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Assessment of Risk Factors and Prevalence of Common Gastrointestinal Parasites among Basic School Children In Greater *Wad Madani* locality, Gezira State , Sudan (2011 – 2014)

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Abstract:
Objectives: The objectives of this study are:
To access the prevalence of intestinal paraites in the study area.
To study the epidemiology of intestinal parasites among school children in the study area.
To know the association between the risk factors and the degree of infection.
To compare and evaluate different diagnostic techniques for the detection of intestinal parasites infections.
Methodology: *The study was conducted in Wad Medini municipality among basic school children.*
10 basic schools were enrolled in the study ,5 schools for girls and 5 ones for boys ,selected randomly from the four direction (East, West ,South and North) in addition to central site , the students attending grade 1,3,5 &7 aged between(5-14 years). Participation was voluntary and children were free to refuse. From each school 40 stool samples were collected randomly & the questionnaire was done for each student .The samples were analyzed by different diagnostic methods (wet prepration , concentration technique and a semi quantative technique(kat – kate technique) .
Statistical analysis: *The data was organized inform tables and figures using SPPS program. Statistical analysis was done and based on descriptive statistics , inferential statistics and mean separation.*
Results: *The infection rate was higher in males than females especially in the age group 5-8 years. The high infection by worms was caused by H.nana whereas G. Lambilia was the dominant protozoa. formol ether concentration technique is the superior method to detect gastrointestinal parasites than wet prepration. The check list demonstrated that there is a strong relation between the school environment and the prevalence of parasitic infection. According to the questionnaire ,there was relationship between behavioural risks, environmental sanitation and living condition characteristics and the rate of infection. Semi quantative Kato – kat technique showed that the intensity of ova was not high ,the highly intensity record from basic school for males.*
Conclusion:. St*udy population showed high rate of gastrointestinal parasites .Prevalence of gastrointestinal parasites are higher in those who used traditional latrines ,had animals in home ,who do not washed vegetables , fruits and hands after playing .The prevalence of gastrointestinal parasites higher in males than females.Absence of health education in the school play an important role in the distribution of gastrointestinal parasites .The badness of the school environment is an important factors in the distribution of gastrointestinal parasites among school children.combination between wet prepration and concentration technique is the best method for correct diagnosis of gastrointestinal parasites.*
Recommendations: *The study recommended the combination of wet prepration and formal ether concentration technique in the diagnosis of gastrointestinal parasites. Health education in schools should improved to reduce the rate of infection. Routine examination for gastrointestinal parasite is recommended for school children for early discover and treatment. The school and home water supply and the sanitation system should be improved to eliminate risk factors of gastrointestinal parasites and STH. H.nana recorded high rate ,therefore further study should be done to determine whether H. nana represent public health problem among school children ,this study is the first study in the study area ,therefore further study should be done*

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I. Introduction

Intestinal parasites are parasites that populate the gastro-intestinal tract in humans and other animals.(Loukopoulos et al, 2007).The major groups of parasites include protozoans (organisms having only one cell) and parasitic worms (helminths). Helminths are worms with many cell, Nematodes (roundworms), cestodes

(tapeworms), and trematodes (flatworms) are among the most common helminths that inhabit the human gut. There are four species of intestinal helminthic parasites, also known as geohelminths and soil-transmitted helminths: *Ascaris lumbricoides* (roundworm), *Trichiuris trichiuria* (whipworm), *Ancylostoma duodenale*, and *Necator americanicus* (hookworms). The infections by these worms are most prevalent in tropical and subtropical regions of the developing world where adequate water and sanitation facilities are lacking.(Savioli and Albonico, 2004) (Cappello, 2004). , it occur through contaminated soil. It has become the most common parasitic infection of humans worldwide. Approximately two billion people (about a third of global population) are infected as of the latest estimate, and four billion at risk, surpassing even the all-time most prevalent parasitic disease, malaria (WHO, 2013). The largest numbers of cases occur in impoverished rural areas of Subsahran Africa, Latin America, Southeast Asia, and China.(WHO, 2001 – 2010). It is regarded as one of the world's most important causes of intellectual and physical retardation. (Bethony et al, 2006)

II. Methodology

Study area

The study was conducted in Wad Madani city, which is the capital city of Gezira state, located in the West site of the Blue Nile about 187 kms south east of Khartoum. Is strategically located intersect with roads, railway, east and west and north and south, also represents the second largest city in Sudan after Khartoum .For all these advantages the city has attracted huge numbers of migrants and displaced persons and asylum-lasting work and seasonal work of the various tribes of the Sudan .The population of the city is about 332752 . The study area known as endemic area of parasitic diseases, this may due to as mentioned previously that it is an agriculture area and most people migrate to it for work in farms, lives in random areas lacks to basic health services which lead to spread of parasitic infections that associated with health services.

Sample size and sampling strategy

The sample size was calculated for the primary objective taking the prevalence to be estimated at 50% for gives the maximum sample size, with 95% level of confidence and 5% bound on the error of estimation.

