



The Incidence of Pinworm *Enterobius Vermicularis* Among School Children Aged 6-10

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Volume: 3

Issue: 1

Page Number: 1 - 11

Keywords:

Enterobius Vermicularis, Tarhuna, School Children

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Received: 20\09\2024

Accepted: 20\11\2024

Published: 01\01\2025

DOI: <https://doi.org/10.71147/t76nen08>



ABSTRACT

Enterobiasis or pinworm infection is a common, contagious, parasitic infestation that affects mainly children and is caused by *Enterobius vermicularis*. Many studies have been conducted around the world to fully understand this parasite. This study aimed to determine the prevalence of *E. Vermicularis* among primary school children in the Tarhuna region (north-western Libya). Stool samples from 56 primary school children aged 6 to 10 years were collected, and then examined under a light microscope using Lugol iodine solution and Normal Saline. A questionnaire was created in Arabic to gather important demographic data regarding the current study such as (gender, number of siblings, residence, nature of housing, intestinal complaints, and history of anti-parasitic therapy...). The results of the current study showed that 25.00% of studied children were positive for *E. Vermicularis* ova. The incidence of infection was higher in rural areas than in urban areas, and more prevalent in girls than in boys. The results of this study showed that the rate of infection was greater among children who played in the soil, especially those who lived in the rural area. This study offers a new vision on prevalence of pinworm infection among school children in the Tarhuna region – Libya. The results of the current study revealed a higher incidence of *E. Vermicularis* among children in Tarhuna district.

1. INTRODUCTION

Enterobius vermicularis (*E. vermicularis*), also known as Pinworm, or Seatworm (previously named *Oxyuris vermicularis*) is a small white worm with a thread-like appearance. It is one of the most common nematode infections worldwide. Its host is exclusively humans, causing *Enterobiasis* (Cook 1994; Dahlstrom, and Macarthur 1994; ELIZABETH 2013; Kubiak, Dzika, and Paukszto 2017). The infection occurs through the faecal-oral route "direct infection from a patient", by contaminated hands of the patient with *E. vermicularis* ova "Autoinfection", and finally through the respiratory tract, "inhaling of dust or aerosol contaminated with eggs" (Assafa, et al 2004; ELIZABETH 2013).

The intestinal parasite *Enterobius vermicularis* is found worldwide (cosmopolitan distribution). Literature data indicate that it affects almost 1 billion people in various socio-economic groups. Infection is possible for everyone, but children are more susceptible to infection due to their immature hygiene practices. (Kaneva et al 2022). Laoraksawong et al 2020 found that, the overall prevalence of *E. vermicularis* infections among schoolchildren from 3 to 9 years of age in Thailand was 5.79% (23 of 397) (Laoraksawong et al, 2020). In Malakand region, Pakistan, a study conducted to detect the prevalence of *E. vermicularis* in school children, the infection was found in 23 (5.75%) out of study sample. (Khan et al 2022). In Bulgaria, the average national prevalence of *E. vermicularis* for the period (2013-2014) was 0.81% (Rainova et al, 2018). In 2006, Crotti and D'annibale in Perugia province (Italy) found that 13.4% of the 119 children who were examined had *E. vermicularis* eggs visible (Crotti and D'annibale, 2006). Talib Abdullah and Dua Baha (2014) in Iraq found that, the prevalence of *E. vermicularis* among population in two regions (Abu Ghraib and Al-Amriya) were 1.88% and 1.07% respectively, ((Taleb, Douaa, 2014) According the study of Khayyat et al in Palestine at 2015 on 384 children, 22.1% of them had been *E. vermicularis* infestation (Khayyat et al 2021). In Libya, pinworm infection is one of the most frequent health issues, but data is still insufficient and not comprehensive, despite the numerous studies that have been carried out in several Libyan regions about this parasite, its spread, and the factors affecting it, there are few studies for example: *E. vermicularis* rate was 98 of 253 (38.7%) children aged 1-7 in Elmarj city, Libya (Mohammed et al, 2023). The results showed that the highest infection in Umm Al-Jarasan, Yafran, and Al-Zintan (located in the western mountain region) was with the *E. Vermicularis* parasite (72 of 147) by rate reached 48.9% (Amer, Ali, 2019). In Sebha district, a stool samples from 115 schoolchildren were screened for *E. vermicularis* infection from January to November 2019 by use of the cellophane scotch tape method, the overall infection of this parasite was 11.3% (13 out of 115) (Rugaia et al, 2023). Sadaga and Kassem 2007 in Derna district reported that, the rate of *E. vermicularis* was 0.6% among 1039 stool specimens that has been examined (Sadaga and Kassem 2007). Prevalation of *E. vermicularis* in Nalout was (7.5%) (Al Kilani et al, 2008). From the above it is clear that enterobiosis is one of the most common parasitic diseases in children "has a cosmopolitan character". The mostly affected are the paediatric pre-school and school age population, therefore more studies should be conducted on enterobiosis to identify the seriousness of this parasitic infection in the country, especially since the data related to the infection rate of pinworms is incomplete.

