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HEALTH EDUCATION INTERVENTION TO SECONDARY SCHOOL STUDENTS ON FOOD-BORNE PARASITES, TREATMENT AND PREVENTION

By

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Abstract

Food-borne parasites (gastrointestinal parasites) are one of the global public health problems that greatly infect children particularly in developing countries. This study evaluated the effect of health educational intervention to secondary school students on food-borne parasites. Design: A quasi experimental research design. Setting: The study was conducted at the governmental secondary school, Cairo Governorate. Sampling: A multistage cluster random sample of 188 students was divided into 2 groups; G1: Control (n=88) received only standardized anti-parasitic treatment and G2 examined (n=100) subjected to health education program and standardized anti-parasitic treatment. Tools: 1- Morning macro & microscopic stained stool examinations. 2- Interview questionnaires & 3- Observational checklist for personal hygiene. The results showed parasitic prevalence of 38.0%; in a descending order of abundance were *Enterobius vermicularis, Hymenolepis nana, Ascaris lumbricoides, Giardia lamblia* and then *Entamoeba histolytica/dispara* and a single case of *Blastocystis hominis.* Parasitic risk was more or less a socioeconomic status, significant differences among them as to knowledge, health attitude, and personal hygiene after the program implementation. Albendazole® treated all infected students, but two enterobiasis cases needed repeated course and follow-up tests after among intervention group.

Key words: Schoolchildren, Food-borne parasites, Health education, Treatment

Introduction

Food-borne parasites is a problem differed from those of importance globally, requiring targeted surveillance, intervention measures, and preparedness planning that differ from a country to another (Morsy *et al*, 2023). Gastrointestinal helminthiasis and protozoa cause a significant health problem with increased morbidity and, to some extent, mortality globally, but common in the developing countries (Ahmed, 2023). Generally, the food-borne parasites affect children more than adults lead to malnutrition, mal-absorption, mental & growth retardation, and learning disorders, especially in poor rural areas (Elmonir *et al*, 2021). WHO (2017) recommended preventive chemotherapy especially regular anthelmintic drugs deworming, for school-children in helminth-endemic areas improved their overall health. But, anthelmintic resistance was a serious challenge worldwide, proper using of existing anthelmintic and reducing dependence on treatment, which must be implemented to reduce the zoonotic infections in the pets and farm animals (Fissiha and Kinde, 2021).

No doubt, majority of food-borne parasites are zoonoses from cattle (Haridy *et al*, 1999), poultry (Anh *et al*, 2010), fish & crabs (El-Sayed *et al*, 2019), and pet dogs (Sabry *et al*, 2012), cats (Sabry *et al*, 2013), and pet horses, donkeys and mules (Morsy *et al*, 2014).

In Egypt, students aged 5-15 years old were 37.7% of total population (UNICEF, 2000), but from 6-12 years were 7.446 million and aged from 0-14 years were 32.7% (male/female=13,725,282/13,112,157) of total population (CIA, 2011). Also, in Egypt, there was a relatively high rate of intestinal parasites, mainly in a rural area with polluted water and the risk soil transmitted parasites (El-Wakil *et al*, 2023). Health education among school children are a major mean to control the soil transmitted parasites, by increasing awareness on hand-washing and other infection control

measures to avoid the parasitic risk complications (Garn *et al*, 2022). Nowadays, the neglected tropical diseases (NTDs) have become important public health threats requiring the multi-faceted control interventions to minimize morbidity and even mortality in the poor communities (Oyeyemi *et al*, 2024).

The present study aimed to evaluate the effect of health educational intervention to school students on food-borne parasites in Greater Cairo by: 1- To assess food-borne parasites among mixed secondary school students, 2- Plan & implement a health education intervention of food-borne parasites to improve knowledge and health habits, 3- To treat positive cases, & 4- To evaluate health education intervention on knowledge, health habits and food-borne parasites.

Hypotheses: 1-After the intervention implementation a significant improvement in childrens' knowledge, personal hygiene and health habits to food-borne parasites was achieved. 2- There was a decrease of parasitosis among them by appropriating treatment and implementation of the program.

Materials and Methods

Setting: The study was conducted in mixed primary school (188), in the rural area, the Greater Cairo Governorate.

Sampling: Multistage cluster random sampling was used to select schoolchildren having the following inclusion criteria: registered in 4th grade, both sexes, and parents' oral consent was taken before conducting the study. Children enrolled were divided randomly into 2 groups: GI (n=88): Control received only standardized anti-parasitic treatment and GII (n=100): Given health education intervention and anti-parasitic drugs.