The sample size was calculated using the formula described by Martin, et al. (1987) as follow.

$$N = \frac{4*P*Q}{L2}$$

N= sample size

P= expected prevalence

L= desired absolute precision

Q= (1-P). (Martin, *et al*., 1987)

From the records of teaching hospitals in the state the prevalence of *parasitic infection* wasn't calculated before. then the sample size was calculated:-

$$N = \frac{4*(0.5)*(1-0.50)}{(0.0025)} = 400 \text{ samples}$$

The minimum sample size required was 400 stool samples .

4 Ethical consideration

The study was approved by the Ministry of Health (MoH) of Gezira state. Another approval for the collection of stool samples from the school was taken from the ministry of basic education of Gezira state.

Questionnaire survey

The questionnaire was designed in English language ,consist of 15 questions ,about the demographic data (i,e.age,gender grade) , behavioural risks (i.e. personal hygiene such as hand washing and food consumption), environmental sanitation and living condition characteristics (i.e., latrine system, and presence of domestic animals) and health conditions with history of symptoms (i.e. diarrhoea, nausea, vomiting and abdominal pain).The questionnaire was done by interviewing the student by the researcher .

Study population

10 basic schools were enrolled in the study ,5 schools for girls and 5 ones for boys ,selected randomly from the four direction (East, West ,South and North) in addition to central site , the students attending grade 1,3,5 &7 aged between(6-14 years). Participation was voluntary and children were free to refuse.

Laboratory Methods

Stool collection and processing

From each school 40 stool samples were collected randomly & the questionnaire was done for each student . a check list which consist of six questions about the school environment was filled .The samples were analyzed by different diagnostic methods (wet prepration , concentration technique and a semi quantative technique(kat – kate technique)

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Faecal sample collection

Following the administration of the questionnaire, 40 stool samples were collected in labeled wide ,neck proof ,dry and clean containers .

The samples received in the same day and wet mount (by normal saline and logulos iodine) done in the same day according to the standard method .(Monica 1998).

Procedure

One drop of physiological saline(0.85%) was placed on one end of the slide and drop of iodine on the other end ,after mixing of the specimen ,about 2 mg of stool was taken by wooden stick and mixed well in the two solution to make thin suspension, covered by cover glass and examined microscopically firstly by x10 to screen all the slide and then x40 for identification of the parasite.(Monica,1998)

Formal ether concentration technique

The principal of the test depends on faeces emulsified in formal water solution (to kill the parasite).The parasites fixed and sediment ,faecal debris separated in layer between ether and formal water.

Method

One gram of stool was emulsified in 4 ml 10% formal water. The suspension was sieved and 3ml of 10%formal water was added .3ml of diethyl ether was added, shake well for 1minue. The suspension centrifuged at 3000 rpm for 1 minute. After centrefugation ,4 layers were present, in the top ether and dissolved fat ,a layer of fecal debris ,formal water .then in the bottom the parasite sediment . (Monica,1998)

Triplicate Kato – Kate technique

Done to some of the sample as followed:

Small amount of stool was passed through wire screen , to remove large particles of stool ,about 20 – 50 mg of stool was transferred to the hole of the template placed on slide ,drop of normal saline was added ,the prepration was covered by cover glass and examined under the microscope to count the eggs.(Monica,1998)

Statistical analysis

The data was organized inform tables and figures using SPPS program. Statistical analysis was done and based on descriptive statistics , inferential statistics and mean separation.

III. Results

Wet prepration technique

By wet prepration out of 400 stool samples , 64.25% samples were positive . The infection by worms was 19%.(16.% of them infected by H.nana, 1% was the infection by S.mansoni, infection by Enterobious vermicularis was 1% and also the infection by Taenia spps.)

Infection by protozoa was 47%, With regard to intestinal protozoa, the most common species was the non-pathogenic *Entamoeba coli* (21%), followed by Giardia lamblia 20%,Giardia trophozoite 3% and E.histolytica cyst 1%.(table3. 1).

Table (3.1) Prevalence of common intestinal parasites by wet prepration (%).

	positive	Infection by helminths	Infection by protozoa
	64.25	19	47
H.nana	0	16	0
S.mansoni	0	1	0
E.vermicularis	0	1	0
Taenia spps	0	1	0
E.coli cyst	0	0	21
Giardia cyst	0	0	20
G. trophozoite	0	0	3
E.histolytica	0	0	1

Distribution of the detected parasites by wet prepration according to age group :

According to age ,the study population was classified to three groups : group one range from 5 -8years old ,group two range from 9 – 12 years old and group three range between 13 – 16 years old.

group (1) the positive was 26.75%, H.nana 7.5%,Enterobious vermicularis .25%,10.75% Giardia cyst,7.25% E.oli and 1% Giardia trophozoite.

Group (2) positive was 22%, H.nana 6.25%,S.mansoni 0.5%, 5.75% Giardia cyst, 9.5% E.colicyst

.Group (3),positive was 13.5%, H.nana 2.5%, 4% Giardia cyst 4%,E.coli cyst 3% (table 3. 2).

Table (3.2) Common intestinal parasites according to age group (%).