Objectives of the study:

This study is aimed to determine the extent of the prevalence of *E. vermicularis* among school children in the Tarhuna region, and identifying the factors related to the prevalence of this parasite.

2. METHOD

Study area: This cross-sectional study was conducted in Tarhuna District (north-western Libya). This region was selected for several reasons, primarily because of being that the majority of residents are live in rural areas, and their main occupation are agriculture and livestock raising.

Data collection: The study was carried out between 10 February and 30 April 2024. Fifty-six stool samples were collected from children enrolled in Tarhuna district primary schools (32 boys and 24 girls) aged 6 to 10 years. Prior to starting the study, a questionnaire was created in Arabic to gather important demographic data regarding the current study such as (gender, number of siblings, residence, nature of housing, intestinal complaints, and history of anti-parasitic therapy...). To explain the purpose of this study and obtain permission to conduct it, the parents of the students as well as the administrators of each school were contacted. A total of 140 questionnaires were sent, 82 of which have been signed by child parents whose permission their kids to take part in the study. Then, only 56 children (32 boys and 24 girls) voluntarily participated in the study.

A day before specimen collection, all the participants in the current study were given verbal instructions on how to handle and collect stool samples with the provided clean, dry, screw capped, stool container. All of them were provided with a copy of a questionnaire to fill it with the help of their parents. The next day, the available samples were delivered to the laboratory for examination.

Statistical analysis:

The Statistical Package for Social Science version 20 (SPSS) software for biostatistics analysis was used to achieve valid and reliable results, P value < 0.05 were considered significant), the obtained data were presented as tables and figures.

3. ETHIC APPROVAL

The research obtained informed consent from the parents of the participants children, approval from the administrations of the children's schools, and approval from the college ethics committee.

4. RESULT

This study was conducted on 56 primary school children in the Tarhuna region, who aged 6-10 years. The number of boys was 32, representing 57.14%, while the number of girls was 24 (42.86%), as shown in figure 1.

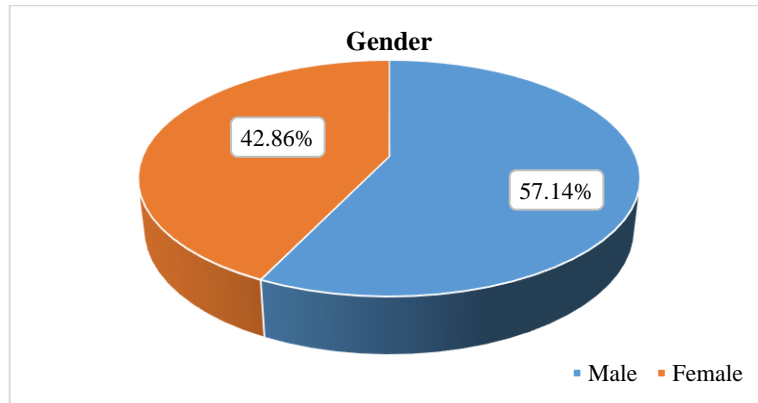


Figure 1. represents the total cases (boys, and girls) who participate in this study.

The current study demonstrated that of the 56 children examined, 14 students had *E. vermicularis* ova in their stool samples, representing a rate of 25.00%, while 42 students 75.00% did not show any ova in their stool samples. Based on gender, the results indicated (as shown in figure.2 and table 1) that the prevalence of *E. vermicularis* among girls in Tarhuna region was greater than among boys 41.67% and 12.50% respectively.

