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PREVALENCE OF INTESTINAL PARASITES AND ITS IMPACT ON NUTRITIONAL STATUS AMONG PRESCHOOL CHILDREN LIVING IN DAMANHUR CITY, EL-BEHERA GOVERNORATE, EGYPT

By

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Abstract

This cross sectional study was done in Damanhur City, the Capital of El-Behera Governorate to detect the prevalence of intestinal parasitic infection among preschool aged children and to find out its effect on their nutritional status. Five-hundreds children aged between 2-6 years were enrolled; a detailed questionnaire, complete clinical and anthropometric assessment as well as complete stool analysis and blood picture were done. The study revealed that 51.8% preschool children were infected; Cysts of *Entamoeba histolytica* and *Giardia lamblia* were found in 16.8%, and 14.8% respectively. In 1.8% of cases, both cysts were found together. Ova of *Ascaris lumbricoides*, *Enterobius vermicularis*, *Ancylostoma duodenale* and *Hymenolepis nana* were detected in 14%, 3.4%, 5% & 0.2% of cases, respectively. In 0.4% of cases, ova of *A. lumbricoides* and *E. vermicularis* were found together. Mixed infections were found in 3.6% of children. Significantly lower weight for age z-score (WAZ) and weight for height z-score (WHZ) were found among infested children compared to non-infested ones (P<0.05). Moreover, stunting was found in 44.1%, underweight in 39.1% and wasting in 11.5% of infested children. Prevalence of anemia among all studied population was 39%; 48.6% in infested group compared to 28.8% in non-infested children (x=20, P<0.001). Improper hand washing, and playing in the street bare footed, together with playing with animals and family history of parasitic infestation were considered the independent predictors of parasitic infestation by using binary logistic regression.

Key words: Egypt, Preschool-children, Intestinal Parasites, Nutrition, anthropometric measurements

Introduction

Although all infectious agents in humans are parasites, by convention, parasitic diseases are defined as those caused by protozoa or helminthes (Chacon-Cruz and Mitchell, 2007). Intestinal parasitic infection is a serious public health problem world-0wide particularly in developing countries (Quihui *et al*, 2006). It is a well-known fact that parasitic infections are more common in pediatric age group as children are more vulnerable population. The consequences of these parasitic infections result in mal-nutrition, anemia, cognitive impairment and increased susceptibility to other infections (Östan *et al*, 2007). Various risk factors are responsible for this prevalent disease, which include low socioeconomic status, poor hygienic conditions, impure drinking water, low literacy rate of parents, large size of the family and poor health status of the child (Okyay *et al*, 2004).

In Egypt, 56.0% and 47.0% of children suffered from intestinal parasites and anemia, respectively (UNICEF, 2000). There has been an increased awareness of the public health importance of parasitic infections, but much of the interest was focused on chemotherapy as a means of control while the study of social, cultural and economic factors underlying infection risk has been relatively neglected (Boatin *et al*, 2012).

This study aimed to investigate the prevalence of intestinal parasitic infection among preschool-aged children living in Damanhur City, El-Behera Governorate and to assess its impact on nutritional status of those children.

Subjects, Materials and Methods

This cross sectional study was conducted on 500 preschool children (2-6 years) living in different areas in Damanhur City. They were taken randomly after excluding the following criteria: Children with systemic diseases that could affect nutritional status, Children with history of blood transfusion or hereditary blood disease, and Children took anthelminthic drugs during the last 6 months.

A detailed questionnaire was filled up considering the different variables, with estimation of social status (Park and Park, 1979). They were subjected to complete clinical examination with special emphasis on anthropometric measurements; weight, height, skull circumference, left mid arm circumference and body mass index (BMI), and calculation of Z-scores (WHO, 2006) growth charts. Laboratory investigations included complete blood count (CBC) by Sysmex XT-1800i (Sysmex, Kobe, Japan), stool analysis macroscopically for pin-worms, cestod-segments, blood, mucus and consistency and microscopically by direct wet mount method (Cheesbrough, 2004) after staining with haematoxylin an eosin as well as Lugol iodine solutions. For the detection of *Cryptosporidium* oocysts, smears from fecal samples were prepared on glass slides using sterile swabs, dried and stained by modified Ziehl-Nielsen (acid-fast) method (Garcia *et al*, 1983). Stool analysis by Kato-Katz method (Katz *et al.,* 1972) was done whenever indicated.

