this study, three of the orphanages were not functional, one had no child as inmate during the period of recruitment of the subjects and one of the orphanages with eight inmates was used for pretesting and was excluded from the final analysis. The 10 orphanages used for this study had a total of 165 inmates. The following children were excluded from the final analysis: children with history suggestive of common childhood chronic illnesses such as pulmonary tuberculosis, sickle cell anemia, and human immunodeficiency virus (HIV). These chronic illnesses affect physical growth.^[14] Children with obvious chronic neurological disorders such as cerebral palsy (CP) were also excluded due to physical growth deformity (disorder of posture and movement) associated with such children.^[15] It may not be reliable using the same growth chart for assessment of physical growth with normal standard for normal children since measurement of such parameters as height is not reliable in children with CP due to their physical deformity.^[11]

Of the 165 inmates recruited for this study in the orphanages, 6 of the inmates were aged 18 years or more, 6 had CP, 3 were positive for HIV, 10 children either did not submit stool sample or the stool samples submitted were unsuitable for analysis. Complete data and appropriate stool samples were available for 140 giving a response rate of 84.8%.

Preliminary meetings were held with the proprietors/ proprietresses of the selected orphanages where the outline of the program was explained in details. An informed written consent was signed by each proprietors/proprietresses and an assent obtained from older children within the orphanage for participating in the study.

Ethical approval was obtained from the Ethics and Research Committee University of Benin Teaching Hospital, Benin City, Nigeria. In addition, a written permission was obtained from the Ministry of Women Affairs and Social Development, Edo State Nigeria and written informed consent from the proprietors/proprietresses of the selected orphanages.

During recruitment of participants, the procedure of

stool collection with a wooden stick was clearly explained to the older children and the caregivers within the orphanages. Each child within the orphanage was given an identification number. Stool containers labeled with each child's identification number were given to the caregivers within each orphanage on the previous day. Morning stool samples were preferred for analysis,^[16] and the researcher/assistants were at the orphanages in the morning to collect the stool samples.

Stool sample collected in the mornings from each subjects was examined the same day with the Kato–Katz method to calculate the number of eggs per gram of feces^[16] in Research Laboratory, Department of Child Health, University of Benin Teaching Hospital, Benin City. In order to ensure proper identification of hookworm ova, the preparation of each stool slide was read not later than 4-6 hours after taking the samples.^[16,17] All the slides were read by one medical microbiologist specialized in parasitology and consistency of the readings was assured by second readings performed in 20.0% of the slides randomly selected. Another reading was done after 24 hours in search for ova of *Schistosoma mansoni*.^[16,18] Intensity of infections for each worm was defined according to the thresholds proposed by the World Health Organization (WHO) Expert Committee in 1987.^[17]

Anthropometry of the children was done as follows:^[1]

The weight of each child was measured using a mechanical bench scale (SALTER model 180 England) for those aged 12 months and below, and a mechanical floor scale (SECA model 761) for children above 12 months. The scales were calibrated daily using a known weight. Weighing scales were standardized once weekly in the Maintenance Department. Children below 3 years were weighed nude while older children were weighed lightly clothed. Weight was recorded in kilograms to the nearest 0.1 kilograms.

For children less than 24 months, the supine length was measured with the child placed on the back and firmly immobilized on a firm surface, both legs fully extended and feet flat against the foot piece. The head was positioned with the head touching the headpiece. This was done with the aid of an assistant, and the length was read off with a tape. For children above 24 months, standing height was obtained using a stadiometer fitted with a sliding headpiece, at right angles to the upright which could be lowered onto the child's head with the aid of an assistant. The child was positioned erect, with shoulders, buttocks and heels touching the upright backboard and the eyes looking straight ahead, with the shoulders relaxed and arms hanging freely by the sides of the trunk with palms facing the thighs. All measurements were taken twice and the average length/height of each child was recorded to the nearest 0.1 cm. Before measurement of length/height, all head gears and footwear were removed.

Data Analysis

The overall prevalence and specie-specific prevalence of intestinal helminths were obtained. The Z-scores for height/length-for-age (HFA), weight-for-height/length (WFH), and weight-for-age (WFA) were calculated for all the subjects using the revised WHO growth charts from Centre for disease Control (CDC) as reference.^[19] Children with HFA Z-score, WFH Z-score, and WFA Z-score below -2 standard deviation (SD) of the reference median value were classified as stunted, wasted, and under-weight, respectively.