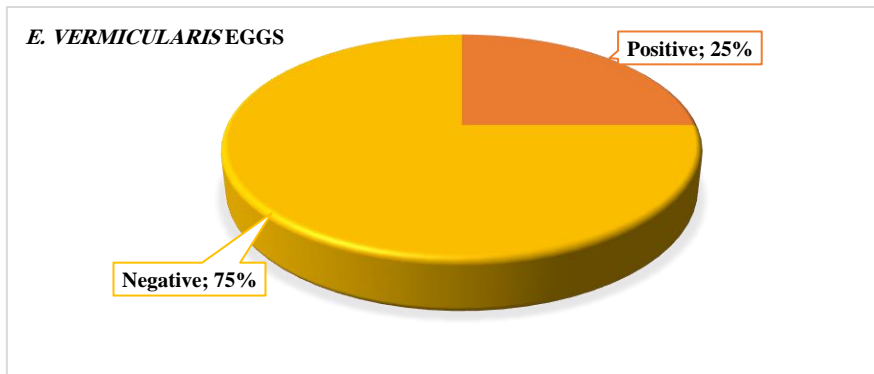


Figure 2. shows the positive and negative results of *E. vermicularis* ova in study sample.

Table 1. displays distribution of *E. vermicularis* by the sex among children in Tarhuna.

Gender	Number/%	Positive	Negative
Male	32 (57.14%)	4 (12.50%)	28 (87.50%)
Female	24 (42.86%)	10 (41.67%)	14 (58.33%)
Total	56	14 (25.00%)	42 (75.00%)

As figure 3 illustrate, the number of children in the family does not significantly affect the incidence of pinworm infection, the highest infection rate was among children from families with only two children, while in families with just one child did not find any positive cases. In the other hand the percentages were very close among children belonging to the rest of the families (families with 3 to 7 children).

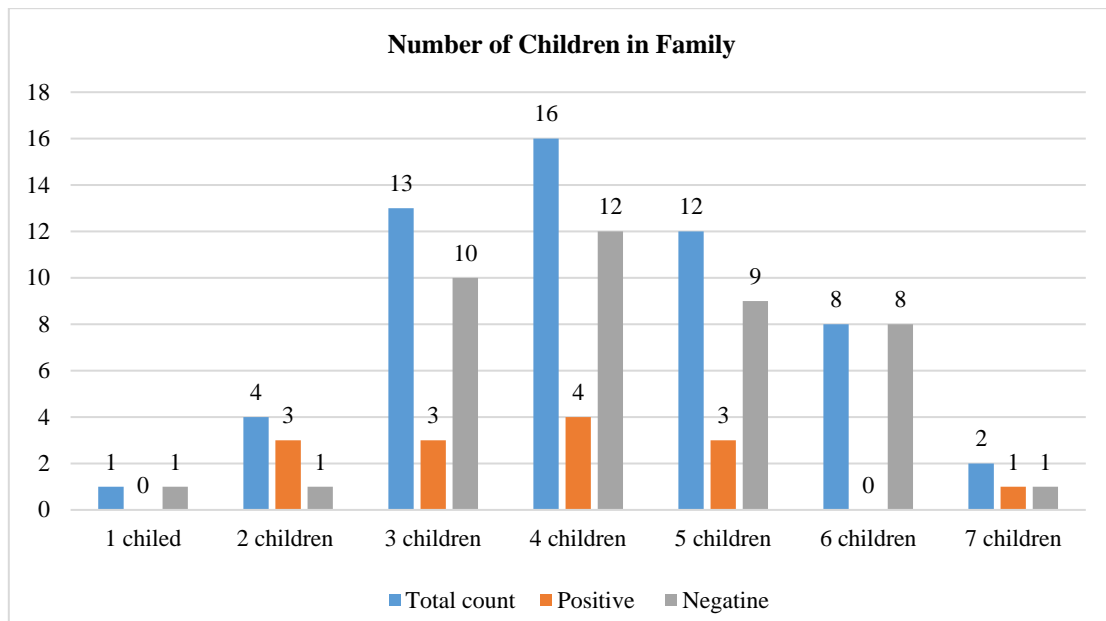


Figure 3. shows the relationship between the rate of pinworm infection and the number of children in each family of the study sample.

As shown in figure 4 and table 2, the number of children who live the city was 22, the positive ones of them were 13.64%, while the number of children that reside in the rural (village or farm) was 34, of them 32.35% were positive, these results showed statistical significance between prevalence of *E. vermicularis* and nature or place of residence (P value = 0.013).

