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Prevalence and Risk Factors Associated with Intestinal Parasitic Infections among School Children in Gashky, West of Iran

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Abstract

Background

Parasitic intestinal infections (IPIs) represent as the greatest cause of illnesses and diseases worldwide, especially in less developed countries. People of all ages are affected by IPIs; although, children are the most affected. This study aimed to assess prevalence and risk factors associated with IPIs among school children in West of Iran.

Materials and Methods

This cross-sectional study was conducted on 200 school children who selected randomly among 390 attending health care centers in Gashki, West Iran in 2016. This study we used a validated questionnaire and stool tests to gather epidemiological and disease data. The samples were examined for the presence of the parasites by direct wet mount, Lugol's iodine solution and modified formaline-ethyl acetate sedimentation methods. Chi- square and binary logistic regression procedure was applied to test the association between the variables. A p-value of <0.05 was considered significant.

Results

The mean and standard deviation of children ages were 10.7±2.29 years old. The overall prevalence of the IPIs was estimated at 66 (33.0). The highest prevalence of the IPIs was related to Blastocystis 35 (17.5%), and Giardia lamblia 22 (11.0%), respectively. 18 (9.0%) out of 66 infected children had double infection. Male gender (Adjusted odds ratio (AOR): 2.20 95% Confidence Interval (CI): 1.19-4.09) was only factor significantly associated with the prevalence of the IPIs in this population.

Conclusion

The present study found a high rate of prevalence of parasitic intestinal infections among school children in Gashky, West of Iran. The current study highlights the importance of testing for intestinal parasites in children aged school, and emphasizes the necessity of school-based prevention and control programs.

Key Words: Children, Intestinal disease, Iran, Parasites, Prevalence, Risk factors.

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1- INTRODUCTION

Intestinal Parasitic infections (IPIs) represent as the greatest cause of illnesses and diseases worldwide, especially in less developed countries. People of all ages are affected by IPIs; although, children are the most affected (1-3). The evidence is strong that children living in low and middle income countries are likely to be suffering from baseline IPIs, especially among the poorest sectors of rural communities (4, 5).

Overall, IPIs are associated with lack of sanitation and safe water, poor hygiene, illiteracy, hot and humid tropical climate and especially poverty (1, 2). Intestinal parasites with direct life cycle are transmitted by fecal-oral route to persons (6, 7). These parasites consume nutrients of infected persons and destroy tissues and organs. In addition to the general adverse effects of IPIs, it increases the risk of nutritional anemia, weight loss, aggression, malnutrition and other physical, mental, and intellectual problems (8-10), depending on the host immune status and psychosocial factors (7).

Epidemiological evidence suggests that sanitation facilities, safe water supply, personal hygiene, household income (e.g. hand washing with soap-water before having meal), etc. are effective in preventing IPIs (11). Giardia lamblia is the most common protozoan parasite globally. Approximately 200 million people being currently infected to giardiasis (12, 13). Blastocystis hominis is of the prevalent unicellular protozoan in the intestinal tract of humans and animals (14). Escherichia coli (E.coli), is the most known bacterium commonly causing diarrhea and urinary tract infections. Chilomastix and Butschlii are another common intestinal protozoan and amoeba, respectively which their parasitic status is under debate. According to World Health Organization estimates, approximately 3.5 billion people are exposed, and 450 million are ill as consequences of IPIs, more than half of them being children (10, 15, 16). The burden associated with IPIs is substantial; it is usually related with 39 million disability-adjusted life years (DALYs), economic instability, health deprivation, and social marginalization and all these lead to financial burden on the family and society (17, 18). Therefore, there is a necessity to monitor and tackle this problem time to time in the interest of public health.

The distribution and prevalence of intestinal parasites differs from region to region due to a range of different factors. Hence, assessing the prevalence of IPIs is a prerequisite to formulate the appropriate control strategies for high risk communities and also to predict risk factors. In a country like Iran, the prevalence of IPIs is controversial. On the other hand researches conducted in Iran were mostly performed in urban areas and the prevalence of IPIs in rural communities of Iran remains vague and neglected to a great extent therefore, essential to be addressed appropriately. This study was aimed to assess the prevalence of parasitic intestinal infections and associated factors among children aged-school in a rural community of Western Iran.