The data obtained was entered into spread sheet using the Microsoft Excel 2007 and the analysis was done using the Statistical Package for Social Sciences (SPSS) software versions 11.0 and 16.0 (SPSS Inc Chicago, IL, USA). Quantitative variables were summarized using means and standard deviations. The significance of association between variables was tested using Chi-square and Fisher's exact tests where appropriate for comparison of proportions while student *t*- and *z*-tests as appropriate was used for comparison of mean. Correlation between intensity of intestinal helminthic infection and height/length of infected subjects was obtained using Pearson's correlation coefficient. The level of significance of each test was set at $P < 0.05$.

Results

Of the 140 children, 60 (42.9%) were boys and 80 (57.1%) girls; mean age (\pm SD) was 7.1 ± 4.7 years, and mean (\pm SD) years lived in the orphanage was 3.5 ± 3.4 years. Table 1 shows gender, age distribution and educational status of the subjects. Sources for material resources/fund for all the orphanages were by donors and members of the community. Child to caregiver ratio in the orphanage studied was 6:1.

Prevalence of intestinal helminthiasis was 29/140 (20.7%). Orphanage F ($n = 12$) has the highest prevalence of

Table 1: Age and educational status by gender distribution of the subjects

Age (Years)	Male (%)	Female (%)	Total (%)
0-5	23 (38.3)	38 (47.5)	61 (43.6)
6-11	16 (26.7)	27 (33.8)	43 (30.7)
12-17	21 (35.0)	15 (18.7)	36 (25.7)
Total	60 (100.0)	80 (100.0)	140 (100.0)
Educational status			
Nursery	8 (13.3)	15 (18.8)	23 (16.4)
Primary	33 (55.0)	32 (40.0)	65 (46.4)
Secondary	3 (5.0)	6 (7.5)	9 (6.4)
Vocational school	0 (0.0)	1 (1.3)	1 (0.8)
Under age for school attendance	14 (23.4)	23 (28.8)	37 (26.4)
Not in school	2 (3.3)	3 (3.8)	5 (3.6)
Total	60 (100.0)	80 (100.0)	140 (100.0)

intestinal helminthiasis 6/12 (50.0%). Others were as follows: H ($n = 22$) 9/22 (40.9%), C ($n = 28$) 6/28 (21.4%), J ($n = 9$) 2/9 (22.2%), B ($n = 13$) 2/13 (15.4%), and A ($n = 27$) 4/27 (14.8%). There was no intestinal helminths identified in orphanages D ($n = 6$), E ($n = 9$), G ($n = 9$), and I ($n = 5$). There was no significant gender difference in helminthic infection between girls: 15/29 (51.7%) and boys: 14/29 (48.3%) ($\chi^2 = 0.44$, $P = 0.53$, Odds ratio [OR] = 1.3). Age of infected subjects (9.1 ± 4.5 years) was significantly higher than observed in noninfected subjects 6.6 ± 4.6 years ($t = 2.69$, $P = 0.01$, 95% confidence interval (CI) = 0.63, 4.40). Age group specific prevalence of intestinal helminthiasis in this study was 16.4% in children aged 0-5 years; 16.3% in children aged 6-11 years; and 33.3% in 12-17 year old.

Species of intestinal helminths isolated were *Ascaris lumbricoides* in 26/29 (89.7%) and *Trichuris trichiura* in 3/29 (10.3%) of subjects.

The mean weight of the subjects was 22.10 ± 12.8 kg, and the mean WFA Z-score was -1.56 ± 1.18 . The mean weight of infected subject was 25.88 ± 11.91 kg as against 21.10 ± 12.88 kg for noninfected subjects. The mean WFA Z-score for infected subjects (-1.93 ± 0.84) was significantly lower than (-1.47 ± 1.24) for noninfected subjects ($t = -2.37$, $P = 0.021$, 95% CI = -0.85 , -0.07).

The mean height/length of the subjects was 102.8 ± 21.5 cm while the mean HFA Z-score for the subjects was -2.56 ± 1.02 . Mean HFA Z-score for infected subjects (-2.93 ± 0.26) was significantly lower than (-2.46 ± 1.12) for noninfected subjects ($t = -4.05$, $P = 0.000$, 95% CI = -0.70 , -0.24). There was no significant difference in mean WFH Z-score in infected subjects (0.86 ± 1.43) and 0.62 ± 1.53 observed in noninfected subjects ($t = 0.79$, $P = 0.431$, 95% CI = -0.37 , 0.85).