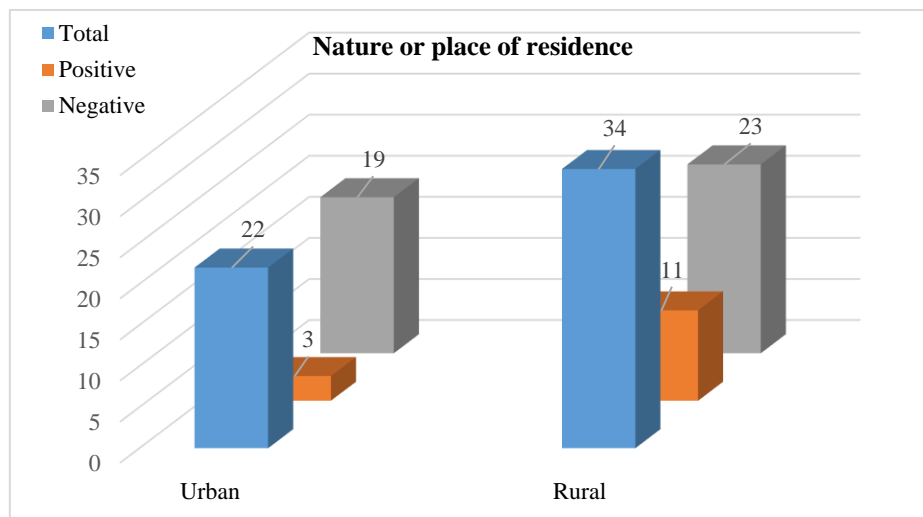


Figure 4. indicates the prevalence of *E. vermicularis* among Urban and Rural children in Tarhuna district.

Table 2. represents the prevalence of *E. vermicularis* among Urban and Rural children in Tarhuna district.

Nature or place of residence	Number out of the total		Number out of the total	Positive	Negative
Urban (City)	22 (39.29%)	//	//	3 (13.64%)	19 (86.36%)
Rural	34 (60.71%)	Village	23 (41.07%)	7 (30.43%)	16 (69.57%)
		Farm	11 (19.64%)	4 (36.36%)	7 (63.64%)
Total	56	//	//	14	42

The results of this study showed that 45 of children are playing in the soil, of whom 11(24.44%) infected with *E. vermicularis* (78.57% out of 14 affected kids in this study), and that 19.64% of children are not playing in the soil, 3(27.27%) of whom infected, these findings showed statistical significance between prevalence of *E. vermicularis* and playing in the soil (P value = 0.000), as demonstrated by table 3 and figure 5.

Table 3. illustrates the connection between kids playing in the soil and the prevalence of the pinworm parasite infection.

Playing in the soil	Results	Out of (14 +ve or 42 -ve) results	Out of total 56 cases
Yeas	Positive	11(78.57%)	11(19.64%)
	Negative	34(80.95%)	34(60.71%)
No	Positive	3(21.43%)	3(05.36%)
	Negative	8(19.05%)	8(14.29%)

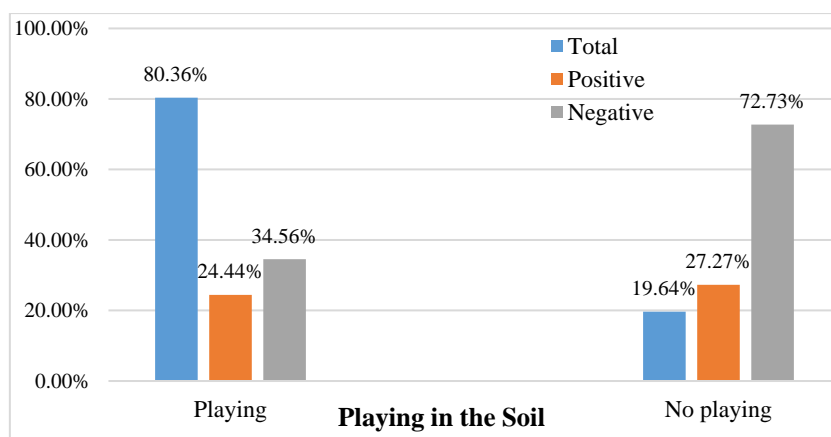


Figure 5. shows the relationship between children playing in the soil and the prevalence of the pinworm parasite.

The association between playing of children in the soil, their nature of residence and the rate of *E. vermicularis* infection is displayed in table 4. The findings demonstrated that, children of rural areas had a greater infection rate when playing in the soil than children of urban area, among 15 kids playing in the soil in the urban area, 13.33% had pinworm infection. In contrast, among 30 kids playing in the soil in the rural regions, 30.00% had pinworm infection.

