

# DISCUSSION

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Globally, the neglected intestinal parasitic infections (IPIs) such as soil-transmitted helminthes (STH) and protozoa infections have been recognized as one of the most significant causes of illnesses and diseases especially among poor communities.<sup>(5)</sup> With an average prevalence rate of 50% in developed world, and almost 95% in developing countries.<sup>(4)</sup> These infections occur with high prevalence among the poor and socioeconomically deprived communities where overcrowding, poor environmental sanitation, low level of education and lack of access to safe water are prevalent.<sup>(59)</sup> These parasitic diseases contribute to economic instability and the poor people of under developed nations experience a vicious cycle of under nutrition and repeated infections leading to excess morbidity with children being the worst affected.<sup>(5)</sup> There are main four types of intestinal parasites can infest children causing several clinical manifestations: nematodes, cistodes, intestinal flukes and protozoa.<sup>(7)</sup>

The ultimate goal of the present study was to improve the health of children aged 6-12 years in Egypt. Specifically, the researcher aimed to estimate the prevalence rate of parasitic infestations in children aged 6-12 years attending Sidi krir family health unit, to determine the most common types of intestinal parasites among those studied children, to reveal the effect of parasitic infestations on child health and to identify the predisposing factors of parasitic infestations among those studied children.

A cross-sectional survey design was used. All children aged 6-12 years and their key informants attending Sidi krir family health unit during 3 months period of the field work were enrolled in the research, those children who refused or their key informants refused to participate and those children who were in emergencies were excluded. The enrolled children and their key informants were interviewed to complete the interview questionnaire, then, the children were clinically examined to complete the clinical examination sheet. The laboratory investigations (stool examination and HB level estimation) were carried out for each enrolled child in the laboratory attached to the studied unit.

As regard **prevalence of intestinal parasitic infestations**, the prevalence of intestinal parasitic infestations among studied children was found to be very high (96.4%). This rate is higher than what was reported by Erdis *et al*<sup>(124)</sup> in a study carried out in a rural area in Ethiopia in the year 2010, where the prevalence rate of intestinal parasitic infestations among children was 83%. That higher prevalence rate in the current study might be attributed to poor environmental sanitation, low economic and educational status of parents and poor personal hygiene among studied children.

On studying **the types of intestinal parasites isolated from infected children**, it was found that *Entrobious vermicularis*, *Entamoeba histolytica*, *Ascaris lumbricoides* and *Giardia lamblia* were isolated, the most prevalent parasite was *Entrobious vermicularis* which was isolated from about two thirds of the stool specimens (63.8%) either single (46.9%) or with other intestinal parasites as *Entamoeba* (12.7%) or *Giardia* (2.3%) or *Ascaris* (1.9%). This rate is much higher than what was reported by Kuman *et al*<sup>(125)</sup> in a study carried out in a rural area in west Turkey in the year 2008 where the prevalence rate of intestinal parasitic infestation among children aged 7-13 years by *Entrobious* was 22.4%. The high prevalence of *Entrobious vermicularis* infection in the current study might be due to improper hygiene including not washing hands with soap after defecation, before eating and before food prepare. The higher prevalence of *Entrobious vermicularis*

infection could also be explained by the highly infectious nature of the parasite. Enterobiasis occurs worldwide, usually involving school-aged children. In general, *Enterobius vermicularis* infection is transmitted by hand to mouth and/or person to person directly. On the other hand, the prevalence rates of *Entamoeba histolytica* and *Giardia lamblia* in the current study were 34.7% and 9% respectively. These rates are much higher than those reported by Cartwright<sup>(126)</sup> in a study carried out in the year 2009 in a rural area in Cuba where the prevalence rates of intestinal parasitic infestations in children aged 6-13 years by those two parasites were 3% and 2.5% respectively. These higher rates might be due to the increased chance of water born infection in the study district (table 1).

As regard **the infestations by more than one parasite**, multiple infections (polyparasitism) occurred in 19.7% of those who had intestinal parasites (table 1), which was higher than what was reported by Legess and Erko<sup>(127)</sup> in a study carried out in a rural area in Ethiopia in the year 2007 where the prevalence rate of double infestations by intestinal parasites in school children was 13.5% of those who had intestinal parasites. The presence of multiple infections might be attributed to presence of multiple risk factors for the occurrence of parasitic infestations among affected children which make the exposure to many parasites possible.

