

Relationship Between Body Mass Index and Worm Infection Incidence in School-Age Children from Pakistan

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Abstract

Aim: To estimate how widespread worm infestation is which type of worm is involved and to link the impact of these infections on children to their body mass index.

Method: The project collected data from school children between 5 and 10 years old, in Pakistan. Different age groups with low socio economic status were chosen. 305 children from different schools in various union councils took part (95 males and 102 female). In the morning, fresh stool samples were put in labelled, securely closed plastic containers and examined under a microscope in the laboratory to check for eggs or worms. Weight, height and mid arm circumference of participants were measured with instruments at the spot. The Body Mass Index was worked out and was compared to charts that represent the expected percentiles based on age and gender.

Results: Among the children tested, 135 (44.26%) were infected with worms and of those, there were 95 (27.36%) helminth males and 210 (32.38%) helminth females. Risk of infestation was higher for both male and female children in the sixth and seventh year of age. More *Taenia saginata* parasites were found in the gastrointestinal tract of males living there and more *Giardia lamblia* in women were seen among the children studied. A single intestinal worm was detected in 127 (94.07%) children, whereas only 8 (5.92%) had more than one intestinal worm. 58.51% had lower, 40 % had normal and only 1.48% had lower normal BMI among the infected children. More than half (65.9%) of non-infected children weighed normally, below normal in 27.2% and above normal in 6.9%.

Conclusion: After comparing the results, we conclude that intestinal worms play a major role in decreasing the anthropometric measurements of school going children. Personal hygiene, their way of eating, the water they drink, pets in the home, a crowded and stuffy atmosphere, many family members, the toilet used, toilet training, noticing poor hygiene, habits of eating dirt and a lack of deworming can all lead to a heavy worm burden in the children. There is no single reason why people's dimensions' change.

Keywords

Body Mass Index, Infections by Worms, Pakistan, Statistical Anthropometry, School-Age Children

1. Introduction

Enterobius vermicularis or the pinworm, is what causes enterobiasis, one of the most common parasitic infections in people all around the world. Children are more likely than adults to get pediatric diseases. People with NF1 often have itching around their anus, throat irritation and general symptoms of insomnia and restlessness. Quite a few children exhibit hunger issues, are irritable, experience mood changes and have trouble keeping urinary control. Very occasionally, *Leishmania* can be found at unusual sites and creates thick lesions called granulomas [1].

This is recognized as the main human parasitic infection which touches the lives of over a billion people across all kinds of communities in the world. Young children between ages five to ten are where *E. vermicularis* is most often found. It could be because they do not keep good hygiene or do not practice healthy lifestyle habits [2].

An infection can start if people drink or eat something with eggs in it or dust containing eggs. These may lead to troubles with bowel movements, plus sleeplessness and eating challenges for children. Gut infestation happens only occasionally, showing as diarrhea and abdomen pain and infections of the genital-urinary system are rare [3].

Pinworms in the family Oxyuridae are responsible for oxyuria & enterobiasis. The worm was recognized in ancient times and it was Linnaeus who gave the first description in 1758. Many birds, mammals, reptiles and amphibians can get pinworms, but they are hardly ever found in fish and never in dogs and cats. As a result, humans might become

infected with pinworms if the cats or dogs carry these eggs on them. *Echinococcus granulosus* can be found in children everywhere in the world. It is found more often as a parasitic infection than any other worldwide. A comprehensive account was given of each stage of its development [4].

The aim of this study is to determine the level of intestinal protozoans and worm infections among primary school children in Pakistan (5-10 years).

2. Literature Review

Different areas worldwide report that between 0.21 and 54.86% of their populations have *E. vermicularis* infections. Under the age of 90 in Thailand, the rate of *E. vermicularis* infections is somewhere between 0% and 50.90%. Among all groups, children from crowded parts of the community with weak personal hygiene are the most affected [5].

Among children, infections with *E. vermicularis* are often connected to the family environment, where they live and how clean they are. According to our research, children raised by mothers with a primary school education are more likely to become infected [6].

The risk of worm & protozoan infection is greater for school children aged 5-10 years. One-five of all disease-related problems in children happen in this group. An iron deficiency anemia is a main result of having worms and protozoans in the body. Whipworms in children prevent normal growth and can also result in anemia. Heavy burdens of roundworm and whipworm lead to protein energy malnutrition. It is especially worrying that these infestations may slow down children's cognitive and learning progress [7].