Table 2 showed nutritional status (WFA, HFA, and WFH) of the subjects in different orphanages studied. Virtually all the children in the orphanages were stunted while the highest proportion of under-weight children (58.3%) was observed in orphanage F. This orphanage also had the highest prevalence of intestinal helminthiasis when compared with other orphanages. Nutritional status (WFA, HFA, and WFH) of subjects according to age group showed that significant proportion of the children with stunted growth were within age group 12-17 years ($\chi^2 = 32.23$, degree of freedom (df) = 2, $P = 0.00$). This age group had the highest prevalence of intestinal helminthiasis compared with the other age groups. Wasting was observed only among children aged 0-5 years. There was no significant difference in the weight for age among the different age groups ($\chi^2 = 0.23$, df = 2, $P = 0.89$).

Table 3 shows physical growth parameter and its association with intestinal helminthiasis among the subjects. A higher

proportion of the infected subjects (93.1%) were significantly more stunted compared with 71.1% observed in noninfected subjects ($\chi^2 = 6.02$, $P = 0.014$, OR = 0.18).

The intensity of intestinal helminthic infection was light in 22/29 (75.9%) and moderate in 7/29 (24.1%). No heavy intensity and mixed infections were observed in any of the orphanages in this study. Eggs per gram range among the infected subjects were 48-8000, and median egg per gram was 820 eggs per gram. There was no significant correlation between intensity of intestinal helminthic infection and weight ($n = 29$, $r = 0.087$, $P = 0.653$) and height/length of infected subjects ($n = 29$, $r = 0.183$, $P = 0.341$), respectively.

Discussion

This study showed that high proportion of the children living in the orphanages in Benin City were under-weight and stunted. All the orphanages were privately owned and depended on the income of the proprietors/proprietress and donors from members of the communities. Nigeria is a country where more than 80.0% of the population lives below one dollar per day,^[10] there is no doubt that the finding observed in this study is a reflection of the poor socioeconomic circumstances within the country, which advertently affected the orphanages in Benin City. Most of the children who were stunted were within age group 12-17 years, which was the same age group with the highest prevalence of intestinal helminthiasis in this study. Again, stunted growth and under-weight were observed highest in orphanages with the highest proportion of intestinal helminthiasis showing a positive relationship between intestinal helminthiasis and nutritional disorders. This finding has been corroborated by other authors who had linked intestinal helminthic infections with poorer nutritional outcome, including an increased risk for nutritional anemias, protein energy malnutrition, and growth deficit in children.^[2-7] Most of the infected subjects in this study were stunted and under-weight perhaps showing both short and long-term complications of intestinal helminthiasis on nutritional status of these children.^[8] Significant association between intestinal helminthic infections and stunting has been documented by previous authors specifying growth failure as the major long-term complication of intestinal helminthic infections in children.^[6-8] Therefore control of intestinal helminthic infection by regular de-worming exercise is a valid and practical method of nutritional intervention in communities with high prevalence of both under-nutritional disorders and intestinal helminthiasis.^[20]

Stephenson *et al.*^[6] suggested that an association between helminthic infection and height or physical growth in a population of young children is probably not worth

Table 2: Nutritional status (WFA, HFA, and WFH) of subjects by orphanages

Orphanage	Under-weight (WFA)		Stunted (HFA)		Wasted (WFH)	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
A (n=27)	7 (25.9)	20 (74.1)	23 (85.2)	4 (14.8)	2 (8.0)	25 (92.0)
B (n=13)	6 (46.2)	7 (53.8)	9 (69.2)	4 (30.8)	3 (30.0)	10 (70.0)
C (n=28)	8 (28.6)	20 (71.4)	22 (78.6)	6 (21.4)	0 (0.0)	28 (100.0)
D (n=6)	0 (0.0)	6 (100.0)	3 (50.0)	3 (50.0)	1 (16.7)	5 (83.3)
E (n=9)	0 (0.0)	9 (100.0)	6 (66.7)	3 (33.3)	0 (0.0)	9 (100.0)
F (n=12)	7 (58.3)	5 (41.7)	11 (91.7)	1 (8.3)	0 (0.0)	12 (100.0)
G (n=9)	1 (11.1)	8 (88.9)	4 (44.4)	5 (55.6)	0 (0.0)	9 (100.0)
H (n=22)	3 (13.6)	19 (86.4)	17 (77.3)	5 (22.7)	0 (0.0)	22 (100.0)
I (n=5)	2 (40.0)	3 (60.0)	4 (80.0)	1 (20.0)	1 (25.0)	4 (75.0)
J (n=9)	2 (22.2)	7 (77.8)	7 (77.8)	2 (22.2)	0 (0.0)	9 (100.0)
Total (n=140)	36 (25.7)	104 (74.3)	106 (75.7)	34 (24.3)	7 (5.0)	133 (95.0)