Al-Makhlafi *et al* 2007<sup>(128)</sup> mentioned that there was a web of risk factors associated with high prevalence of intestinal parasitic infestations in children which included age, low family income, inadequate sanitation, presence and close contact with livestock/pets, untreated water supplies, low level of personal education and poor personal hygiene.

As regard **age**, the highest prevalence rate of intestinal parasitic infestations in the current study was in age group 6-8 years, while the prevalence of IPIs in age group 8-10 years was lower (98.8% and 91.3% respectively), with significant difference ( $p=0.03$ ). This may be attributed to the low level of awareness and poor hygienic condition of the lower age group (table 2). That coincides with the results of Lim and Poon 2009<sup>(129)</sup> who demonstrated that the highest prevalence rate of parasitic infestation occurred in age group 5-9 years followed by 9-13 years (76.3% and 63.8% respectively). That result was from a study conducted in a primary school in a rural area in Malaysia.

Regarding **the relation between school attendance and intestinal parasitic infestations in children in this study**, it was noted that all children who had been dropped out from school were infested with one or more intestinal parasites (table 2). this rate is higher than what was reported in a study carried out in a rural area in the western region in Turkey in the year 2009, where 42.2% of children participated in that study were infested with one or more intestinal parasites, 59.5% of children who had been dropped out from school were infested with one or more intestinal parasites.<sup>(130)</sup> This higher rate in the current study reflected low socioeconomic conditions and low awareness with education benefits of the parents whose children enrolled in the study.

On studying **the relation between educational level of the fathers of children and intestinal parasitic infestations** of those children enrolled in this study, it was found that all children whose fathers only read and write, were infested with one or more intestinal parasites ( $p=0.00$ ), also on studying **the relation between occupation type of the fathers of children and intestinal parasitic infestations** of those children enrolled in this study, it was found that all children with manual worker fathers and farmer fathers were infested (table 3) ( $p=0.00$ ). These rates are comparable or even higher than what were reported by Taher<sup>(131)</sup> in a study which was carried out in a village Nahia in Giza in the year 2010

where it was noted that 89.4% of children with illiterate fathers were infested with one or more intestinal parasites, and about two thirds (67.2%) of children whose fathers not working were infested with one or more intestinal parasites, with significant difference ( $p=0.03$ ). the higher rates in the current study might be attributed to the close relationship between low socioeconomic conditions of the family and occurrence of intestinal parasitic infestations in children. The lower socioeconomic condition of the family, the higher is the prevalence rate of intestinal parasitic infestations among children. The higher rates in the current study might also be attributed to the fact that these children help their fathers in their work, which make their exposure to parasitic infestation common, especially with soil-transmitted helminthes.

As regard **the relation between educational level of mothers and intestinal parasitic infestations among their children** in the current study, it was noted that all children of illiterate mothers were infested with one or more intestinal parasites (table 3). This rate is higher than what was reported by Topcu and Ugurlu<sup>(132)</sup> in a study carried out in a rural area in Turkey in the year 2009, where it was noted that 88.4% of the children of illiterate mothers were infested with one or more intestinal parasites. This result could be explained as mentioned by Topcu and Ugurlu who stated that the prevalence of intestinal parasites was higher in groups where the mother in the household had less than a primary school education, where the hand is habitually used for the cleaning of anal area and where toilet paper is never used. The relation between a child health and the mother's education is well known. Health indicators of children whose mother's educational level is lower are always worse.

As regard **the relation between occupational status of mothers and prevalence of intestinal parasitic infestations in their children** in this study, it was found that 98.5% of children with unworking mothers were infested with one or more intestinal parasites (table 3) ( $p=0.00$ ). this rate is much higher than what was demonstrated by Bethonyl *et al*<sup>(133)</sup> in a study carried out in a rural area in Diamantina school in Brazil in the year 2006, where it was noted that 38.3% of children with unworking mothers were infested with one or more intestinal parasites and this difference was statistically significant ( $p=0.01$ ). The higher rate in the current study explains the principle that worked mothers may help to increase the family income which in turn improves the socioeconomic conditions of the family with marked improvement in hygiene and sanitation inside the family, also the educational level of children will in turn increase.