Statistical analysis: Standard computer program SPSS for Windows, release 13.0 (SPSS Inc, USA) was used for data entry and analysis. Quantitative variables are presented as mean ± standard deviation (SD) while qualitative variables as number and percentage. Comparison of different variables in various groups was done using student t and Mann Whitney tests for normal and nonparametric variables respectively. Chi-square test was used to compare frequency of qualitative variables among different groups. Binary logistic regression analysis was used to find out the significant independent predictors of special dependent variable by using backward likelihood ratio technique. For all tests a probability (p) less than 0.05 was considered significant (Miller, 1992).

Results

The results are shown in tables (1, 2, 3, 4, 5, 6 & 7).

Table 1: Demographic data of children

Variables	Non infected children (n=241)	Infected children (n=259)	X^2	P
Age (months)	50.9±9.5	49.3±8	1	>0.05 NS
Male Female	120(49.8%) 121(50.2%)	135(52.1%) 124(47.9%)	0.9	>0.05 NS
Social class Low Middle High	 37(15.4%) 35(39.4%) 109(45.2%)	 119(45.9%) 92(35.5%) 48(18.5%)	66	<0.001 HS
Past history of parasitosis	50(20.7%)	142(54.8%)	61	<0.001 HS
Family history of parasitosis	166(68.9%)	230(89.1%)	31	<0.001 HS

Table 2: Recovered parasites from the preschool aged children in Damanhur City

Parasites detected	Infected children
Entamoeba histolytica	16.8%,
Giardia lamblia	14.8%
Ascaris lumbricoides	14%,
Enterobius vermicularis	3.4%,
Ancylostoma duodenale	5%
Hymenolepis nana	0.2%

Table 3: Comparison between children with and without parasitic infection regarding hygienic habits

Variables	Non infected	Infected children	X^2	P
Hand washing before meals	196(81.3%)	102(39.4%)	91	<0.001 HS
Hand washing after defecation	184(76.3%)	97(37.5%)	76	<0.001 HS
Swimming in canals	15(6.2%)	79(30.5%)	48	<0.001 HS
Trimming of finger nails	152(63.1%)	106(40.6%)	24	<0.001 HS
Play in street bare footed	123(51%)	236(91.1%)	99	<0.001 HS
Play with animals	26(10.8%)	115(44.4%)	69	<0.001 HS
Proper washing of veg. &fruits	227(94.2%)	232(89.6%)	3.5	<0.05 S
Proper cooking of meat and fish	241(100%)	258(99.6%)	0.9	>0.05 NS

Table 4: Comparison between cases with and without parasitic infection regarding clinical manifestations

Variables	Non infected	Infected children	X^2	P
Abdominal Colic	64(26.7%)	195(75.6%)	119	<0.001 HS
Constipation	7(2.9%)	72(27.8%)	58	<0.001 HS
Diarrhea	7(2.9%)	45(17.4%)	28	<0.001 HS
Vomiting	3(1.2%)	15(5.8%)	7.5	<0.05 S
Urinary incontinence	105(43.6%)	141(54.4%)	5	<0.05 S
Passage of worm segment	1(0.4%)	49(18.9%)	47	<0.001 HS
Fatigue	44(18.6%)	92(35.5%)	17.6	<0.001 HS
Lack of concentration	50(21.1%)	110(42.5%)	25	<0.001 HS
Palpitation	7(2.9%)	29(11.2%)	13	<0.001 HS
Peri anal itching	2(0.8%)	84(32.4%)	87	<0.001 HS
Increase appetite	109(45.2%)	64(24.7%)	23	<0.001 HS
Decrease appetite	129(53.8%)	192(74.1%)	22.4	<0.001 HS
Weight loss	51(21.2%)	128(49.6%)	43	<0.001 HS
Tenismus	4(1.7%)	70(27%)	63	<0.001 HS
Bloody stool	1(0.4%)	34(13.1%)	30	<0.001 HS
Fever	6(2.5%)	16(6.2%)	4	<0.05 S
Pallor	177(75%)	228(89.4%)	18	<0.001 HS
Abdominal distention	7(2.9%)	126(48.8%)	134	<0.001 HS
Lymphadenopathy	0	2(0.8%)	0.2	>0.05 NS
pityriaisis alba	164(68%)	219(84.6%)	19	<0.001 HS

Table 5: Comparison between children with and without parasitosis regarding anthropometric measurements