	Group (1)	Group (2)	Group (3)
positive	26.8	22.0	13.5
H.nana	7.5	6.3	2.5
S.mansoni	0	0.3	0
E. vemicularis	0.3	0	0

Giardia cyst	10.75	5.75	4
G. trophozoite	1	0	0
E.coli cyst	7.5	9.5	3

Distribution of detected parasites by wet prepration according to sex :

The stool samples taken from 200 males and 200 females . The females group ,positive was 64.5%, 15.5% H.nana ,0.5% S.mansoni ,giardia cyst and trophozoite 15.5% and 6.5% repectively and 26.5% E.coli cyst .Male group ,69% positive, H.nana 17%, S.mansoni 0.5% , Enterobious vermicularis 0.5%,Taenia spps o.5%, 28.5% and 5.5%G iardia cyst and trophozoite respectively and 16.5% E.coli cyst (table 3 .3)

Table (3.3) Sex – related prevalence of common intestinal parasites by wet prepration .

	Males	Females
Positive	69	64.5
H.nana	17	15.5
S.mansoni	0.5	0.5
E.vermicularis	0.5	0
Taenia spps	0.5	0
Giardia cyst	28.5	15.5
G.trophozoite	5.5	6.5
E.coli cyst	16.5	26.5

Formal ether concentration technique

By this method positive samples were increased to 72.75 %, infection ,worms increased to 23.25% (20.5% H.nana ,0.75% S.mansoni ,0.25% S.haematobium ,0.5% Ascaris lumbercoides,1.5% Enterobious vermicularis and 0.5% Taenia spps).

Infection by protozoa was increased to 78.25%,(32% Giardia cyst,38.75% E.coli cyst,7.5% E.histolytica cyst and 0.25% Isospora belli cyst).(table3. 4)

Table (3.4) Prevalence of common intestinal parasites by formal ether concentration technique.

	Helminths	Protozoa
Positive	72.75	78.25
H.nana	20.5	0
S.mansoni	0.75	0
S.haematobium	0.25	0
Ascaris	0.5	0
E.vermicularis	1.5	0
Taenia spps	0.5	0
Giardia cyst	0	32
E.coli cyst	0	38.75
E.histolytica	0	7.5
Isospora belli	0	0.25

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The prevalence of single and multiple helminths and pathogenic intestinal protozoa species infections are 37.7% ,26.7% had dual infection whereas only 12% had at least three parasitic infection (figure 3.1)

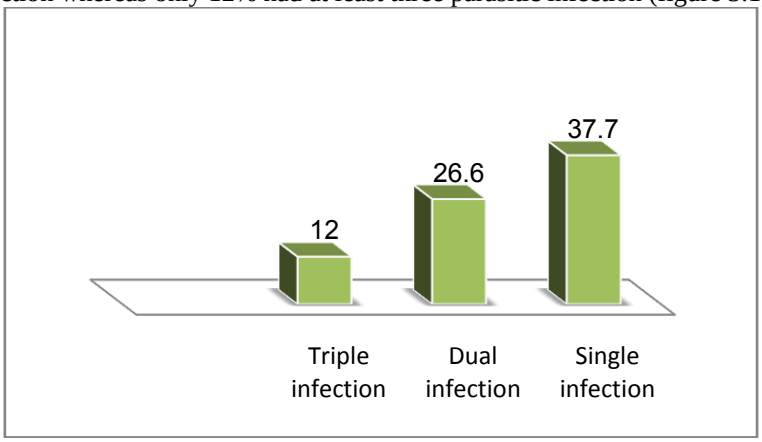

Figure (3.1) Prevalence of single , dual and triple infection (%)

Most widespread co-infections were combinations with *Giardia* and *E.coli cyst* (38.25%%), followed by *H. nana* and *Giardia*(26.25%). The most common triple infection was *H. nana*, *E. coli* and *G. intestinalis* (12 .25%).(figure3. 2)

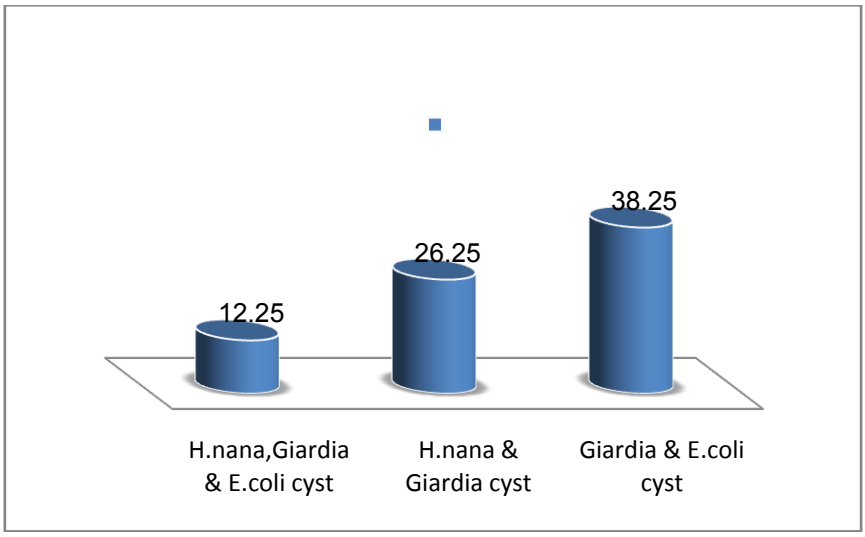

Figure (3.2) Prevalence of co – infection.