Regarding **the relation between animal breeding at home and intestinal parasitic infestations of children**, it was found that 48.1% of children enrolled in the study found to be closely contact with livestock or pets at home, 98.1% of them were infested with one or more intestinal parasites (table 4). That result is comparable or even higher than what was demonstrated by Montresor *et al*<sup>(134)</sup> in a study carried out in a rural area in Malaysia in the year 2007 to determine the risk factors of intestinal parasitic infestations in children aged 7-13 years. The researchers there have been demonstrated that 90.4% of the study population were closely contact with livestock/pets through breeding animals at their homes, 72.5% of them were infested with one or more intestinal parasites. These figures denoted that although percentage of children who were closely contact with livestock/pets in Malaysia was higher than that in the current study, yet the prevalence rate of IPIs among them was lower. The higher rate of infestations in the current study may be attributed to bad environmental sanitation which is associated with animal breeding at homes. More than one parasite have been reported to be transmitted by animal to human route as nematodes and protozoa.

On studying **the relation between family income (as an indicator of socioeconomic level of the family) and intestinal parasitic infestations** in children, it was noted that The average income of families with non-intestinally infested children is about three times more than that of families with intestinally infested children (table 3) with significant difference ( $p=0.002$ ). Montresor *et al*<sup>(134)</sup> in the same previous study reported that 83.1% of study population were with household income <500 RM/month, 83.5% of them were infested with one or more intestinal parasites. The lower income of the family, the higher is the prevalence of intestinal parasitic infestations in its children, which may be attributed to lower socioeconomic status and lower sanitary level, which in turn predispose to intestinal parasitic infestations.

On studying **the relation between water supply sources and methods of sewage disposal as risk factors of intestinal parasitic infestations** in this study, it was found that 14% of all participants had no safe water supply, 96.8% of them were infested with one or more intestinal parasites. 9% of all participants had no sanitary sewage disposal; all of them were infested with one or more intestinal parasites (table 4). these results are relatively similar to what reported by Shaw *et al*<sup>(135)</sup> in a study carried out in a rural area in western Turkey in the year 2005, where the researchers reported that 12.5% of all children participants in their study had no safe water supply, 83% of them were infested with one or more intestinal parasites. 11.8% of all children had no sanitary sewage disposal, 86.3% of them were infested with one or more intestinal parasites. These results explain the high prevalence rates of *Entamoeba histolytica* and *Giardia Lmbilia* in the current study both can be transmitted by drinking contaminated water and both are environmental contaminants of water supplies. The water supply is really an important risk factor for giardiasis and several large outbreaks of giardiasis have resulted from the contamination of municipal water supplies with human waste.<sup>(136)</sup> *Giardia cysts* have been isolated from water supplies in different parts of the world.<sup>(135)</sup> The problem is greater in the rural areas that don't have a municipal water network or sewage system.

As regard **the relation between individual hygienic practices of the participants and prevalence of intestinal parasitic infestations** in this study, 56.8% of all participants practiced poor hand washing before eating, 99.2% of them were infested with one or more intestinal parasites, where the intestinal parasitic infestations were significantly associated with poor hand washing practices ( $p=0.02$ ), and 6.3% of all participants never wash vegetables before eating, all of them were infested with one or more intestinal parasites. The likelihood of acquiring intestinal parasitic infestations in children who didn't practice hand washing was 1.4 times higher than among those who had good hand washing practice (table 5). These rates are comparable or even higher than what were reported by Tadesse<sup>(137)</sup> in a study carried out in a rural area around lake Langano in the year 2005, where the researchers demonstrated that 63.8% of the study participants had practiced poor hand washing before eating, 85.7% of them were infested with one or more intestinal parasites, and 66.8% of the same study participants hadn't washed vegetables before eating, 74.5% of them were infested with one or more intestinal parasites. Most of nematodes found to be transmitted by ingestion of unwashed vegetables or eating by contaminated hands.<sup>(8)</sup> This explains the high prevalence rate of nematodes infestation in the current study.

Regarding **the relation between eating outside home and parasitic infestations in children** In the present study, it was found that 90% of all participants found to be eating outside their homes (contaminated food), 98.5% of them were infested with one or more intestinal parasites (table 5), and this difference was statistically significant ( $p=0.000$ ). this

result is comparable to what was reported by Cyelan *et al*<sup>(138)</sup> in a study which was carried out in a rural area in Turkey in the year 2009, where it was noted that 41% of all children aged 6-13 years enrolled in that study found to be eating vegetables from a garden watered with contaminated sewage, 93.2% of them were infested with one or more intestinal parasites. That high prevalence rate in the current study indicates the low socioeconomic level and poor hygienic practices of children enrolled in the current study.