Sample size: Epi-info computer software package version 6, calculated the sample as the following: frequency among exposed population was 32.0% practiced hand washing, 52% didn't practice hand washing among children with parasites and 80% study power, 95% confidence interval. Sample size was 209 with 10-15% added considered as dropout to study sample.

Students were assigned and randomly divided into two groups: 1- A control (n=88): Given only massively Albendazole and 2- Educated ones (n=100): Given health education intervention & Albendazole and followed up for curity.

Data collection was carried out as followed: First one was stool analysis and checking medical sheet (health insurance record) was done before and after program implementation to examine parasites among them (G11).

Second one was questionnaires (pre/posttest) of 3 parts. Part I: Entailed 22 closed-ended questions; 10 for the socio-economic data (name, age, sex, parents' education and occupation, crowding index…etc.), and 12 for house data (electricity, tape water, sewage… etc.). Part II: Assessed their knowledge on food-borne parasites (mode of infection, clinical manifestations, prevention, and treatment… etc.). It included 7 close ended questions on causative agent, signs and symptoms, data source and general knowledge, and 4 open ended questions on mode of transmission, risk factors, hand washing, prevention and treatment (from 23-34). Part III: Assessed student personal hygiene (bathing, hand-washing…etc.). It included 21 closed ended questions, presented in 3 answers; never, sometimes and always (from 35-55) and then observation of personal hygiene of 6 specific closed ended question (from 56-61).

Scoring system for assessing questions was correct & complete answer scored two, incomplete one or didn't know/wrong answer scored zero except for questions 24, 28, & 33; as one & zero fitted for right and wrong answers respectively. Total score was 19. A total score of $\geq$75%, 50-74% & <50% was respectively good, averaged and poor knowledge level.

Scoring system for habits assessment questions was as follows: zero for never, one for occasionally and two for always. Total score for questions were 46 grades, and a total score equal to or more than 50% was a good level while that below 50% was as bad one.

Scoring system for personal hygiene: Assessed questions were scored as: zero for not correct appearance and one for correct appearance. Questions total score was 7 degrees,

>50% & <50% was yes (good) and no (bad) personal hygiene levels.

Statistical analysis: Data collected, tabulated, and analyzed by the statistical package for social sciences version 23.0 (SPSS Inc., Chicago, Illinois, USA). Data were expressed as M ±SD, medians, ranges, frequencies, & %. Variables were checked for normality by Shapiro-Wilk test and more than two categories by ANOVA test. Post-hoc test was calculated by Tukey's corrections for pairwise compared between both groups. If P value <0.05, it was considered significant.

Ethical approval: The protocol was approved after Helsinki declaration (WHO, 2024) official letters were addressed to the Public Health Medical Authors, and Head-master was informed about date and time of the study, aim was also explained to parents, who signed approval for students to participate.

Health education intervention questionnaires were given in four simple talks to children, whom was divided into four groups, each one attended four talks, of 30-40minutes.

Health intervention contained three phases: 1- Preparatory phase used the revised tools on the food-borne parasites general knowledge. 2- Developed program to implement knowledge and attitude of treatment and prevention covered the following: a- Different food-borne parasites, prevention and personal hygiene. b- Methods were talks, discussion, data-show and teaching media. 3- Education's evaluation after implementation for knowledge level and personal hygiene post-education & follow-up.

Results

Students were 56.4% males & 43.6% females. Mothers' education 31% & 57% were illiterates or primary or secondary or more compared to 42.0% & 46.6% in control respectively, mothers' work, 62.0% & 19.0% were housewives and employees as compared to 52.3% & 23.9% in control respectively, 27% & 37.5% were of low social media. Personal hygiene education program was significantly increased their knowledge.

Data were given in tables (1, 2, 3, 4, 5, & 6), and figures (1, 2, 3 & 4).