Pinworms from the species *Enterobius vermicularis* affect a lot of people, mainly children at school. The esophagus in this type has a swaying posterior bulb. Worms are found in greatest numbers in the cecum and appendix. Humans are believed to be the only host for these worms, but chimpanzees and gibbons have occasionally been found with them, as well. Many people suffer severe itchiness because female worms migrate at night to the host's anus to lay their eggs. Majority of the time, the virus shows up with no symptoms. Even so, discomfort around the rectum, rectal or vaginal itchiness, abdominal pain, constipation or diarrhea are still possible. Because of poorer personal hygiene habits, children tend to get infected more often with the disease than adults [8].

3. Material & Methods

3.1 Study Area

Hyderabad, a city in Sindh province, Pakistan, is the second-largest population center and is set on the east bank of the Indus River. The town is about 140 kilometers north-east of Karachi, the capital of Sindh. The city acts as the administrative center of Hyderabad District and is a major city in southern Pakistan. Rich tradition, diverse cultures and a focus on education and trade are part of the city's reputation. Since Hyderabad has a population greater than two million, it mixes urban and semi-urban qualities which creates a good base for research on Relationship Between Body Mass Index and Worm Infection Incidence in School-Age Children from District Hyderabad Sindh. Because Hyderabad's population is racially and economically diverse and open to research, it is a good place for conducting this study.

3.2 Sample and Procedures

The information for this research was obtained from various government and private schools situated in Hyderabad Sindh. Those between 5 and 10 years of age were studied to see how disease affects their health. Most of the children are from communities with low income and have experienced poverty at home. A larger number of the youngsters were female than male. The research was studied as a cross-sectional observational project. It was important to decide on the number of samples needed to be sure that the calculated level of accuracy and faith could be trusted for a large population.

Other than measuring a person's height and weight, the BMI was calculated as well to access anthropometric data. Together with the school's instructors specially assembled at the invigilation site, the scholar performed the task. Between January 2025 and May 2025, early morning stool samples were collected from 305 children both in the government and private schools and stored in containers with lids. If the first microscopic stool test result was negative for a child, a second stool sample was taken.

Diagnosis centers looked at samples using microscopes to check for the eggs, ova or larvae of several worms. With a questionnaire, information was collected on a person's socio-economic situation, recording their name, age, gender, family, details of their pets and their home address. They also planned to collect information about families and children that was unprocessed, including where they got water, if they had toilets, how they were brought up, their daily hygiene habits, unusual eating habits and records of worms or treatments for them. Body Mass Index was compared to the age values using the WHO standard method and the outcomes were plotted on WHO standard BMI-for-age graphs to assess nutrition according to whether the children were boys or girls.

Formula:

$$\text{BMI: weight (Kg) / [Height (m)]}^2$$

Simply divide weight in kilograms by the height in meters squared to get BMI. Everyone from the schools was in favor of the project. Before families visited for the stool sample and examination, I asked parents how their child was doing and explained the study.

The information collected from people and how tall or short they were being written onto the specified questionnaire. Assessing the health of the family and their socioeconomic position required a self-developed form, covering education, where money comes from, the number of children, the family group, kinds of animals or pets maintained, areas where people live, the monthly income in rupees and the status of water and sanitary facilities within the home according to Agarwal et al. 2005. From these laboratories, microscopic examinations of stools were carried out using a microscope, clinical centrifuge, 0.9% normal saline, glass test tubes, glass slides and cover slips. To ensure the study included appropriate participants, we prepared guidelines for children ranging from 5 to 10 years old (both 5 and 10 included) in Pakistan.