**Effects** of the intestinal parasitic infestations on child health are many, and may differ from one child to another. As regard **colic** in this study, it was found that 75.9% of the intestinally infested children had frequent colic (table 6) with significant difference ( $p=0.001$ ).this rate is relatively similar to what was reported by Speelman *et al*<sup>(139)</sup> in a study carried out in the year 2006, where they found that 72.5% of the intestinally infested children with parasites found to be complaining of colic. Colic resulting from parasitic infestations might be either intestinal, and this is thought to be due to presence of parasites into the intestinal lumen or invasion of intestinal mucosa causing intestinal dysmotility and maldigestion, or even obstruction.<sup>(140)</sup> Colic also might be biliary, this occurs when the worms enter the hepatobiliary or pancreatic systems. Here, radiological investigations (as ultrasonography, CT scanning and endoscopic retrograde cholangio-pancreatography ERCP) and endoscopic removal of some worms may be required.<sup>(141)</sup>

Regarding **diarrhea** in the present study, it was noted that 11.3% of the intestinally infested children had frequent diarrhea and 25.9% had rare diarrhea (table 6). This result is comparable to what was reported by Moore *et al*<sup>(142)</sup> in a study carried in the year 2005, where it was demonstrated that 32.3% of the intestinally infested children in their study had diarrhea and the most prevalent intestinal parasite in the study was *Giardia lamblia*. In general, the most common intestinal parasite causing diarrhea is *Giardia*.<sup>(61)</sup> Diarrhea might be attributed to adherence of *excysted Giardia* to the mucosal surface of the intestine, causing stimulation of an inflammatory cytokine response. Also, *Giardia* can cause deconjugation of bile salts by over growth of bacteria leading to malabsorption, which in turn cause diarrhea.<sup>(143)</sup>

As regard **constipation** in the current study, it was found that 6.1% of the intestinally infested children found to be complaining of constipation (table 6). This result is comparable to what was reported by Mintz *et al*<sup>(144)</sup> in a study carried out in the year 2006, where the researchers showed that 3.5% of the intestinally infested children in their study had constipation. Constipation in intestinal parasitic infestation might be attributed to intestinal dysmotility.<sup>(144)</sup>

Regarding **pruritis around anus** in the present study, it was found that 57.1% of the intestinally infested children had pruritus ani (table 6), with significant association ( $p=0.001$ ). This result is much higher than what was reported by Ashford *et al*<sup>(116)</sup> in a study carried out in the year 2005, where it was found that 5.3% of the intestinally infested children in their study had pruritus ani. The most common intestinal parasite causing pruritus ani is *Entrobious vermicularis*,<sup>(100)</sup> the symptom which is typically worse at night. This symptom occurs when the female worms put its eggs onto the perianal skin, causing insomnia and restlessness. Enuresis and local eczematous reactions may be seen. Also vulval vaginitis and acute urinary tract infection may occur in girls.<sup>(100)</sup> The most prevalent intestinal parasite in the current study was *Entrobious vermicularis* (63.8%).

As regard **fatigue** in the present study, it was found that 30.2% of the intestinally infested children had fatigue (table 6), with significant association ( $p=0.046$ ). This result is less than what was reported by Brodsky *et al*<sup>(145)</sup> in a study carried out in the year 2005 where it was noted that 43% of the intestinally infested children in their study had fatigue frequently. Fatigue in an intestinally infested child might be attributed to loss of iron and other nutrients through the intestine and anorexia.<sup>(146)</sup>

Regarding **lack of concentration** in the current study, it was found that 69.3% of the intestinally infested children had lack of concentration (table 6). this result is comparable to what was reported by Nokes *et al*<sup>(147)</sup> in a study carried out in the year 2008 where it was found that about two thirds (63.8%) of the intestinally infested children enrolled in their study had lack of concentration. Also, anorexia, iron deficiency anemia and loss of other essential nutrients might play a role in that symptom.<sup>(146)</sup>