2- MATERIALS AND METHODS

2-1. Study population

In the present study, the data was acquired from a public health center in Gashki. Gashki, a big village, with 3,640 inhabitants that 310 of them are children aged-school, in Western Iran, is one of less developed rural community suffering from lack of sanitation facilities (**Figure.1**).

In Gashki, there is a public health center which provides people, especially children, with its primary care services, therefore, a good setting for our study.

Fig.1: The location of Gashki, Kamyaran County, Kurdistan Province, Iran.

2-2. Study design and Sampling

In this cross-sectional study, population was children aged-school attending to Primary Health Care Centers (PHCC) in Gashki, 2016. Participants were selected randomly using simple randomization table. According to a similar previous study that reported a prevalence rate of 22.2% (19), and using a confidence level of 95% and error margin of 5%, and also based on single population proportion formula:

$$Z^2 \text{ p (1-p) / } d^2$$

Where, (**Z** is known as the critical value and a 95% degree confidence corresponds to **α**= 0.05. Therefore, the critical value is Z= 1.96. **P** is known as the prevalence and also **d** is shown as absolute error or precision) for determining sample size, a sample size of 245 was considered to be studied. Total students who were studying in Gashky school were 310. When systematic random sampling method was used, due to large number of non-compliance children, we had to interview approximately with all of them to participate in the study in order to reach target sample size. Finally, the study subjects were limited to 200 school children. In this study, nobody refused the consent.

2-3. Instrument used for data collection

2-3-1. Demographic questionnaire

We established a validated questionnaire based on risk factors and the objectives of study to gather data on socio-demographic characteristics such as gender, age, monthly family income, family size, and socio-economic status. The validation of the questionnaire was examined by 3 experts of epidemiology, heath promoting and public health.

2-3-2. Stool exam

After instruction, each student was given a dry, clean, leak proof plastic container furthermore they were asked to provide a stool sample. All of container was labeled with the child's name, identification number and school name. Likewise, children or their parents were guided on how to collect the sample. In proper hygienic and bio-safety condition, stool samples were obtained from all participants and kept at 4 ° C.

Within four hours after collection, the stool specimens transported to the central laboratory at Sanandaj University of Medical Sciences. First, at all samples were macroscopically examined for color and consolidation. In the next step, they were studied for the presence of the intestinal parasite cysts, eggs, trophozoites and larvaes using direct wet mount, Lugol's iodine solution and modified formaline-ethyl acetate sedimentation methods. In the laboratory, slides directly were prepared for wet mount in saline and also in iodine afterward they were microscopically examined initially under low power (10.10 magnification) bright fields then under high power (40.40 magnification) bright field. Finally, the samples were concentrated using formol-ether acetate technique according to the standard guidelines (20) and then the iodine stained slides were applied and again examined microscopically.

2-4. Data analysis

All data analysis was performed using statistical package for social sciences (SPSS statistical software (Version 16.0; IBM Corporation, Chicago, USA). The categorical variables were summarized as frequency and percentages and also normally distributed continuous variables were reported as means and standard deviations. Chi- square was used to test the association between the variables.

To identify factors associated with IPIs, Binary logistic regression procedure was employed, finally the association between independent variables and dependent variables were describe on the basis of odd ratio (OR) with 95 % confidence interval (CI). We also categorized school children into two age groups (i.e. 7-11 and 12-14 years) to identify if the elder children had been more affected by two parasites than the young subjects. So, Chi-square test was also used to evaluate the association between age and double infection prevalence. The level of statistical significance was considered at $P<0.05$.

2-5. Ethics approval

The Research Ethics Board of the Deputy of Research of the Kermanshah University of Medical Sciences (KUMS) approved the study protocol (project registration number: 95117). Participants were given adequate information about purpose and importance of study. The written consent was obtained from the study participants and also their personal information was kept confidential.