Variables	Non infected	Infected children	X^2	P
WAZ At risk(-1>SD >-2) Under weight(<-2SD)	 37(74%) 13(26%)	 56(60.9%) 36(39.1%)	3	<0.05 S
HAZ At risk (-1>SD >-2) Stunted (<-2SD)	 65(59.1%) 45(40.9%)	 76(55.9%) 60(44.1%)	0.2	>0.05 NS
HCZ At risk(-1>SD >-2) Below average (<-2SD)	 20(87%) 3(13%)	 35(79.5%) 9(20.5%)	0.6	>0.05 NS
WHZ At risk of wasting(-1>SD >-2) Wasting (<-2SD) Over weight (1<SD<2) Obese (>2SD)	 19(9.6%) 15(5.5%) 46(47.4%) 17(7.5%)	 35(36.5%) 11(11.5%) 36(37.5%) 14(14.6%)	6.8	<0.05 S
Left mid arm circumference Z	-0.68±55	-0.67±0.45	1.7#	>0.05 NS
BMI Z	-1.10±0.50	-0.97±0.45	1.4#	>0.05 NS

Mann Whitney test

Regarding CBC picture, significantly lower values of hemoglobin (Hb) and mean corpuscular volume (MCV) were found among infested children (table 5). Prevalence of anemia among all studied population was 39% (48.6% of infested children compared to 28.8% in non-infected group (x=20, P<0.001)

Table 6: Comparison between children with and without parasitic infestation regarding CBC picture

Variables	Non infested	Infested children	t-test	P
HB	11.1±4	10.8+2.5	4	<0.001HS
RBCs	4.4±1.2	4.3±1.5	1.9	>0.05NS
Hematocrit value	34.6+3	33.8+2.6	1.7	>0.05NS
MCV	78.6±7.6	76±6	3	<0.001HS
MCH	25.4+3	25.4+6	0.8	>0.05NS
MCHC	40±15.7	31.6±13	1.6	>0.05NS
RDW	13.3±3	13±2.6	1.1	>0.05NS
Platelets	390±146	319±80	0.6	>0.05NS
TLC	7.2+3	8.2+1.7	1.2	>0.05NS

HB= hemoglobin, RBCs= red blood cells, MCV= corpuscular volume, MCH= corpuscular hemoglobin, MCHC=corpuscular hemoglobin concentration, RDW=red cell distribution width, TLC- total leucocytic count.

Table 7: Relation between different risk factors versus parasitic infestation by logistic regression

Independent predictors	Beta-coefficient	P	Odd's (95%CI)
Hand washing before	-1.3	<0.001 HS	5(1.2-17.8)
Playing bare footed	1.1	<0.001 HS	2.5(1-11.4)
Playing with animals	1.1	<0.001 HS	2.3(1.1-16)
Family history of parasitosis	0.83	<0.05 S	2.2(1-15.7)

Discussion

In the present study, parasitic infection was found in 259 children (51.8%). *Entamoeba histolytica* and *Giardia lamblia* cysts were found in 16.8%, & 14.8% respectively, and double infection with both was in 1.8%. Ova of *Ascaris lumbricoides*, *Enterobius vermicularis*, *Ancylostoma duodenale* and *Hymenolepis nana* were detected in 14%, 3.4%, 5% & 0.2% of cases respectively. Double infection with both was found in 0.4%. Mixed infections were found in 3.6% of children. Demographic data revealed that low social class and positive family and past history of parasitic infestation were significantly higher among infested group (Tab.1). El-Gammal *et al*. (1995) in Egypt reported that the prevalence of parasitic infection among school children in Malames village in Lower Egypt was 31.9% and 88.5% in Tamouh and Demo villages in Upper Egypt. El-Masry *et al*. (2007) in Sohag Governorate (Upper Egypt) found that 38.5% of school students in a village in Tahta District had parasitic infection. Among Egyptian youth and adults, Bakr *et al*. (2009) in village, Menoufia Governorate reported 47.8% with at least a single parasite and Mousa *et al.* (2010) in Cairo found an overall parasitic infection of 60.9% among patients suffering from diarrhea. Abroad, Rim *et al.* (2003) in Laos found that 61.9% of primary school children had intestinal helminthes. These differences of prevalence may be attributed to difference in sites, human habitats, ages, sanitation levels, water supply, hygienic measures and food behaviors.