Results of Formal ether concentration technique according to age groups

Group (1), positive was 30% , H.nana 6.75% , Enterobious vermicularis 0.75% ,Giardia and E.coli cyst were 10.75% and 11.75% respectively.

Group (2),positive were 40.75% , 8% H.nana ,Enterobious vermicularis 0.5%,Ascaris lumbercoides 0.25%,S.mansoni 0.75% , S.haematobium 0.25% ,13.5% Giardia cyst ,17.5% E.coli cyst.

Group (3) , positive were30 % ,H.nana 5.5% , Taenia o.25% ,Giardia cyst 8.5%,E.coli cyst 12.5% and Isospora belli cyst 0.25%.(table .3.5)

Table (3.5) Age – related prevalence of common intestinal parasites by formal ether concentration technique.

	Group (1)	Group (2)	Group (3)
Positive	30	40	30
H.nana	6.75	8	5.5
S.mansoni	0	0	0
S.haematobium	0	0.25	0
Ascaris	0	0.25	0
E.vermicularis	0.75	0.5	0
Taenia	0	0	0.25
Giardia cyst	10.75	13.5	8.5
E.coli cyst	11.75	17.5	12.25
Isospora belli cyst	0	0	0.25

Distribution of detected parasites by formal ether concentration technique according to sex

From the 200 stool samples of female , 85.5% were positive .H.nana 22% ,S.mansoni 1% ,Ascaris lumbercoides 1% ,Enterobious vermicularis 1%, Giardia cyst 27% and E.coli cyst 33.5 % .

The males ,92 5% were positive ,25% H.nana ,0.5% S.mansoni ,s.haematobium 0.5% ,1.5% Enterobious vermicularis ,Taenia spps 0.5%.Giardia cyst 37% , E.coli cyst 27% and 0.5% Isospora belli.(table 3.6)

Table (3.6) Sex - related prevalence of common intestinal parasites by formal ether concentration technique.

	Males	Females
Positive	92.5	85.5
H.nana	25	22
S.mansoni	0.5	1
S.haematobium	0.5	0
E.vermicularis	1.5	1
Ascaris	0	0.5
Taenia	0.5	0
Giardia cyst	37	27
E.coli cyst	27	33.5
Isospora belli	0.5	0

Kato – kat technique

Females schools

Kato – kat technique was performed for 30 samples,8 samples from girls school(4 samples from Elsheima basic school for girls (31.6 ,23 ,16.3 and 23.6 ova /gram) 3 samples from atrra basic school for girls (8 , 14.3 and 13.3 ova /gram) ,1 sample from Al adwia school for girls (53.6 ova /gram) .(figure 3.3)

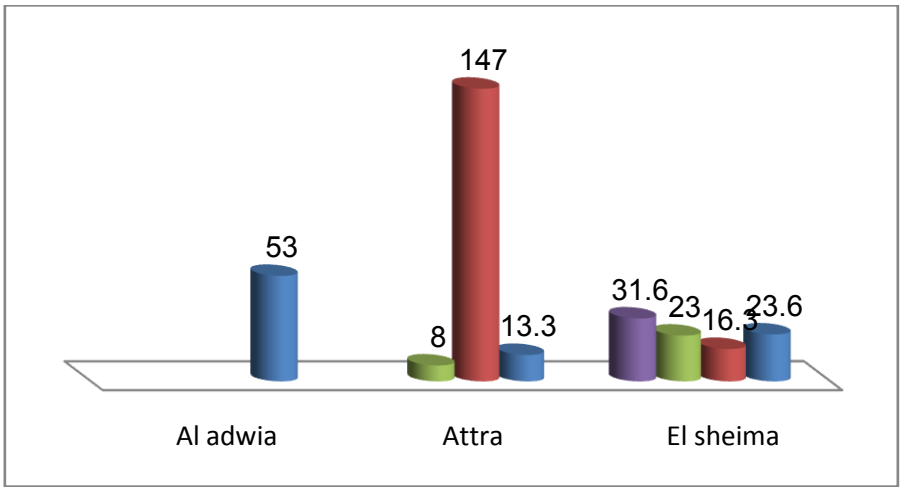

Figure (3.3) Results of Kato – kat technique in females schools (ova /gram).Males schools

3 samples from Shigiddi basic school for boys (34 ,19.6 & 24 ova /gram). 14 samples from atrra basic school for boys (16.3,5,4.6,20.6,9.3,147.3,13.3,9.3,70.3,5.3,5.6,13.3,8, and 8.6 ova /gram).3 samples from A.A.Alaziz shool for boys (167.6,160.6,50.6 ova /gram).1.2 samples from Alkareeb school for boys (25.6 and 41.3 ova /gram) .(figure 3.4)