As regard **effect of intestinal parasitic infestations on appetite** in the current study, it was noted that 9.9% of the intestinally infested children had **polyphagia** (table 6). This result is comparable to what was reported by Ashford *et al*<sup>(116)</sup> in a study carried out in the year 2005, where 2.5% of the intestinally infested children enrolled in their study had polyphagia. The most common parasite causing polyphagia is *Entrobious vermicularis*.<sup>(100)</sup> On the other hand, it was noted that 84.4% of the intestinally infested children in the current study had **anorexia** (table 6). This result is higher than what was reported by Shaw<sup>(148)</sup> in a study carried out in the year 2005, where 33.4% of the intestinally infested children in their study had anorexia. It is found that the main cause of anorexia in intestinally infested children is colicky pain associated with intestinal parasitic infestations.<sup>(140)</sup>

On studying **the effect of intestinal parasitic infestations in children on their hemoglobin level** in the current study, it was noted that the mean hemoglobin level in intestinally infested children was 9.87 gm/dl, compared to that in non intestinally infested children which was 12.88 gm/dl (table 7) with significant difference ( $p=0.006$ ). These results are comparable to what were reported by Nokes *et al* in a study carried out in the year 2006,<sup>(149)</sup> where it was found that the mean hemoglobin level of the intestinally infested children enrolled in their study was 9.81gm/dl, and about three quarters (76%) of those children were pale, but the mean hemoglobin level in non intestinally infested children was 12.5 gm/dl. it was found that there was no significant association between body weight and intestinal parasitic infestations in the present study. the mechanism whereby lack of concentration and pallor may occur have been suggested to be nutritional deficiency. Iron deficiency has strong association with impaired school performance.<sup>(147)</sup> Soil transmitted helminthes produce anticoagulant protein which inhibits coagulation. The blood loss will lead to loss of plasma proteins in the gut and loss of nutrients. Loss of iron will lead to microcytic hypochromic anemia and has an effect on enzyme systems specially neurotransmitters, leading to intellectual deficits of the intestinally infested children.<sup>(150)</sup> Lower height for age (stunting) has been associated with detriments in cognitive function, mental development, behavior and educational achievement, and these are complications of heavy infection with intestinal nematodes as soil transmitted helminthes.<sup>(150)</sup>

# **SUMMARY**

## SUMMARY

Globally three billion individuals were infected with intestinal parasites; out of these majorities were children living in poor communities. Parasitic infections are considered as a major public health problem. Infections with intestinal parasites have been associated with stunting, physical weakness and low educational performance of schoolchildren.

There are several types of intestinal parasites isolated from children stool specimens, with several routes of transmission to human. Nematodes, cestodes, trematodes and protozoa can be transmitted to human causing a wide range of clinical manifestations. Weight loss, anorexia, polyphagia, fatigue, loss of concentration, pruritis ani, abdominal colic, diarrhea and constipation are common manifestations.

Parasitic infections are governed by behavioral, biological, environmental, socioeconomic and health systems factors. Local conditions such as quality of domestic and village infrastructure; economic factors such as monthly income, employment and occupation and social factors such as education influence the risk of infection, disease transmission and associated morbidity and mortality. These infections are more prevalent among the poor segments of the population. They are closely associated with low household income, poor personal and environmental sanitation, and overcrowding, limited access to clean water, tropical climate and low altitude. Intestinal parasitic infections such as amoebiasis, ascariasis, hookworm infection and trichiuriasis are among the ten most common infections in the world.

Prevalence of intestinal helminthes and other intestinal parasites have been studied in different areas in the world. A number of studies focusing on intestinal parasites were done in different community groups such as preschool children and schoolchildren. In line with this, interventions were undertaken to minimize the burden, there is a deworming program in schools and villages in the study area. Therefore, the aim of this study was to determine the prevalence and risk factors of intestinal parasites among schoolchildren. The findings of this study might help in strengthening the information available so far and encourage policy makers to design effective strategies to combat intestinal parasitic infections in the study area.

To achieve this research, the descriptive epidemiological approach was used where cross-sectional survey was selected and carried out. The study was conducted in Sidi krir family health unit in El-Agamy district. The target population is children aged 6-12 years attending Sidi-krir family health unit in the period of field work (started from February till the end of April 2014). 220 children were enrolled in this study.