Table 4. shows the connection between the nature (place) of habitation, playing in the soil, and rate of infection with *E. vermicularis* in Tarhuna area:

Nature or place of residence	playing in the soil	Positive	Negative
Urban 22(39.29%)	Yeas 15(68.18%)	2 (13.33%)	13(86.67%)
	No 7(31.82%)	1(14.29%)	6(85.71%)
Rural 34(60.71%)	Yeas 30(88.24%)	9(30.00%)	21(70.00%)
	No 4(11.76%)	2(50.00%)	2(50.00%)

On the basis of the source of drinking water, the answer of the questionnaire showed that the sources which children uses for drinking are: rain water, pure sterile bottled water, water of desalination plants, and wells water; where the number of children who drinks from each source was:5, 6, 40, and 5 respectively. The results appear that the highest *E. vermicularis* infection was among children who using wells water as a source of drinking water by rate of 60.00%, as illustrated in table.5.

Table 5. explains relationship between prevalence of *E. vermicularis* and source of drinking water in Tarhuna region.

Drinking water sources	Number of cases out of the total	Positive	Negative
Rain water	5(08.93%)	1(20.00%)	4(80.00%)
Pure, sterile bottled water	6(10.71%)	2(33.33%)	4(66.67%)
Water of desalination plants	40(71.43%)	8(20.00%)	32(80.00%)
Wells water	5(08.93%)	3(60.00%)	2(40.00%)
Total	56	14	42

According to the results of the current study, there is no statistically significant correlation between children's weight loss and *E. vermicularis* infection (P value = 0.202). Of the 18 children in the study sample who complained of weight loss, pinworm ova found in stool samples for 7 of them, as presents in figure 6.

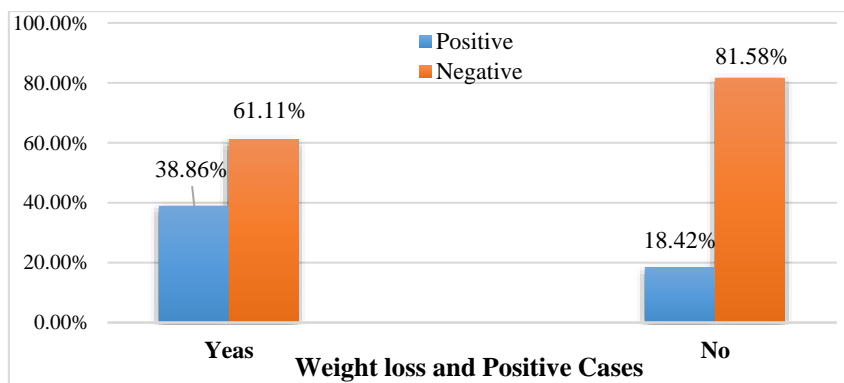


Figure 6. shows the connection between weight loss and rate of *E. vermicularis* infection in study sample.

As shown in figure 7, this study showed that 7 of the children complains from discomfort, vomiting, or diarrhea, it was noted through microscopical analysis that *E. vermicularis* ova have been seen in stool samples of 2 of them. On the other hand, the number of children who did not suffer from discomfort, vomiting, or diarrhea were 49 children, the presence of pinworm eggs was confirmed in the stool of 12 of them. These results demonstrated statistical significance between prevalence of *E. vermicularis* and complaints from discomfort, vomiting, or diarrhea (P value = 0.000).

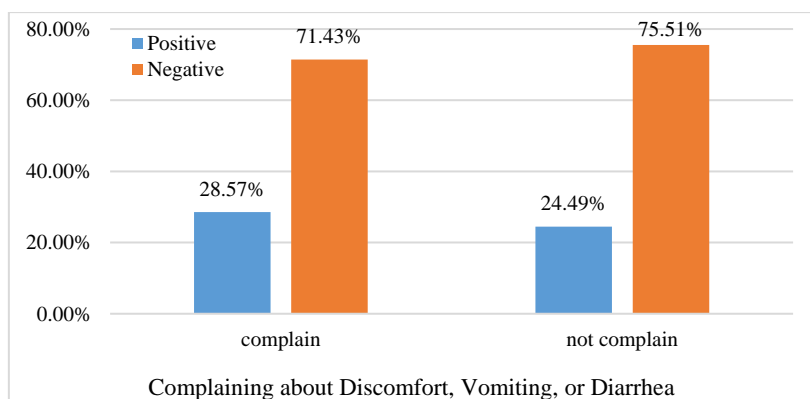


Figure 7. illustrates the relation between complaining about discomfort, vomiting, or diarrhoea, and prevalence of *E. vermicularis* among kids in Tarhuna area.