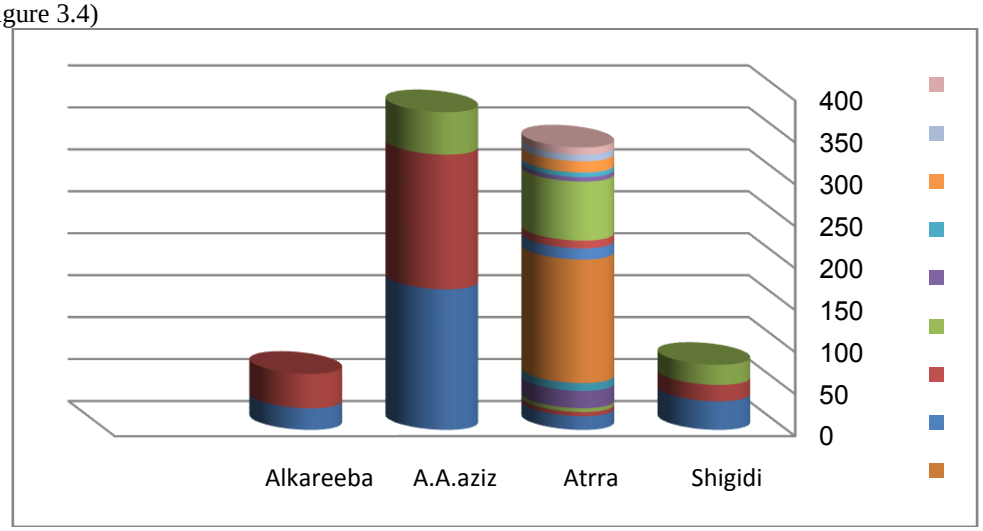

Figure (3.4) Results of Kato – kat technique in females schools (ova /gram).

Questionnaire survey

The questionnaire designed of 15 question ,about the demographic data (i,e.age,gender grade) , behavioural risks (i.e. personal hygiene such as hand washing and food consumption), environmental sanitation and living condition characteristics (i.e., latrine system, and presence of domestic animals) and health conditions with history of symptoms (i.e. diarrhoea, nausea, vomiting and abdominal pain).

Descriptive statistical analysis of frequency tables

10 basic school were enrolled in the study ,five school for boys and five one for girls located at North ,West, South ,East and centre of Wad Madni city , from each school 40 faecal samples were taken from the students attending grade 1, 3,5 and 7.(Table3.7

Table (3.7) Frequency of schools.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Shegeddi	40	10.0	10.0	20.0
	industerial	80	20.0	20.0	40.0
	Attra female	40	10.0	10.0	51.3
	Attra males	40	10.0	10.0	60.8
	Ahmed Aziz	40	10.0	10.0	69.8
	Aladaweia	40	10.0	10.0	80.0
	Kareiba males	40	10.0	10.0	90.0
	kareiba females	40	10.0	10.0	100.0
	Total	400	100.0	100.0	

Table (3.8) demonstrated that the number of males and females participate in the study were equal (50% males and 50%females).

Table (3.8) showed frequency of gender .

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	200	50.0	50.0	50.0
	female	200	50.0	50.0	100.0
	Total	400	100.0	100.0	

The age grouped was classified to three groups :group (1) (5 – 9years) showed moderate percentage (34.5%), whereas group (2) (9 – 12 years) showed high percentage 47.5%, then group (3) (13 – 16 years) the percentage was72%. (Table3.9)

Table (3.9) Frequency of age group.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5-8yrs	138	34.5	34.5	34.5
	9-12yrs	190	47.5	47.5	82.0
	13-16 yrs	72	18.0	18.0	100.0
	Total	400	100.0	100.0	

The students participated in the study were attending class 1 ,.3 , 5, and 7,the percentage for each class was 25% as shown in table (3.10)

Most of The students who participated in the study washed their hands after playing by water and soap (62%) .whereas 14.5% used water only and about 23.5% don't washed their hands at all .(Table3. 10)

Table (3.10) % of students who washed hands and who do not.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	water+soap	248	62.0	62.0
	water only	58	14.5	14.5
	no or sometime	94	23.5	23.5
	Total	400	100.0	100.0

Most of the students don't know the importance of washing vegetables and fruits before eating ,the study demonstrated that 84.3% don't washed vegetables and fruits ,3.8% replied that they washed it sometimes ,whereas only 12% washed it (Table 3.11)

Table (3.11) Washing vegetables and fruits .

	Frequency	Percent	Valid Percent	Cumulative Percent
No	269	67.3	67.3	67.3
Yes	66	16.5	16.5	83.8
sometimes	65	16.3	16.3	100.0
Total	400	100.0	100.0	

84.8% of the students had latrines in their home ,whereas only 15.3% had W.Cs system (Table3.12)

Table (3.12) Type of lateriens .

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	w.c	61	15.3	15.3	15.3
	lateriens	339	84.8	84.8	100.0
	Total	400	100.0	100.0	

42.5% of the s tudents had domestic animals in their home (cat and dog),12.8% had others animals (such as goats ,sheeps..etc) ,whereas 44.8% hadn't animals at all.(Table3.13)

Table (3.13) Presence of animals in home .

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	cat &dog	170	42.5	42.5	42.5
	others	51	12.8	12.8	55.3
	no animals	179	44.8	44.8	100.0
	Total	400	100.0	100.0	

38.5% of the students were infected by worms before ,whereas 61.5% were not infected as shown in table (3.14)

Table (3.14) Infection by worms .