Table 1: Socio-demographic data of children (n= 188)

Socio-demographic data	G1(n=88)	%	G2(n=100)	%	Total	%
Male	45	51.1	61	61.0	106	56.4
Female	43	48.9	39	39.0	82	43.6
Mother education: read and write	37	42.0	31	31.0	68	36.2
Primary	5	5.	6	6.0	11	5.9
Secondary/Diploma	41	7	57	57.0	98	52.1
University/&higher	5	46	6	6.0	11	5.9
Father education: read and write	28	31.8	26	26.0	54	28.7
Basic education	8	9.	1	1.0	9	4.8
Secondary/Diploma	46	1	61	61.0	107	56.9
University/&higher	6	52.3	12	12.0	18	9.6
Mother work: Housewife	46	52.3	62	62.0	108	57.4
Farmer	21	23.9	19	19.0	40	21.3
Employee	21	23.9	19	19.0	40	21.3
Father work: Technical work	38	43.2	36	36.0	74	39.4
Employee	50	56.8	64	64.0	114	60.6
Children number: 1-2	24	27.3	23	23.0	47	25.0
3-4	54	61.4	68	68.0	122	64.9
5±	10	11.4	9	9.0	19	10.1
Average family income : Satisfactory	21	23.9	23	23.0	44	23.4
: Just enough	40	45.5	34	34.0	74	39.4
: Not enough	27	30.7	43	43.0	70	37.2
Socioeconomic level: High	28	31.8	45	45.0	73	38.8
: Middle	27	30.7	28	28.0	55	29.3
: Low	33	37.5	27	27.0	60	31.9

Table 2: Health habits level and scores.

Habits level	Pre test		Post test		Follow up		Pre-post	Pre-follow up	Post- Follow up
	No.	%	No.	%	No.	%			
Yes	35	35.0	96	96.0	96	96.0	p< 0.000	p< 0.000	--
No	65	65.0	4	4.0	4	4.0	$X^{2=}$ 79.65	$X^{2--=}$ 79.65	X^2
M±SD	26.6600±2.9754		35.8300±3.8140		35.5900±4.2333		t:18.98, P:0.000	t:17.28, P:0.00	t:0.42, P:0.67

Significant difference (p=0.000).

Table 3: Personal cleanliness level and scores.

Habits level	Pre-test		Post-test		Follow up		Pre-post	Pre-follow up	Post- follow up
	No.	%	No.	%	No.	%			
Yes	50	50.0	93	93.0	97	97.0	P 0.000	P 0.000	P 0.33
No	50	50.0	7	7.0	3	3.0	X^2 43.28	X^2 54.32	X^2 1.68
M±SD	4.5800±0.9968		5.6500±0.7961		5.7700±0.5291		t:804, P:0.000	t:10.64, P:0.000	t:1.27, P:0.20

Table 4: Health habits level, and scores of control (n=88).

Habits level	Pre-test		Post-test		Follow up	
	No.	%	No.	%	No.	%
Yes	37	42.0	37	42.0	37	42.0
No	51	58.0	51	58.0	51	58.0
mean± SD	27.1705±3.6929		27.1705±3.6929		27.1705±3.6929	

No change in total level of personal habits among control group throughout program.

Table 5: Personal hygiene level, and scores of control (n=88).

Habits level	Pre test		Post test		Follow up	
	No.	%	No.	%	No.	%
Yes	63	71.6	63	71.6	63	71.6
No	25	28.4	25	28.4	25	28.4
mean± SD	4.8750±1.1628		4.8750±1.1628		4.8750±1.1628	

Significant improved total satisfactory level of personal cleanliness in control.

Table 8: Correlation matrix between knowledge on parasites, health habits and personal hygiene.

Variables	Stage	Knowledge	Health habits	Personal hygiene
Habits	Pre-test	R=0.125, P=0.215	-	-
	Post-test	R=0.50, P=0.000	-	-
	Follow-up	R=0.44, P=0.000	-	-
Personal hygiene	Pre-test	R=0.058, P=0.56	R=0.94, P=0.350	-
	Post-test	R=0.149, P=0.140	R=0.027, P=0.791	-
	Follow-up	R=- 0.085, P=0.401	R=0.075, P=0.460	-
Prevalence	Pre-test	R=-0.22, P=0.02	R=- 0.48, P=0.000	R=-0.10, P=0.310
	Post-test	R=-0.321, P=0.001	R=- 0.248, P=0.013	R=-0.355, P=0.000

Discussion

After stool analysis and distribution of food-borne parasites among the students sample, there was a higher prevalence of parasitic food borne infection for educated group than the control group with an overall percentage of parasitic infections accounting for more than half before the program implementation. This more or less agreed with the UNICEF (2000); Egwunyenga and Ataikiru (2005); Houmsou, *et al.* (2010), who reported a prevalence of 57.70% & 58.5% parasitic infection among Nigeria schoolchildren respectively, Escobedo *et al.* (2008), who reported that the overall prevalence of intestinal helminthes was 59.5% in Pinar del Rio, Cuba and with Mehraj *et al.* (2008), who in Pakistan reported prevalence of 52.8%.