Table 3: Physical growth parameter and its association with intestinal helminthiasis in subjects

Physical parameters	Infected	Non-infected	P value	OR	95% CI
	n=29 (%)	n=111 (%)			
HFA: < -2 SD	27 (93.1)	79 (71.1)	0.014*	0.18	0.04-0.81
≥ -2 SD	2 (6.9)	32 (28.9)			
WFA: < -2 SD	8 (27.6)	28 (25.2)	0.796	0.89	0.35-2.22
≥ -2 SD	21 (72.4)	83 (74.8)			
WFH: < -2 SD	1 (3.4)	6 (5.4)	0.667*	1.60	0.18-13.84
≥ -2 SD	28 (96.6)	105 (94.6)			

OR = Odds Ratio; CI = Confidence Interval; *Fisher's Exact test

investigating in communities where the prevalence of helminthic infection is below 20.0%. For example, Borekci *et al.*^[12] did not find any significant relationship between intestinal helminthiasis and physical growth of the children in orphanage in Mersin City, Turkey because the prevalence of intestinal helminthiasis in that study was 3.7% and level of nutritional care was said to have been better than what was obtainable in this present study locale. Though the caregiver child ratio was not mentioned in Borekci's study but it was observed that most of the children within the orphanages in that study had close relatives who frequently visited the orphanages. The children were occasionally allowed to visit these relatives and these could have improved the personal and nutritional care of the children. Most of the children in the orphanages in this present study were abandoned and the way about of their parents and close relatives were not known. The children were brought to the orphanages either through the Ministry of Women Affairs and Social Development or Nigeria Police. The ideal child to caregiver ratio in orphanages is 3-4:1 as against the average of 6:1 observed in this study.^[11] Orphanages with poor child to caregiver ratio also had the highest proportion of intestinal helminthiasis and nutritional disorders.^[11] It could be possible that few numbers of caregivers in each orphanage had paid more attention to the care of younger children than the older children. This could be the reason for highest proportion of both intestinal helminthiasis and nutritional disorders (stunted growth and under-weight) among these older children (12-17 years) in this study. It

therefore implies that improvement on the level of care of these children in orphanages by employing adequate number of caregivers to take care of these children would be another practical approach to prevention and control of intestinal helminthiasis and nutritional disorders in the orphanages. There is also the need for donor agencies, philanthropists, governmental, and nongovernmental organizations to come to the aid of the children living in the orphanages in Benin City. Health programs as obtainable in the regular community should be extended to the orphanages such as regular de-worming exercise at least every 3 months as a means of controlling intestinal helminthic infections among these groups of children.^[21,22] Children living in the orphanages should not be left out of nutritional interventional programs.^[11]

Species of intestinal helminths isolated in this study included *A. lumbricoides* and *T. trichiura*. Moderate to heavy worm intensity have been shown to have deleterious effect on growth and cognitive development of children.^[2,5,8] In 2005, Ezeamama *et al.*^[5] found that there was a significant association between intestinal helminthiasis and lower performance of cognitive function (learning, memory, and verbal fluency) among Filipino children (aged 7-18 years). This impaired cognitive function was associated with poor nutritional effect of intestinal helminthiasis. Most children with moderate intensity of intestinal helminths in this study had stunted growth. Chronic intestinal helminthic infection and moderate to heavy worm intensity in a vulnerable

population (such as observed in this study) will not only jeopardize their health, but will also render them susceptible to other diseases.^[8,23] To protect these children therefore, regular examination of stool specimens of children living in orphanages for intestinal helminths is essential as a prelude to effective management and control of intestinal helminthiasis in this population as well as entire communities.^[23]

Conclusion

This study showed that intestinal helminthiasis is associated with under-weight and stunted growth in children living in orphanages.