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	154	38.5	38.5	38.5
	No	246	61.5	61.5	100.0
	Total	400	100.0	100.0	

From the 154 infected persons ,only 14.5% received treatment and 25.8% did not get treatment .(Table 3.15)

Table (3.15) Treatment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	58	14.5	14.5	14.5
	No	103	25.8	25.8	40.3
	not infected	239	59.8	59.8	100.0
	Total	400	100.0	100.0	

23.3% get reinfection ,whereas 9.8% had successful treatment.(Table3.16)

Table (3.16) Reinfection after treatment.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	93	23.3	23.3	23.3
	no	39	9.8	9.8	33.0
	not infected	268	67.0	67.0	100.0
	Total	400	100.0	100.0	

.

Infection was 58.75% among the students who do not washed vegetables and fruits, and only 9% among who do that. Table (3.17)

Table (3.17) Correlation between washing of vegetables and fruits and distribution of infection:

	not infect	mononio infect	Triple	
No	102	139	96	337
Yes	12	17	19	48
Sometime	7	6	2	15
Total	121	162	117	400

Table (3.18) The mean ,std and std. error mean.

	N	Mean	Std. Deviation	Std. Error Mean
type of animal	400	2.02	.935	.047
wash of vegetables &fruits	400	1.20	.482	.024
type of toilets	400	1.85	.360	.018
washing hand	400	1.62	.842	.042
wearing shoes	400	1.7900	.77291	.03865
place of playing	400	2.4675	1.01317	.05066
Gender	400	1.50	.501	.025
Age	400	1.84	.706	.035
Class	400	4.00	2.239	.112
animals in home	400	1.43	.496	.025
infection by worm	400	1.62	.487	.024
treated of infection	400	2.45	.734	.037
current infection	400	2.43	.850	.042
frequency	400	3.68	.709	.035
school	400	4.78	2.526	.126
wash of hand	399	1.4912	.75973	.03803
infection	399	2.4612	1.40096	.07014
concentration	400	1.9900	.77226	.03861

The correlation between the demographic data (age ,gender and grades) ,the behavioral risks (wear of shoes ,washed of hands ,washed of vegetables and fruits and place of playing) ,environmental behavioral (type of toilets) , living conditions (animals in home) and health status (infection by worms ,treatment ,current infection and frequency) were presented in table (3.19)

Table (3.9)The correlation between the infection and risk factors

Risk factors	P.value	Mean diffrence	95% Confidence Interval of the Difference Lower - Upper
Demographic data			
Age	.000	1.835	1.77 - 1.90
Gender	.000	1.500	145 - 155
Grade	.000	4.000	3.78 - 4.22
Behavioral risk			
Washing vegetables and fruits	.000	1.195	1.15 - 1.24
Washing hands	.000	1.615	1.53 - 1.70
Wear of shoes	.000	1.79000	1.714 0 – 1.8660
Place of playing	.000	2.46750	2.3679 – 2.5671
Environmental behavior			
Type of toilet	.000	1.848	1.81 - 188
Living condition			
Animals in home	.000	2.022	1.93 - 2.11
Health status	.000		
Infection by worms	.000	1.615	1.57 - 166
Treatment	.000	2.452	2.38 - 2.58
Current infection	.000	2.432	2.35 - 2.55
Frequency	.000	3.685	3.62 3.75

Different superscripts indicate significant difference at $p \leq 0.05$

IV. Discussion

Parasitic diseases caused by intestinal parasites are a major public health problem in developing countries of Africa (Bethony, 2006). Majority of these infections with parasites results from low standard of living associated with poor socioeconomic status, poor sanitation, and misdiagnosis of parasitic infections. More than 2 billion people might be infected with helminths, mainly in the developing world (Schneider ,2011) At highest risk of morbidity are pre-school and school-aged children and pregnant women .(Pullan,2012).The nutritional impairment caused by helminthes and intestinal protozoa in Infected children is recognized to have a significant impact on growth and physical development .The study area is an agriculture area in nature and the most farm workers live in poor hygiene areas therefore the parasitic diseases distributed widely among them and the Intestinal parasitism is common among children in developing countries, but the risk factors for infection are not well characterized. ,although the problem is large but no previous study conducted in the study area. ,therefore this study aims to demonstrate the prevalence of common intestinal parasites among school childrens by using different methods, study the epidemiology of common intestinal parasites and to compare between the different diagnostic methods used in the study . The transmission of intestinal parasites depends on the presence of infected individuals, poor sanitation and principally, the socioeconomic and behavioral factors in the population, therefore this study aimed to highlight on the risk factors that associated in the distribution of parasitic infection .

The present study determining the prevalence of infection by common intestinal protozoa among 400 basic school children aged 5-14 years in 10 randomly selected schools in Wad Madanei city, by using different diagnostic method and to access the risk factors that associated in the distribution of these parasites .

Concentration technique gave good results in compare to wet prepration technique ,this due to the fact that wet prepration can missed the parasites if the secretion of the parsites is too low or there is much debris or fat ,these problems solved in formal ether concentration technique which removed the debris ,dissolved fats and increased the concentration of the parasites. The positivity was increased from 64.25% by wet prepration to 75.25% by formal ether concentration technique.This results was consistent with the study done by Dolo et al,(1994) in West Africa (northern Sudan savannah area of Mali),which showed that the formal ether concentration technique is more sensitive , the protozoan cyst rate and the helminths egg rate were 70.3% and 11%, respectively .