3- RESULTS

Table.1 reports the Sociodemographic characteristics of study population. The mean ± standard (M±SD) age was 10.7 ± 2.29 years (range: 7–14 years old). One hundred (50.0%) participants were between 7 and 10 years of age and half of them were male. About 45.5% of the households had moderate Socio-economic status (SES) status and most family size was 4 ≥ (54.5%). Details are shown in **Table.1**. (*Please see the table at the end of the article*).

The overall prevalence of the IPIs was estimated at 33.0 %, i.e. 67 positive out of 200. Blastocystis hominis, being the most common IPI, was present in 35 samples (18.0%) followed by Giardia lamblia present in 22 samples (11.0%), Escherichia coli in 16 samples (8.0%), Butschili in 8 samples (4.0%), and Chilomastix mesnili in 2 samples (1.0%) were identified from the stool samples **(Table.2)** (*Please see the table at the end of the article*).

Double infection prevalence was 18 (9%). Intestinal double parasitism was more prevalent among children aged in 12-14-year group than 7-11-year group. Chi-square test showed a statistical significant difference between two age groups and double infection prevalence (P-value <0.05). **Figure.1** shows that 11 (61%) out of 18 double infected children are in 12-14-year group, compared to only 16 (33%) out of 48 mono infected children who were in 7-11-year group (**Figure.1**). (*Please see the figure at the end of the article*).

Table-3 presents factors associated with intestinal parasite infections in study population. After adjusting for other variables, male gender was only factor significantly associated with intestinal parasite infections (P=0.017, Adjusted odds ratio =2.20, 95% CI= 1.19-4.09). There was no significant association between intestinal parasite infections and age, Socio-economic, and family size (P≥0.05). (*Please see the table at the end of the article*).

4- DISCUSSION

This study aimed to assess the prevalence of parasitic intestinal infections and associated factors among children aged-school in a rural community of Western of Iran in 2016. Our finding demonstrated that 33% of children were infected with one or more intestinal parasites. These results are similar to 31.8% prevalence rate reported from Aydin state, Turkey in 2004 (7), 34.2% reported from Gondar state, North West Ethiopia in 2013 (21), and 33.0% prevalence rate reported from Sari state, Northern Iran in 2012 (22). However, they are lower than prevalence rate reported for IPIs from other similar studies (23-27).

In the current study, the highest prevalence of intestinal parasite was related to belastocysits and followed by Giardia lamblia, respectively. These finding were in line with studies conducted by Barazesh et al. (28), Rostami et al. (29), Daryani et al. (22), and Turki et al. (30). In contrast, different infection patterns have been found in few studies within our country. In studies conducted in Zanjan and Urmia (Iran), for example, the highest prevalence of intestinal parasite was related to another protozoa such as Entamoeba coli, Chilomastix mesnili, and Oxyur (31, 32).

In understanding these variations, it may be due to differences in climate, geographical, and demographics characteristics, socio-economic and educational status of communities, diagnostic techniques used, the quality of water source, etc. In recent study conducted in center of province of Kurdestan- Iran, the urban area of same setting, the most prevalence of IPIs among school children was associated to belastocysits (24.2%). In contrast, only 3.2% children were affected by Giardia lamblia in urban area of Kurdestan (33).The difference of prevalence of the Giardia lamblia in urban and rural area of Kurdestan is likely related to household pet contact in rural area, especially with dog, as a study on associated risk factors of Giardia has confirmed this correlation (34). Although belastocysits prevalence rates are generally related to water source (urban and rural), and contact with animals (35), when we compared Bahmani's study with our study, the rural setting in our study had a lower rate of prevalence than the urban area. This discrepancy may be due to finding source of exposure is very difficult in these cases, because people flows frequently run from rural to urban and vice versa.