In the present study, the preschool aged children showed an overall infection rate of 51.8%. Abroad, Mumtaz *et al*. (2009) in Karachi found parasitic infection in 68.8% of children less than 5 years old. Niyizurugero *et al*. (2013) in Rwanda found parasitic infection in 50.5% of preschool aged children. Suchdev *et al*. (2014) in Kenya reported parasitic infection in 40% of preschool aged children.

The present study showed that protozoa were detected in 33.4% of children; 16.8% *E. histolytica*, 14.8% *G. lamblia* and 1.8% as double infection. Chacon-Cruz and Mitchell (2007) mentioned an overall world estimation10% to be infected with *E. histolytica*; the highest was in developing countries with the lowest levels of sanitation, and that *G. lamblia* jumped to 20-40% in developing countries, especially among children.

El Masry *et al.* (2007) among school aged children reported *G. lamblia* in 15.2% and *E. histolytica* in 20.4%. Bakr *et al*. (2009) detected *E. histolytica* in 20% of cases, *E. coli* in 10% and *G. lamblia* in 10%.

Handousa *et al*. (2007) in Dakahlia Governorate reported insignificant difference between symptomatic and asymptomatic groups regarding the prevalence of different Giardia genotypes and the prevalence of CD4 and CD8 lymphocyte infiltration grading in different Giardia genotypes. Abou-Shady *et al*. (2011) in Egypt found that most giardiasis-infected children were between 1 and 5 years, with significant affection of weight, abdominal pain, and/or intermittent diarrhea. Serum zinc and iron levels were significantly decreased in the infected group compared to control ($P < 0.001$). El-Gebaly *et al*. (2012) in Cairo evaluated detection of giardiasis in preschool-children. They concluded that the advantage of salivary assays over serum immunoglobulin assay was being easy and non-invasive in sampling technique especially for young children. Eldash *et al*. (2013) in Saudi Arabia found giardiasis in 47 (52.2%) patients and 30 (33.3%) controls with a statistically significant difference p= 0.02, and that the incidence among cases was higher among age group above 5 years (p=0.001), as a significant predictor for RAP. They concluded that association of *H. pylori* and *G. intestinalis* was among 36 (40.0%) patients and 11 (12.2%) controls with a significant difference.

In the present study, the children were *Cryptosporidium parvum* free. In Egypt, Cryptosporidiosis was reported as zoonosis (Youssef *et al*, 2008) and nosocomial in a pediatric hospital (El-Sibaei *et al*, 2003).

In this study, helminthes were detected in 22.8% of preschool aged children; 14% *A. lumbricoides*, 3.4% *E. vermicularis* and 0.4% with double infection, 5% *A. duodenale* and 0.2% *H. nana*. In addition, mixed infections (protozoa and helminthes) were found in 3.6% of children. El-Masry *et al*. (2007) found *E. vermicularis* in 16.6%, *H. nana* in 14.9% and *A. lumbricoides* in 6.5%. Rim *et al*. (2003) abroad detected higher prevalence of *A. lumbricoides* (34.9%), hook worm (19.1%) and *T. trichiura* (25.8%).

In the present study, none was infected with *Fasciola* spp. Rashed *et al.* (2010) in Egypt stated that nearly 24 million Egyptians at risk and about 800,000 were infected. On the global scale, about 180 million are at risk of infection. They added that all ages and both sexes were susceptible to fascioliasis infection and that watercress topped the list of the Egyptian plants born encysted metacercariae followed by lettuce, mint, and alfalfa. No doubt, the establishment of rapid and dependable sero-diagnosis (Rabee *et al*, 2013), the control measures of snails intermediate hosts (Dar *et al*, 2014) and availability of treatment explained the absence of fascioliasis in the group.

In the present study, the social status of infected children was significantly lower than in non-infected ones. Also, logistic regression showed that improper hand washing and playing in the street bare footed, together with playing with animals and family history of parasitic infection were considered the independent predictors of parasitosis.

El Masry *et al.* (2007) found that poor personal hygiene, low socioeconomic level, ≥3 infected siblings, previous parasitic infections and no early consultation for therapy were important risk factors. Bakr *et al.* (2009) found on multiple logistic regression analysis; the risk factor most strongly associated with infection was the presence of another infected family member. Mousa *et al*. (2010) reported that the risk factors rural areas, education level, contact with farm animals and/ or pet animals. El-Sherbini and Abosdera (2013) in Giza stated that poverty, illiteracy, poor hygiene, lack of access to clean water and tropical climate were the factors associated with intestinal parasitic infections all correlated positively with increased rates of infection among school children.