According to age ,the study population classified to three groups ,group (1),which ranged between (5 – 8) and group (2) ranged between (9 – 12) showed high infection rate by the two methods,this due to several factors ,firstly, in this age there is high level of soil contact activity ,secondly ,low personal hygiene (hands washing, nails cutting …etc) ,thirdly, most of the students buy their breakfast from the school and according to the check list all these school had not healthy café, finally the environment of all school participated in the study was un clean which lead to spread of infections. Group (3) showed moderate infection (26.75%) in

compare to others groups, this due to that in this aged (adolescence aged) students mostly take care of themselves .This results agree with the results done in south east Neigeria by C Uneke.(2006), but do not agree with study done in Southern Ethiopia 2012 which showed group (2 and 3) had high infection rate . The study population consist of 50% males and 50% females, males showed high infection rate by the two methods (69 % and 99.5%) ,whereas females showed positivity of 64.5% and 87%,this due to that the parasitic infection usually transmitted through contamination , in nature females usually were more clean than males ,also the cleaning status in the females school is relatively high than the males school. This results agree with study done in South-Eastern Nigeria (C Uneke.2006) and study done by E gwunyenga et al,(2005) in Nigeria and another study by Dr. Lorina Ineta Emeka 2013 in Nigeria , but did not agree with study done in Southern Ethiopia by Ashenafi Abossie and Mohammed Seid (2012) ,which showed that the prevalence in females more than males (42% and 38% respectively)

The prevalence of protozoa more than helminths by the two methods in both genders ,these results do not agree with study done in Southern Ethiopia (2012) ,which indicated that the infection by helminths more than protozoan infection.(63.8% and 23.5%).

The prevalence of single and multiple helminths and pathogenic intestinal protozoa species infections Overall, 37.7% of all children had a single species infection, whereas 26.7% had a dual infection and 12.1% harboured three intestinal pathogenic parasite species .This agree with study done in Southern Ethiopia (2012) and another study done by DS Shubha and Farheen Fatima 2011 in India.

Most widespread co-infections were combinations with *Giardia* and *E.coli cyst* (38.25%%), followed by *H. nana* and *Giardia* (26.25%). The most common triple infection was *H. nana*, *E. coli* and *G. intestinalis* (12 .25%).

The high infection prevalence of worms caused by H.nana (34.75%) ,this may due to the mode of infection by this worm (internal infection , autoinfection and it did not need intermediate host).this agree with study done by Barbara Matthys in western Tajikistan (2011), but did not agree with the study done in Southern Ethiopia (2012),where high infection caused by Ascaris lumbercoides.

The high prevalence of protozoa caused by the non – pathogenic protozoa E.coli (21%).The infection by Giardia was 20% ,the prevalence was high in males in compare to females ,this due to that the main source of infection in Giardiasis is contamination of water and the source of water in males school is more contaminated than females schools.This agree with study done by Barbara Matthys in western Tajikistan (2011), but did not agree with study in Southern Ethiopia (2012),which showed that the high infection caused bt E.histolytica and high prevalence in females.

The study showed there is a strong relation between the school environment and the prevalence of parasitic infection **,** The environment status of Al sheima and Al adwia (basic school for females) were similar in the level of cleaning , source of water ,no animals, prescence of health education ,all this factors reflect on the that these school showed low distribution of parasites in comparison to other schools (the percentage of parasites were 49%and and 60% respectively). Shigiddi and A.A.aziza had almost the same environment, , (source of water, level of cleaning ,health education and so on) but they showed high percentage of parasites (85% and78%),this due to that these school for boys and as showed previously they do not take care of health .The environment of the industry school. Attra basic school for boys ,attra basic school for girls ,Al kareeba basic school for boys and Al kareeba basic school for girls were the top of badness ,there were very dirty even the teachers office , the source of water were Aziar (only 2) and pipe lay on the ground ,there is no health education ,no café and the students looked unhealthy ,therefore they showed high percentage of parasitic infection (97.5% ,98,78% ,80% and 88%) .This results agree with the study done in Northern Ethiopia (2012) ,which showed that there was strong relation between the status of cleaning and spread of parasitic infection.

According to the questionnaire ,there was relationship between behavioural risks (i.e. personal hygiene such as hand washing and food consumption), environmental sanitation and living condition characteristics (i.e., latrine system, and presence of domestic animals) and the rate of infection .The infection was high among those who do not washed their hands after playing than who did that (46% and 17.5% respectively) , this due to that soil suspected to be contaminated and most parasitic infection its mode of infection through contamination of food or water. The infection high among those who do not washed vegetables and fruit before eating (58.75%) this due to that these were contaminated food. Prevalence of infection was more high in those who had animals ,because animal is a source of infection. The prevalence of infection increased in those who had traditional latrines than those who had W.Cs (61.5% and 8.5%) ,this due to that the possibility of spread of infection through using of latrines more higher than using of W.Cs,this agree with study done by Dolo (1996) who showed that improvement of sanitation reduced the spread of parasitic infection .

Semi quantative Kato – kat technique was done to some of the faecal samples, in general the intensity of ova was not high ,the highly intensity record from basic school for males (167 ova /gram) .The differences between males and females was not significant .This results agree with study done by Barbara Matthys in

western Tajikistan (2011) which showed that All infections were of light intensity and there was no statistically significant difference in infection intensity between boys and girls.