4. Result

In this study, researchers wanted to inspect how many worm infections middle childhood children had and assess their connection to the children's BMI. Following approval from parents, we selected 305 children, equally divided between the genders, from both the urban and rural areas of Hyderabad Sindh. To know if parasites were involved and what kinds were involved, stool samples were taken, placed in plastic containers and labelled with their lids on tight. For this research, standard devices were used to measure participants' weight and height during the study. Out of everyone in the population, approximately one-third were infected with worms that fall into many categories and impact different age groups. All told, there were 210 girls and 95 boys. Of all the reported cases, 27.36% affected male children and 32.38% affected female children with intestinal worm infections. The majority of the infections found were from *Taenia Saginata* (28.88%), with *H. nana* the least common (4.44%). Almost all children (89.6%) had infections from only one intestinal worm and only a small number (5.92%) had infections from several different worms. Kids ages 6 to 7 were affected the most, with no difference based on sex. *Taenia Saginata* was often found in males and *Giardia* was the most common organism in females during those years. Intestinal worms most often found were Cestodes, making up 35.86% of the cases. A total of 37.93% of affected young people lived with animals or pets. Officials found that around 42.39% of youngsters drink tap water.

Low BMI was most common among infected children 58.51%, 40 % of them had normal BMI and only a small number 1.48% had BMI above normal. More than two-thirds (65.9%) of healthy children had normal BMI, just under a third (27.2%) were below normal and 6.9% were above normal. 1/3rd of children was seen to have intestinal worms in both urban and rural locations. The most common organisms found in children aged 6-7 were *Taenia Saginata* and *Giardia*. Because of intestinal worms, intake of nutrients from food is reduced in children which affects their health, growth and development. So, it is advised to provide programs that share the importance of health at this stage, cleanliness, safe water and caring for pets to help prevent both high disease rates and widespread undernutrition among younger people.

Table 1. Severity of Worm Infections in Sequence among Children

Type of worm	No. of infested	Percentage
<i>Taenia Saginata</i>	39	28.88%
<i>Giardia</i>	28	20.74%
<i>Enterobius Vermicularis</i>	23	17.03%
<i>Hook Worm</i>	13	7.4%
<i>Parasitic Eggs</i>	12	11.11%
<i>Mixed Infection</i>	08	5.92%
<i>H. nana</i>	6	4.44%

The table above shows how seriously the worm infections affected children, males and females alike. A total of 28.88% of the infected children showed *Taenia saginata* infection. There were *H. nana* infections in just 4.44% of children from Tehsil D.I. Khan. Only single types of intestinal infections were found in a high number of children, with very few mixed infections noted.

Table 2. Type of Infections among Infected Children

Types of worm	Infected children	
	Number	Percentage
Nematodes (Single Worm)	38	28.14%
Cestodes (Single Worm)	47	34.81%
Trematodes (Single Worm)	2	1.48%
Parasitic Eggs (Unicellular)	23	17.03%
Mixed Infestation	8	5.92%
Protozoa	17	12.6%
Total	135	100

Lab results on children's stool microscopy detected *Enterobius vermicularis*, *H. nana*, *Taenia saginata* and either nematodes or Cestodes known as Hookworms. The *Taenia* species (*Taenia saginata* and *H. nana*) made up the largest proportion of stool at 35.86% (52/145). Stool samples from kids in Tehsil Dera Ismail Khan tested negative for Trematodes.

Table 3. Distribution of Data According to Source of Water and Infections

Source of water	No. of selected children	Worm infected children	children Percentage
Deep bore	189	75	37.87
Tape Water	98	52	53.06
Others (Nalka etc)	18	8	44.44

Worm infestation rates among children who drank tap water stood at 53.06% (52/98) which was the same as those using deep bore water (37.87%; 75/189). Among all sources, the largest number of infected people or 49%, used water from Nalka.

Table 4. Distribution of Data According to Toilet Training of Child and Infections

Toilet habits	Selected children	Worm infected children	Percentage
Washing himself	276	120	43.5
Mothers help	12	7	58.33
No regular habit	17	8	47.05

of the 17 tested, 8 showed a significant lack in washing after the toilet. Children receiving help from their mothers showed a higher infection rate, of 58.33% (7/12), compared to those who practiced washing independently, at 43.5%.

Table 5. Distribution of Data According to Pica Habits and Infections

Habits	No. of selected children	Infected children	
		Number	Percentage
PICA	64	19	29.68
No PICA	241	116	48.13

Only 48.13% (116) of children showed signs of PICA in their everyday living, whereas just 29.68% (19) of the infected children had PICA habits indicated by microscopy analysis and the structure questionnaire.