Contaminated children who were 7, 8, 9, 10, and 11 years old mostly suffered from one parasite. Whereas infected elder children had more than one parasite. So, the age-associated patterns of double infection prevalence were suggested in our study. Another very important finding which has come out from our study is that the prevalence of intestinal parasite infections in males was higher than in females, with a statistically significant difference ($P \le 0.05$). This finding is consistent with the findings of previous studies (36-38). The higher prevalence of intestinal parasites in the male may be due to they usually play outdoors, and occupy in outdoor activities then their female peers which may prepare them to higher risks of IPIs (38).

The prevalence of intestinal parasites infections among 11-14- age-group were slightly higher comparing 7-10 age-group; however, there was no association between age, family size, socio-economic status and prevalence of IPIs ($P \ge 0.05$). However, previous studies confirm that the number of household adults and children were associated with prevalence of IPIs such as Giardia lamblia (39). According to our knowledge, in this population, a relatively high rate of intestinal parasitic infection may be due to lack of awareness, using unimproved sources such as irrigation canals, rivers and unprotected wells as drinking water, simple transmission of parasites (fecal-oral), habits such as swimming in river, living in hillside, lack of access to sanitation facilities and health care (40), and also irrigating farms by sewage-contaminated waters.

4-1. Limitations

The present study has several limitations. Firstly, the sample size was limited. Second, this study was conducted in Gashki in West of Iran and the results of this study are not generalizable to the other geographical regions. Third, we limited our focus on main risk factor and did not examine factors such as Seasonal fluctuations and etc. Forth, some samples were unwilling to participating in the study. Future studies should be done in a larger sample size and greater age group with a longitudinal design to trace the long-term exposure of parasites.

5- CONCLUSION

The present study found a high rate of prevalence of parasitic intestinal infections among school children in Gashky, West of Iran. In this siting, Blastocystis hominis and Giardia lamblia were predominant. Furthermore, male gender being the most important factor associated with prevalence of parasitic intestinal infections. In conclusion, the current study highlights the importance of testing for intestinal parasites in children aged school, and emphasizes the necessity of school-based prevention and control programs. In this population, interventions including mass scale deworming and cure to break the transmission chain, health education to promote personal hygiene, environmental sanitation, and also improve water sources are required. As well as, it is possible that our study be questioned. Our findings provide useful suggestions for healthcare professionals to improve the health and decrease the prevalence of parasitic intestinal infections in school children.

6- CONFLICT OF INTEREST: None.

7- ACKNOWLEDGMENT

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Table-1: Sociodemographic characteristics of study population, Gashki-Iran (n=200)

Variables	Characteristic sub-group	Frequency (%)
Age (year)	7-10	100(50)
	11-14	100 (50)
Gender	Male	100(50)
	Female	100 (50)
Socio-economic status (SES)	Very poor and poor	35(17.5)
	Moderate	91(45.5)
	Good and very good	74(37.0)
Family size	Less than 4 people	109(54.5)
	More than 5 people	91(45.5)
Total		200(100.0)