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References

1. Michaelsen KF. Child growth. In: Koletzko B, et al. editors. Paediatric nutrition in practice. Switzerland: Reinhardt Druck, Basel Press; 2008. p. 1-5.
2. Tamramat IR, Olowu AO. Study on prevalence and nutritional effect of helminthic infection in pre-school rural children in Nigeria. *Nig Med Pract* 2008;54:16-20.
3. Okolo SN, John C. Nutritional status and intestinal parasitic infestation among rural Fulani children in Vom, Plateau State. *Nig J Paediatr* 2006;33:47-55.
4. Meremikwu MM, Antia-Obong OE, Asindi AA, Ejezie GC. Nutritional status of pre-school children in rural Nigeria: Relationships with intestinal helminthiasis. *J Med Invest Pract* 2000;1:23-7.
5. Ezeamama AE, Friedman JF, Acosta L, Bellinger DC, Langdon GC, Manalo DL, et al. Helminth infection and cognitive impairment among Filipino children. *Am J Trop Med Hyg* 2006;72:540-8.
6. Stephenson LS, Lathan MC, Ottesen EA. Global malnutrition. *Parasitology* 2000;121:S5-22.
7. Awasthi P, Pande VK. Prevalence of malnutrition and intestinal parasites in pre-school children in Lucknow. *Indian J Paediatr* 1997;34:7-12.
8. Hotez PJ. Hookworms (*Ancylostoma* and *Necator americanus*). In: Behrman RE, Kliegman RM, Jenson Hb, editors. Nelson textbook of paediatrics 17th ed. Philadelphia, Pennsylvania: Saunders the Curtis centre; 2004. p. 1156-8.
9. Hadidjaja P, Bonang E, Suyardi MA, Abidin SA, Ismid IS, Margano SS. The effect of intervention on nutritional status and cognitive function of primary school children infected with *Ascaris lumbricoides*. *Am J Trop Med Hyg* 1998;59:791-5.
10. Orphans in Nigeria. Available from: <http://allafrica.com/stories/200908170747.html>. [Last accessed on 2012-Sept-10].
11. UNICEF. State of the world children 2008- Child survival. Available from: <http://www.unicef.org/sowc08>. [Last accessed on 2012-Sept-10].
12. Borekci G, Uzel A. The determination of intestinal parasites, physical growth and hygiene behaviours of children in the Mersin City Social Service Child Care Centre. *Turkiye Parazitol Derg* 2009;33:63-72.
13. Ogbe MG, Ado OO. Intestinal helminthiasis in an orphanage in Nigeria. *Biosc Res Comm* 1990;2:105-18.
14. Saloojee H, Cooper P. HIV and AIDS. In: Koletzko B, et al. editors. Paediatric nutrition in practice. Switzerland: Reinhardt Druck, Basel Press; 2008. p. 162-7.
15. Izuora GI, Okoro AB. Some clinical aspects of cerebral palsy among Nigerian Igbo children. *Central Afr J Med* 1981;27:155-9.
16. Montresor A, Crompton DW, Hall A, Bundy DA, Savioli L. Guidelines for the evaluation of soil-transmitted helminthiasis and schistosomiasis at community level. World Health Organization/CTD/SIP 1998. p. 1-48. Available from: http://whqlibdoc.who.int/hq/1998/WHO_CTD_98.1.pdf. [Last accessed on 2012-Sept-10].
17. World Health Organization. Prevention and control of intestinal helminth infections. Report of WHO Expert Committee. Technical Rep. Series 749. Geneva: WHO; 1987. p. 12. Available from: http://whqlibdoc.who.int/trs/WHO_TRS_749.pdf. [Last accessed on 2012-Sept-10].
18. Massoud J, Arfaa F, Jalali H, Reza M. Comparative study of Kato's Thick-smear technique with concentration formalin-ether and flotation methods for quantitative and qualitative diagnosis of intestinal helminth infections. *TUMS Publ* 1978;7:139-44.
19. NCHS. Clinical growth charts (black and white). CDC Growth Chart, USA. Available from: <http://www.cdc.gov/growthcharts>. [Last accessed on 2011-Apr-13].
20. Gupta MC, Pardad N, Tandon BN. Effect of round worm infection upon growth and nutritional status. *Ind J Prev Soc Med* 1978;9:31-3.
21. Nwaneri DU, Ibadin MO, Ofovwre GE, Sadoh AE. Intestinal helminthiasis in children with chronic neurological disorders in Benin City, Nigeria: Intensity and behavioural risk factors. *World J Paediatr* 2011;0119:R3 (accepted for publication in December 2011).
22. Ekundayo JO, Aliyu MA, Jolly PE. A review of intestinal helminthiasis in Nigeria and the need for school-based intervention. *J Rural Trop Publ Hlth* 2007;6:33-9.
23. Adeyeba OA, Tijani BD. Intestinal helminthiasis among malnourished school age children in peri-urban area of Ibadan, Nigeria. *Afr J Clin Exp Microbiol* 2002;3:24-8.

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