**The results of this study were portrayed in four parts:**

### **I. Prevalence of intestinal parasitic infestations among studied children**

Intestinal parasitic infestation – either single or multiple infestations- was proved in 212 children with a prevalence rate of 96.4%. The children infested with a single intestinal parasite were 170 children and the prevalence rate of single intestinal parasite infestation is estimated to be 77.3%. On the other hand, the total number of children who were infested by more than one intestinal parasite was 42 children with estimated prevalence rate of 19.1%.

## II. Types of isolated intestinal parasites

It was found that about two thirds of children with intestinal parasites (64%) were infested with *Entrobious vermicularis* either single (47.1%) or with other intestinal parasites as *Amoeba* (12.7%) or *Giardia lamblia* (2.3%) or *Ascaris* (1.9%). On the other hand, about one third of children with intestinal parasites (34.3%) were infested with *Entamoeba histolytica* either single (18.8%) or with others (15.5%). Slightly more than one tenth of children with intestinal parasites (12.2%) were infested with *Ascaris* either single (7.5%) or with *Amoeba* (2.8%) or with *Entrobious* (1.9%). The lowest percent (9%) of children with intestinal parasites were infested with *Giardia lamblia* either single (6.7%) or with *Entrobious* (2.3%).

## III. Risk factors of intestinal parasitic infestation

- 1) Section I: association between intestinal parasitic infestations and socio-demographic characteristics of studied children:
  - The majority of children enrolled in the study were infested by one or more intestinal parasites (97.3% of boys and 95.4% of girls).
  - The highest rate of intestinal parasitic infestation among the intestinally infested studied children was in age group 6<8 years, followed by age group 10-12 years and then 8<10 years (98.8%, 98.6% and 91.3% respectively).
  - The majority of the children who attended school were infested with one or more intestinal parasites (95.6%), on the other hand, all the children who dropped out from school were infested.
- 2) Section II: association between intestinal parasitic infestations among studied children and the socio-economic characteristics of their parents:
  - The majority of the children who attended school were infested with one or more intestinal parasites (95.6%), on the other hand, all the children who dropped out from school were infested.
  - All the children belonging to illiterate mothers were infested with one or more intestinal parasites. Moreover, the majority of those belonging to mothers with basic education were infested (93.75%), but only half of those belonging to mothers with higher education were infested with one or more intestinal parasites.
  - All children belonging to skilled manual workers and farmers were infested with one or more intestinal parasites, but about two thirds of those belonging to employees were infested with one or more intestinal parasites (65.2%).
  - the majority of those belonging to house wives were infested with one or more intestinal parasites (98.5%), compared to 70.6% of those belonging to working mothers were infested with one or more intestinal parasites.
  - The mean average income of families having infested children was 1379.41±721.5 LE, compared to 4250±1752.5LEfor families of non infested children.
  - The mean average income of family member in families having infested children was 224.9±155.1LE, compared to 1045.1±476LE in families of non infested children.
- 3) Section III: association between intestinal parasitic infestations and the housing condition of studied children:
  - It was found that 99.5% of children living in rural areas were infested with one or more intestinal parasites, but only two thirds of those living in semi-urban areas were infested (66.6%).

- The majority (94.3%) of those living in concrete buildings were infested with one or more intestinal parasites, compared to 99% of those living in non concrete buildings.
  - It was found that 98.1% of those breeding animals at home were infested with one or more intestinal parasites, compared to 94.7% of those who don't breed animals at home.
  - Children who were infested with one or more intestinal parasites, more or less equally distributed among those having safe water supply at home (96.3%) and those having unsafe water supply (96.8%).
  - The majority of the studied children having sanitary sewage disposal at home were infested with one or more intestinal parasites (96%), while all studied children who didn't have sanitary sewage disposal at home were infested.
  - The mean home crowding index of infested children was  $4.37 \pm 41.11$ , while that of non infested children was  $0.97 \pm 6.25$ .
- 4) Section IV: association between intestinal parasitic infestations and the hygienic practices of the studied children and their families:
- It was found that 99.2% of the studied children who wash their hands less than three times per day were infested with one or more intestinal parasites, compared to 92.6% of those who wash their hands three times or more per day.
  - It's noted that 95.6% of those whose mothers wash their hands before food prepare were infested with one or more intestinal parasites, while 98.3% of those whose mothers don't wash their hands before food prepare were infested.
  - It was found that 96.1% of the studied children who eat washed fruits and vegetables were infested with one or more intestinal parasites, but all of those who don't wash fruits and vegetables before eating were infested.
  - It's noted that 198 of the studied children used to eat meals outside their homes, 98.5% of them were infested with one or more intestinal parasites, while about three quarters of those who eat their meals only at home were infested (77.3%).