The results of the current study in regard to complaining from insomnia or difficulty sleeping revealed that, 6 out of 56 children were complaining from these signs, 66.67% of them were positive for *E. vermicularis* ova, and the remaining 50 children were not complaining from above mentioned signs, 20.00% of them tested positive. These results showed no statistical significance between prevalence of *E.vermicularis* and complaints of children from insomnia or difficulty sleeping (P value = 0.758), as demonstrated in table 6.

Table. 6. shows the connection between observing of *E. vermicularis* eggs and complaining of children from insomnia or difficulty sleeping.

Complaining of Children from Insomnia or Difficulty Sleeping	Number out of the Total	Positive	Negative
Yeas	6(10.71%)	4(66.67%)	2(33.33%)
No	50(89.29%)	10(20.00%)	40(80.00%)
Total	56	14	42

The current study's findings demonstrated that, of 16 children who experience itching or redness around the anus, 56.25% are positive for the *E. vermicularis*, this represent 64.29% out of 14 positive cases, but 12.50% of 40 kids who did not suffer from these symptoms were also positive for this parasite, this represent 35.71% out of negative 42 cases, these results demonstrated no statistical significance between prevalence of *E. vermicularis* and complaining about experience itching or redness around the anus (P value = 0.981) as showed in figure 8.

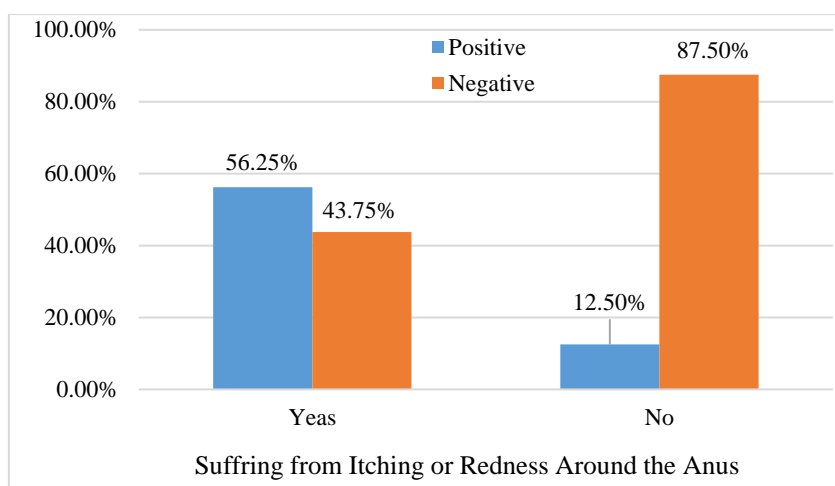


Figure 8. shows the relationship between suffering of kids from itching or redness around the anus and prevalence of *E. vermicularis*.

The table 7 demonstrated that, the number of children who had previously observing worms in the stool or around the anal area was 9 children, 44.44% out of them tested positive for *E. vermicularis* ova, while the number of children who had never seen worms was 47 children, 21.28% of them had positive results, these results are statistically significant (P value = 0.014).

Table. 7. illustrate the relationship between previously observing worms in the stool or surrounding the anal area and prevalence of *E. vermicularis* among children in Tarhuna district.

Previously observing worms around anal area or in the stool	Number of cases out of the total	Positive	Negative
Yeas	9(16.07%)	4(44.44%)	5(55.56%)
No	47(83.93%)	10(21.28%)	37(78.72%)
Total	56	14	42

The results of this study showed that the number of children who previously received therapy for helminths was 19 children, 15.79% of whom were positive for *E. vermicularis*, on the other hand the number of kids who did not take any treatment was 37 children, 29.73% of whom were positive, these results are statistically significant (P value = 0.029), as shown in figure 9.