V. Conclusion

- Study population showed high rate of gastrointestinal parasites .
- Prevalence of gastrointestinal parasites are higher in those who used traditional latrines ,had animals in home ,who do not washed vegetables , fruits and hands after playing .
- The prevalence of gastrointestinal parasites higher in males than females.
- Absence of health education in the school play an important role in the distribution of gastrointestinal parasites among school children.
- The badness of the school environment is an important factors in the distribution of gastrointestinal parasites among school children.
- Formal ether concentration technique is the superior method in identification of parasitic infection ,but combination between wet prepration and concentration technique is the best method for correct diagnosis of gastrointestinal parasites.
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VI. Recommendations

- Improvement of health education in schools will reflect on reducing of gastrointestinal parasites
- Used of wet prepration and formal ether concentration technique to diagnose intestinal parasites will give good results.
- Routine examination for gastrointestinal parasites and STHs should be done for school children to discover the problem early and dissolved it .
- H.nana showed high rate therefore further investigations are needed to determine whether *H. nana* represents a public health problem among the school children.
- Improvement of sanitation and water supply in schools and home will reduce the spread of intestinal parasites.
- Study the risk factors of gastrointestinal parasites and STHs and how to control it .
- This study is the first study done in the study area ,therefore further study should be done .

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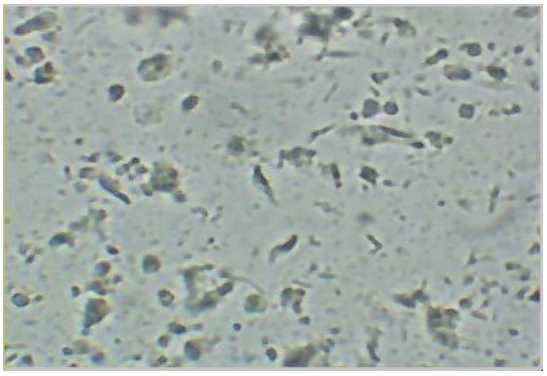
Appendices



Figure(3.12) *Giardia lamblia* trophozoite (spoon shape).Normal saline smear, x40 ,photo by N.H.Osman

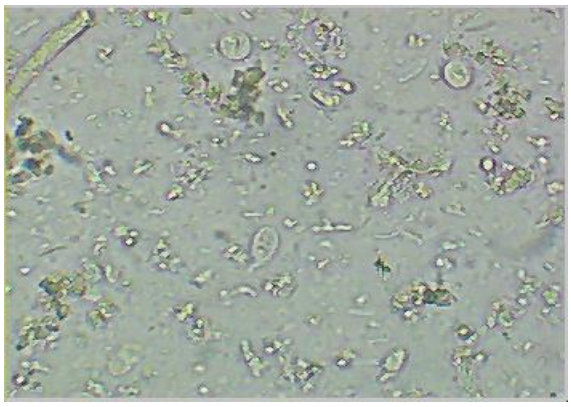
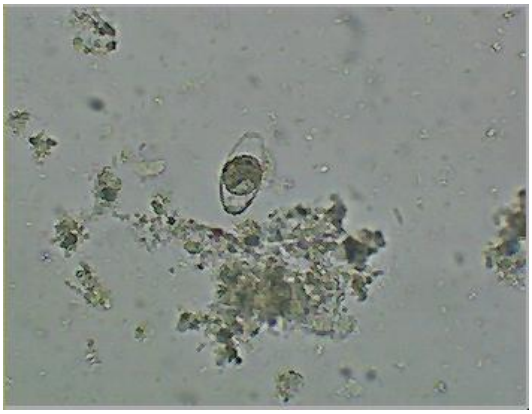


Figure (3.13) *G.lamblia* trophozoite and cyst .Normal saline smear, x40 ,photo by N.H.Osman



***Isospora belli* immature cystFigure (3. 14) *Isospora belli* immature cyst .Normal saline smear x40, photo by N.H.Osman**

Figure (3. 15) *E. vermicularis* ova .Normal saline smear x40 ,photo by N.H.Osman

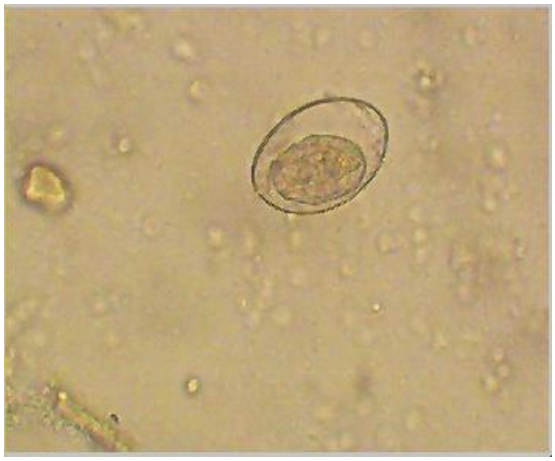


Figure (3. 16) *A.lumbercoides* ova .Normal saline smear x40 , photo by N.H.Osman

Figure (3. 17) *H.nana*ova .Normal saline smear x40,photo by N.H.Osamn

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