The present study showed that food-borne parasites rate was less than that reported by Egyptian authors, which was 60.2% in Tamouh (Shalaby *et al*, 1986); 88.5% in Demo village (El-Gammal *et al*, 1995); 84.6% in Gharbia primary school (Abo Al-Azm *et al*, 1997). El Shazly *et al.* (2006) in Mansoura City reported that parasites in a descending order were *H. heterophyes* 6.4%, *E. vermicularis* 3.9%; *H. nana* 2.2%; *S. mansoni* 0.5%; *T. colubriformis; S. stercoralis* and *F. gigantica* 0.2% of each, and *T. saginata, A. lumbricoides*, and *T. trichiuris* was 0.1% of each. Yones *et al.* (2019) in Assuit rural areas reported that the prevalence of gastrointestinal parasites was 56.3%, which were *A. lumbricoides* (11.4%), *G. lamblia* (10%), *E. coli* (9.7%), *A. duodenale* (8.7%), *E. histolytica/dispar* (8.1%), *C. parvum* (3.3%), *B. hominis* (2.4%), *E. vermicularis* (1.7%) and *H. nana* (1.1%). A single parasite was in 64.8% of children. 23.1% & 12.1% had double and multiple parasitic infections respectively.

Abroad, the prevalence of food-borne parasites in Syria was 67.6% (Shhadah and Dubush, 2007), in Pakistan was 66% (Ullah *et al*, 2009), and in Sudan was 90.4% (Abdel-Aziz *et al*, 2010). The prevalence of food-borne parasites was higher than in Gharbia Governorate urban squatter areas which was

35.2% (Yassien *et al*, 1996); 31.5% (Mahfouz *et al*, 1997), but 29.2% Zagazig City (Wafik *et al*, 2007). In Minia Governorate, 29.3% & 34.25% were reported (Ibrahium, 2011). In Damietta Governorate, Mohammed *et al*. (2012) reported 30.7%. In Sohag Governorate, El Masry *et al*, (2007) reported 38.5% and in Dakahlia Governorate, Amin, (2007) reported 37.31%.

Abroad, in Turkey prevalence of food-borne parasites were 31.0% (Ostan *et al*, 2007). In occupied Palestine from 32.0% to 41.5% were reported (Bdir and Adwan, 2010). WHO (2020) reported that about 24% of the world population were infected with soil-transmitted helminthes, whereas over three bill-ion were infected with parasites but without any clinical symptoms.

In the present study, after health education and treated, the prevalence of the food-borne parasites markedly decreased from 63% to 35.0% with a 28.0% reduction, but in controls the prevalence decreased from 46.6% to 37.5% with a minimal of 9.0% reduction. The decrease in prevalence rate of food-borne parasites was significant in the intervened group, while the decreased in control was not significant (z=0.94, p=0.34). The difference between both groups was highly significant (0.000). Thus, health education intervention decreased prevalence of food-borne parasites among intervened children was more or less justified. This agreed with Kotb *et al.* (1998) in Egypt who reported a parallel significant reduction of schistosomiasis infection in the intervention schoolchildren. Kanoa *et al*. (2006) in Gaza Strip found that the prevalence of intestinal parasites among school children aged 6-11 years old decreased from 21.5% to 5.1%, but was 3.4% in patients received treatment only and 1.62% in those both received treatment and health education, with higher significant difference. This agreed with Abu-Mourad (2006), who reported that at the environmental health awareness program beginning, prevalence of intestinal parasites and diarrhea was 29.8% &13.7% respectively, and decreased after the environmental health awareness progr-am. WHO (2003) reported that over 3 billion people worldwide suffered from one or more parasites, which were widespread and led to morbidity and mortality among population.

In the present study, boys recorded higher prevalence of parasitosis than girls but without significant difference. This was not surprising, especially when one noticed that both sexes live in same community and sharing daily activities as farming and/or fishing. This agreed with Bayoumy *et al*. (2016), and El-monir *et al.* (2021).

In the present study, the mother education was of low level and social class of primary schoolchildren significantly affected parasitic prevalence. This agreed with Pinar *et al*. (2004) in Turkey; El-Masry *et al*. (2007) in Upper Egypt; Amin (2007) in Lower Egypt, but disagreed with Corrales *et al*. (2006) in El Salvador, who reported that maternal literacy and education was not significantly associated with prevalence of rural parasites.