In the present study, clinical characteristics of infected children showed that abdominal colic and anorexia were the commonest symptoms, while pallor and pityriaisis alba were the commonest signs. El Masry *et al*.

(2007) reported 60.3%, 52.4%, 51.9%, 45.4%, 34.3% of students with positive parasitic infections suffered from headache, fatigue, pallor, loss of appetite, abdominal colic respectively. Also, Al-Haddad and Baswaid (2010) in Yemen found similar presentations among the studied cohort. Elwakil and Talaat (2009) reported that the frequency of intestinal symptoms was 64% in protozoan cases. Abdominal pain was the most frequent symptom 78% (7/9), but without definite correlation between RFLP-banding pattern or genetically distinct genotypes and pathogenecity. Moreover, pallor was the commonest sign of anemia as a public health problem among parasitic infection children overwhelms (El Masry *et al*, 2007; Mumtaz *et al*, 2009; Suchdev *et al*, 2014).

Generally speaking, Curtale *et al.* (2003) in El-Berea stated that school health programs offer the opportunity to deliver public health interventions to a great number of beneficiaries at a relatively low cost and are seen with growing interest by policy makers in developing countries and the donors' communities. A pilot school health program was implemented for the past 6 years in El-Behera, the largest and most populous Governorate of the Nile Delta. Program integrated additional activities for control of soil-transmitted helminthiasis, human fascioliasis and anemia in the National Schistosomiasis Control Program (NSCP), implemented in Egypt since 1988 by the Ministry of Health and Population (MoHP). To facilitate planning and direct actions, a strong monitoring system was also developed, that generated useful information for the schistosomiasis control program. The practical steps adopted to develop the program were presented and discussed. They concluded that three rounds of monitoring (2000, 2001& 2002) were analyzed and compared with baseline data conducted in 1996, together with each activity cost. On the basis of the experience gained by El-Behera school health program a number of operational recommendations were formulated.

The present study showed significantly lower z-score values of WAZ and WHZ among children with parasitic infestation compared to those without infestation. Although height for age z-score (HAZ) values were lower in infested children yet did not reach a statistical significant difference from non-infested group. Further, stunting was found in 44.1% of infested children, underweight in 39.1%, wasting in 11.5%. Actually, malnutrition and parasitic infestation are commonly associated. ElMasry et al. (2007) found height for age less than 5th percentile in 31.6% and weight for age less than 5th percentile in 29.2% among Students with positive parasitic infection that was significantly higher than in negative cases. Also, Jiménez Gutiérrez et al. (2014) showed that children with parasitic infections had lower HAZ scores (mean of -1.449) than the reference population. Belizario *et al*. (2011) found overall prevalence of school children with below normal weight for age was 29.9%, while prevalence of those with below normal height for age and BMI for age was 42.8% and 14.9%, respectively. In Mumtaz et al. (2009) study, 29.4% of the children less than 5 years were mildly malnourished while 20.4% showed moderate malnutrition. Suchdev *et al*. (2014) found stunting in preschool and school children with parasitic infestation (29.7% and 16.9%, respectively).

Parasitic infections are thought to contribute to child malnutrition, micronutrient deficiency and protein loss through subtle reduction in digestion and absorption, chronic inflammation and loss of nutrients. Childhood is the time of intense growth; it is the period in which the velocity of individual's growth had a rapid increase (Rees et al, 1999).

Regarding CBC picture, the prevalence of anemia among our studied population was 39% with significantly higher proportions among infested children (48.6% versus 28.8%). The Egyptian studies showed anemia was in 52.4% of infected children and in 32.7% of non-infected students (El Masry *et* *al*, 2007), and WHO/WEE (2006) reported that parasitic infections were usually associated with different types of anemia.

Studies in other countries also showed an association between parasitic infection and anemia; Mumtaz *et al*. (2009) reported that 44.6% of infected children less than 5 years were found to have mild anemia. Also, Suchdev *et al*. (2014) revealed anemia in 38.3% and 14.0% of preschool and school aged children respectively.

Conclusion

The outcome results showed that 51.8% of preschool aged children had parasitic infections in Damanhur City that affected their growth and nutritional status.

This highlights the magnitude of the problem of parasitic infection in this young age group. So, improving personal and environmental hygienic measures, regular screening and treatment for parasitic infections among children in rural and urban areas of Egypt are warrant.

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