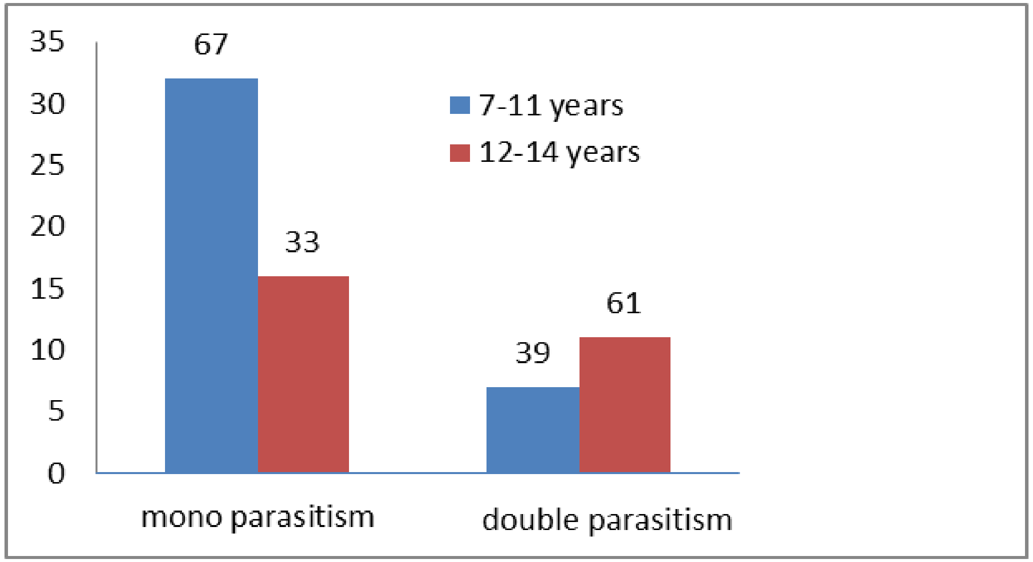

Fig.1: The comparison of mono parasitism and double parasitism according to two age groups of children (%).

Table-2: The prevalence of intestinal parasitic infection in study population (n=200)

Status	Types of parasite	No. of positive (%)	Sex		Age (%)		Socioeconomic status			Family size		Mother's Education Level		
			Male (n= 100)	Female (n= 100)	7-9 years (n= 100)	10-14 years (n=100)	Very poor and Poor (n=35)	Moderate (n=91)	Very Good and Good (n=74)	4≥ (109)	5≤ (91)	Illiterate and primary school (n=176)	Secondary school (n=13)	Diploma (n=11)
Single infection	Giardia	22 (11.0)	11 (11)	11 (11)	11 (11)	11 (11)	1 (0.03)	13 (0.14)	8 (0.11)	12	10	21	0	1
	Blastocyst	35 (17.5)	23 (23)	12 (12)	14 (14)	21 (21)	6 (0.17)	17 (0.18)	12 (0.16)	19	16	32	1	2
	Butschlii	9 (4.5)	6 (6)	3 (3)	2 (2)	7 (7)	1 (0.03)	5 (0.05)	3 (0.04)	4	5	9	0	0
	Chilomastix	1 (0.5)	1 (1)	0 (0)	1 (1)	0 (0)	0 (0.0)	1 (0.01)	0 (0.00)	1	0	1	0	0
	E.coli	17 (8.5)	11 (11)	6 (6)	5 (5)	12 (12)	3 (0.1)	10 (0.11)	4 (0.05)	8	9	15	1	1
Double infection		18 (9.0)	11 (11)	7 (7)	7 (7)	11 (11)	3 (0.1)	10 (0.11)	5 (0.07)	8	10	17	0	1

Table-3: Factors associated with intestinal parasite infections in study population (n=200)

Factors	Prevalence (CI 95%)	Crude OR (CI 95%)	P-value	Adjusted OR (CI 95%)	P-value
Gender					
Male	0.41(0.31-0.51)	2.08 (1.14-3.81)	0.017	2.20(1.19-4.09)	0.012
Female	0.25(0.16-0.33)	Reference		Reference	
Age groups					
7-10	0.28(0.19-0.37)	Reference	0.134	Reference	
11-14	0.38(0.28-0.47)	1.58 (0.87-2.86)		1.71(0.89-3.29)	0.107
Socioeconomic Status					
Poor	0.23(0.08-0.37)	Reference		Reference	
Moderate	0.38(0.28-0.48)	2.11(0.86-5.16)	0.102	2.08 (0.83-5.20)	0.116
Good	0.31(0.20-0.42)	1.52(0.60-3.58)	0.376	1.58 (0.61-4.12)	0.346
Family size					
≤ 4	0.33(0.24-0.42)	Reference		Reference	
≥ 5	0.33(0.23-0.43)	0.99(0.55-1.80)	0.993	0.94 (0.49-1.81)	0.858
Mother's Education level					
Illiterate and primary school (n=176)	35(0.23-0.43)	Reference		Reference	
Secondary school (n=13)	15(0.25-0.42)	0.34 (0.07-1.66)	0.173	0.32 (0.06-1.68)	0.191
Diploma(n=11)	27(0.24-0.39)	0.76 (0.18-2.76)	0.618	0.79 (0.16-2.72)	0.601