In the present study, the majority of parasitic infected children's mothers were housewives or farmers but without significant differences. Egwunyenga and Ataikiru (2005) in Nigeria didn't find relationship between infections intensity and wasting, but children with high infections intensity were more stunted than others. WHO (2019) declared that an acceptable level of health for all people worldwide by the year 2030 can be attained via a fuller and better use of the world's resources, a considerable part of which is now spent on arments and military conflicts. A genuine policy of independence, peace, détente, and disarmament could and must release additional resources that could well be devoted to peaceful aims and in particular to the acceleration of social and economic development of which primary health care, as an essential part, should be allotted its proper share. A community health assessment gives organizations comprehensive information about community's current health status, needs, and issues, which can help develop a community health improvement plan by jus-

tifying how, and where the resources must be allocated to best meet community needs (CDC, 2024).

In the present study, level of the students' knowledge by the program showed that their total score level was poor in most of them in the pre-test. This agreed with Jay and Govenlock (2004), who reported that the presence of significant gap in food safety knowledge of many participants surveyed. Also, this agreed with Osaili *et al.* (2021), who in Jordan found that University Students had insufficient knowledge, attitudes and practices scores concerning trend during the COVID-19 Pandemic. But, the present study showed significant in knowledge improvements after program implementation and follow up tests among them, so that the majority had middle score level in pre-test while the great majority more than middle and high score level respectively in the second test with slight increase in the follow up test, which proved that after implementation of health educational program there was a significant knowledge improvement. Minda *et al.* (2024) in Ethiopia reported that students magnitude of good self-hygiene was 59.2% (95% confidence interval was 55.1-63.0), and proportion <50% in latrine use (62.5%), regular handwashing (55.4%), and oral hygiene (55.2%) practices. However, they added that a considerable proportion of elementary school students in Fiche had score poor personal hygiene practice.

In the present study, students two-thirds practiced low level of health habits compared to one-third had good level with significant improvement post program implementation and most of the intervention ones had good level in health habits as well as personal hygiene at post and follow up tests with also slight increase in follow up test, but in controls, there was insignificant change or improvement in their knowledge and personal hygiene. This agreed with Kotb *et al.* (1998), they in Qualyobia Governorate reported significant improved in students' knowledge and attitude scores of intervention schools of levels I & II a year after the health education program. Kanoa *et al*. (2006) and O'Reilly *et al*. (2008) found that the health education program improved students' knowledge and attitudes. Mwanga *et al.* (2015) in Tanzania reported that despite criticisms, after implementation of a participatory hygiene and sanitation behavior proved to be useful in empowering authorities to control polluted water, sanitation, and hygiene related to infectious diseases. Eriksson *et al*. (2022) reported that females generally practice better personal hygiene than males related to human culture. Albani *et al.* (2024) in Sudan reported that scores of school children had significantly better knowledge and practice scores after an oral health education program. They added that giving theoretical and practical lessons on oral and dental health in school curricula can motivate them to maintain oral health care, and improved the oral health status.

Conclusion

There was significance in total level of knowledge, personal cleanliness, health habits and food-borne parasites rate after program implementation in post and follow up tests in interventions only with slight increase in follow up of knowledge, self-cleanliness and health habits without change in control.

Factors significantly affected prevalence of food-borne parasites was the low levels of both mother education and primary schoolchildren.

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Recommendations

To improve to pre-school and school aged children public health is a must:

1- Periodic stool and urine examinations for of them at the beginning of each academic year for early detection and proper treatment of food and water borne parasites. 2- Health

education about hygienic behaviors and cleanliness should be at the school based clinic. 3- Educating the schoolchildren about the mode of transmission of food & water borne parasites, treatment and prevention. 4- Illustrative posters on mode of transmission of food & water-borne parasites must be in all schools. 5- Improving environmental conditions affecting food & water-borne parasites as well as arthropod-borne infectious diseases under the world climatic changes must be in mind of the Public Health Authorities.

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Explanation of figures

Fig.1: Pre- and post-health education intervention (mean score) of food borne parasites in patients (n=100)
Fig. 2: Pre- and post- intervention prevalence of food borne parasites in control (n=88)
Fig. 3: Total knowledge score of study Significant improvement about parasitic food borne diseases by program p=0.000
Fig. 4: Mean total knowledge scores of patients and control groups.