#### **IV. Effects of intestinal parasitic infestations**

- 1) Section I: association between intestinal parasitic infestations among studied children and the results of their clinical examination:
- About three quarters of the children infested with one or more intestinal parasites complained of frequent abdominal colic (75.9%), compared to only 12.5% of those free from intestinal infestations.
  - It was found that 11.3% of the intestinally infested children had frequent diarrhea, compared to 12.5% of non intestinally infested children.
  - It was noted that 6.1% of the intestinally infested children had frequent constipation, while no case of the non intestinally infested children have frequent constipation.
  - It was found that 57.1% of the intestinally infested children had frequent pruritus ani, while all cases of the non intestinally infested children didn't have pruritis ani.
  - It was noted that 30.2% of the intestinally infested children had frequent fatigue, while all cases of the non intestinally infested children didn't have fatigue.
  - About two thirds of the intestinally infested children had frequent lack of concentration (69.3%), compared to half cases of the non intestinally infested children (50%).

- It was found that 9.9% of the intestinally infested children had polyphagia, while all cases of the non intestinally infested children didn't have polyphagia.
- It was noted that 84.4% of the intestinally infested children had frequent anorexia, compared to 87.5% of the non intestinally infested children.
- The majority of the intestinally infested children were pale (96.2%), compared to 37.5% of the non intestinally infested children.

2) Section II: Consequences of intestinal parasitic infestations:

- The majority of the intestinally infested children were pale (96.2%), compared to 37.5% of the non intestinally infested children.
- The mean level of hemoglobin of the intestinally infested children was  $9.37 \pm 0.75$ , compared to  $12.88 \pm 2.15$  in the non intestinally infested children.

It was found that younger aged children, low educational level of the parents, fathers with manual works, low family income, and living in rural areas, high home crowding index, and infrequent hand washing per day and eating outside homes have been significantly associated with intestinal parasitic infestations among children.

# CONCLUSION

## CONCLUSION

### **From the present study we can conclude the following**

The prevalence rate of intestinal parasitic infestations among enrolled children was 96.4%. either single or multiple infestations.

The most prevalent parasite was *Entrobious vermicularis* (64%) followed by *Entamoeba histolytica* (34.3%).

The highest prevalence rate was of lowest age group (6-8 years) with significant association.

All children who had been dropped out from school were infested with one or more intestinal parasites.

All children whose fathers were either illiterate or with basic education were infested with one or more intestinal parasites with significant association.

All children whose mothers illiterate were infested with one or more intestinal parasites with significant association.

All children whose fathers were either manual workers or farmers were infested with one or more intestinal parasites with significant association.

House wives had significant association with intestinal parasitic infestations of their children.

There was a significant association between low family income and intestinal parasitic infestations among children. Children of families with high income were found to be protected from parasitic infestations.

There was a significant association between living in rural areas and intestinal parasitic infestations among children.

Very high percentage (98.1%) of children who were connected with livestock\pets was infested with one or more intestinal parasites.

All children who had no sanitary sewage disposal at their homes were found to be infested with one or more intestinal parasites.

It was proved that unsafe water supplies as well as unsanitary sewage disposal are considered as risk factors for intestinal parasitic infestations among children

The less frequency of washing hands per day, the more likelihood is the intestinal parasitic infestations among children. Children who washed their hands three times or more per day were found to be protected from intestinal parasitic infestations with significant association.

Poor hygienic practices of the children and their mothers including not washing hands before preparing food, not washing vegetables and fruits before eating as well as eating meals outside homes, were considered as risk factors for intestinal parasitic infestations among children.

Anorexia, Abdominal colic and lack of concentration were the most common complaints among children infested with one or more intestinal parasites.

Pruritis around anus and fatigue were found to be highly prevalent among children with intestinal parasitic infestations.

It was found that mean Hb level of the intestinally infested children was lower than that of the non intestinally infested children with significant association.