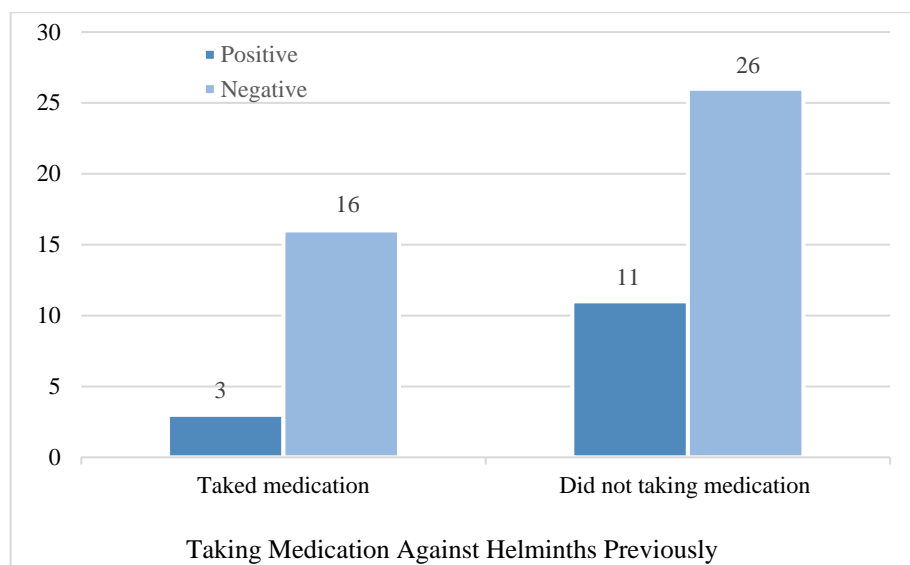


Figure 9. appears the connection between taking of medication against helminths previously and prevalence of *E. vermicularis*.

The link between the prevalence of *E. vermicularis* and the observation of worms in the stool or around the anal area and the use of anthelmintic medication in the past is shown in table 8; as 50.00% of the children who were observed worms in their stool or around their anal area, and the laboratory examination was positive, had taken anthelmintic treatments in the past, while just 10.00% of the kids in whom the worms were not observed in their stool or around their anal area, and the microscopic examination was positive had taken anti-helminthic treatments previously.

Table 8. demonstrate the relationship between observing worms or eggs around anal area or in the stool and taking medication against helminths previously, and correlation to prevalence of *E. vermicularis*.

Observing worms or eggs around anal area or in the stool	Number	Results	Number	Taking medication against helminths previously	Number
Yes	9(16.07%)	Positive	4(44.44%)	Yes	2(50.00%)
				No	2(50.00%)
		Negative	5(55.56%)	Yes	3(60.00%)
				No	2(40.00%)
No	47(83.93%)	Positive	10(21.28%)	Yes	1(10.00%)
				No	9(90.00%)
		Negative	37(78.72%)	Yes	13(35.14%)
				No	24(64.86%)

Finally, this study's findings indicate that there were no statistically significant differences or results for any of the following variables; like washing fresh vegetables with vinegar before consumption (P value = 0.813), cleaning hands thoroughly before and after using the toilet (P value = 0.993), continuous nail trimming for the mother and children (P value = 0.993), washing hands after playing, putting fingers in mouth or sucking thumb, and washing hands well before eating.

5. DISCUSSION

Pinworm infection is a public health problem in many countries, irrespective of socioeconomic status. The infection is often common among communities like children's care centres (orphanages and kindergartens), schools, and overcrowded households. Enterobiasis is not considered to be a serious disease, but the morbidity level in the world is significant, especially in children. Infection with *E. vermicularis* results in adverse effects on the growth and development of children, and impinge upon their nutritional status and morbidity. This nematode remains as the most important intestinal pathogenic parasite specifically in children.

Limited studies have been done on the prevalence of intestinal parasites in Tarhuna Libya. This is the first report that reveals the prevalence of *E. vermicularis* infections among children who live in Tarhuna through laboratory examination using the direct smear technique (iodine and normal saline).

This research determined the prevalence of pinworm infection among primary school children (PSC) aged 6 to 10 years in the Tarhuna region – Libya.

The current study's findings demonstrated that, *E. vermicularis* ova were found in 25.00% of the study sample, and this percentage is considered slightly high.

These findings appear to be in accordance with some previous studies such as: study of Park et al 2005 in Republic of Korea which found that 18.50% of studied cases were positive (Park et al 2005), and study conducted in Italy by Crotti and D'annibale in 2006 that reported that the positive cases were 13.40% (Crotti and D'annibale, 2006). The current findings also agree with study done in West Bank, Palestine which appear that 22.10% of study sample were positive (Khayyat et al, 2021), and in research conducted in 2021 in Republic of Marshall Islands, 12.14% of children were found positive (Fan et al, 2021).

On the contrary, the results of the current study are not consistent with other studies. It is relatively high compared to the study conducted in Pakistan (5.75%) by Khan et al, 2021, 5.79% in Thailand (Laoraksawong et al, 2020), 2.10% in Ethiopia (Taye and Abdulkerim, (2014), 0.81% in Bulgaria (Rainova et al, 2018), and 2.40% in Taiwan (Wang et al, 2010). The results of this study are considered high compared to many similar studies conducted in Libya previously such as: the study conducted in Sebha-Libya by Ibrahim and Salem 2020 which appeared that the rate of positive cases was 0.1% (Ibrahim and Salem, 2020), and another a study by Ruqayyah et al. 2023 in the Sabha region as well that showed the infection rate was 11.30% (Rugaia et al, 2023), 0.60% in Derna district (Sadaga and Kassem 2007), 7.50% in Nalut (Al Kilani et al, 2008), while in Triboli the percentages were 4% (Najla and Musa, 2007), and 5% (Gashout et al, 2017).

It is likely that the reason for the higher infection rate in Tarhuna region compared to the rest of the Libyan regions is the nature and climate of the region, which is characterized by moderate temperatures and humidity, which are among the main factors in keeping the ova of these worms alive and susceptible to infection for a longer period: For instance, the Sebha region is characterized by a very high temperature and average Low humidity, which affects the eggs of these worms.

In addition, Tarhuna area is considered a rural area with a large number of its residents live on farms and mainly practice agriculture and grazing, and this increases the chance of transmitting eggs, unlike residents of large cities.

Regarding gender, the results of the current study showed that the infection rate among girls in the Tarhuna region was greater than among boys (41.67% and 12.50%, respectively). These findings are consistent with other studies such as; Khan et al In Pakistan (Khan et al, 2021), study conducted in rural area of Malaysia (Norhayati et al, 1994), in West Bank, Palestine (Khayyat et al, 2021), study of Park et al in Republic of Korea (Park et al 2005), and study of Mohammed et al in Elmarj City-Libya (Mohammed et al, 2023). While these findings are not consistent with study of Li et al, 2015 in China (Li et al, 2015), and study in Thailand (Laoraksawong et al, 2020).

On the other hand, the current study findings are relatively low compared to the study conducted in many countries such as: 54.86% in China (Li et al, 2015), 40.40% in Malaysia (Norhayati et al, 1994), 45.50% in Thailand (Tukaew et al, 2003), and in Libya the high rates of infection were reported in, 48.90% in Umm Al-Jarasan, Yafran, and Al-Zintan (Ali Amer, 2019), 38.70% in Elmarj city (Mohammed et al, 2023).

The results of the current study also showed that the rate of infection with *E. vermicularis* was higher in rural areas than in urban areas, at a rate of 21.35% and 13.64%, respectively. These results are consistent with the results previously recorded in some studies such as that of Li et al in China which showed that the infection rate by *E. vermicularis* in rural area was 57.57%, and in urban area was 51.05% (Li et al, 2015), as well as in other study performed by Fan et al in Republic of Marshall Islands (Fan et al, 2021). The possible explanation for the higher incidence of infection in the rural area may be due to the lack of opportunities for city children to go out and play outside the house, or to the lack of spaces containing soil due to the paving of most city streets.

The results of this study showed that 78.57% out of 14 affected kids were from the ones who playing in the soil. Also, the findings demonstrated that, children of rural areas had a greater infection rate when playing in the soil than children of urban area. This gives an additional indication of the role of contaminated soil in transmitting the pinworm infection. The results of the current study also showed that 60.00% of children who use well water as a drinking source are infected with *E. vermicularis*.

In relation to the common symptoms of pinworm infection, the results showed that a large number of infected children were suffering from these symptoms, for example 56.25% of those suffering from itching, redness and irritation around the anal area were positive for *E. vermicularis*. In the same context, the results of laboratory examinations also showed that 44.44% of the children who had previously seen worms in their stool or around the anus were positive for *E. vermicularis*. This supports the validity of the laboratory analysis of the samples of this study.

It is also notable that 50.00% of the children in who worms were observed around their anal area or in their stool and whose laboratory examination was positive, had previously taken anthelmintic medication; and that only 10.00% of children in who no worms were observed around their anal area or in their stool and microscopic examination of their samples was positive, had not used any anthelmintic treatments previously. This might be because the children who had previously been observed to have worms in their stool or around their anal area visited the doctor and received treatment, which helped them recover and the ova are not found in the stool sample. Meanwhile, the remaining children who received antihelminthic treatment and whose results remained positive either had reinfection or the duration of taking the treatment was short and not complete healing.

6. CONCLUSION

Pin worm infections continue to be a significant health issue among children. Therefore, the current study offers new vision on prevalence of pinworm infection among school children Tarhuna region - Libya.

The results of current study exhibited the higher rate of prevalence of *E. vermicularis* among children in Tarhuna district. The results also indicate that the infection rate is higher in girls than in boys, as well as higher in rural area than urban area.

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