Table 6. Association of Worm Infections with Personal Hygiene Practices

Hygiene & practice activity	Selected children	Infected children	
		Number	Percentage
Washing hands before meal	365	82	22.46
Do not wash hands before meal	132	73	55.30
Washing hands after meal	165	21	12.72
Do not wash hands after meal	276	122	44.20
Washing hands after toilet	180	89	49.44
Do not wash hands after toilet	100	48	48.0

According to the questionnaire survey, 22.46% (82/365) of the children washed their hands before meal had become infected. Seventy-three out of the one hundred thirty-two children interviewed did not practice handwashing before they ate. Just over half of the infected group, 48% (48/100), did not practice washing their hands after using the bathroom, while for the infected group that showed this habit, 49.44% (89/180) did.

Table 7. Distribution of Data According to the BMI Status in Children

BMI status	Infected children (Total 135)	Non-infected children (170)
Low BMI	79	54
Normal BMI	54	97
Over BMI	2	19

Table 7 includes data on the BMI status for the whole study population. Most worm-infected children 79/135 (58.51%) had a lower body mass index, while 54/135 (40%) had no effect and just 2/135 (1.48%) had a higher index. It also gives the body mass index status for children who did not become infected with worms. Thirty-one percent of children in the selected area were measured to have a lower body mass index during the study.

5. Discussion

The study was undertaken to measure how common worm infection is in school children of various ages and social backgrounds. Out of 305 children, 95 were boys and 210 were girls and microscopic analysis of their stool was used to check for infection. Epidemiological data was collected using a predesigned questionnaire during interviews with each case and using measurements following World Health Organization rules. Through stool microscopy, 135 children (95 of them male and 210 female) tested positive for worms. The top two ages groups infected by worms were six and seven years of age. In males studied, *Taenia saginata* infection was observed, accounting for 37%, but in females it was *Giardia lamblia*, at 27%.

In our study area, male children had a higher rate of infection with *Taenia saginata*. Eating meat that has not been prepared well from infected animals is the common method of contracting trichinemias. Animals can catch infections while they feed or drink contaminated fluids. Animals can pick them up by swallowing and the parasites pass on to the human body with the meat [9]. When families live in rural areas and have a low socioeconomic status, it is thought that the men will have a better outlook, so their children are fed a high protein diet.

A number of *Giardia* infections in female children were noted in rural areas, confirming the opinion that the organism travels through water. Female children tend to be at home more, have pets for longer periods and help with pet care and these activities can cause them to become more exposed to *Giardia* infections. Worms were found to affect more people in rural areas than in urban areas.

In those countries, contaminated drinking water is one of the main shockers of infections, next to poor sanitation and foods. Because people in developing countries are undernourished and lack treatment, the implications of

gastrointestinal diseases are much more serious. About 1.7 million people die each year due to poor quality water, sanitation and hygiene. Nine times out of ten, deaths among children took place in developing countries [10].

A big proportion of people in the areas, 53.06%, became infected because they drank contaminated tap water. Almost 38% of the worm infections in stool microscopy in this study were caused by deep bore water, thanks mainly to the handling and storing by the people. Personal hygiene, improper cleanliness of water and meal tools, poor water sanitation and eating together may be why such results were found. Many children who get the intestinal worm are infected because of problems with hygiene. The community with unhygienic habits often contains *Ascaris lumbricoides* which is considered a major parasite [11].

Children in this study area who did not wash their hands before eating meals had about 40.66% positive worm infections. Nearly 35% children aged 6 to 12 had no habit to wash their hands after going to the toilet at school when this was studied. Most PICA cases were found in places with low economic conditions and mostly among pregnant women and children. Before, problems such as iron deficiency anemia, lead intoxication and worm infections have been seen for the disorder. PICA occurs because of many different influences [12]. The study covered children during a range of ages, all between 5 and 10 years old. It discovered that PICA consumption played a main role in giving youngsters intestinal worm infections and negatively affected their movement and mental abilities. Anemia, malnutrition and Vitamin A are often related to intestinal parasitic infections. A deficiency, along with some other difficult situations. Worm infections in children during the study from the 1970s and 1980s were linked to having poor nutrition, physical work capacity and muscle strength [13].

School going children in the study area had a higher rate of significant (≤ 0.05) worm infection than the general population. It was noticeable that BMI takes a hit which results in less effective bodily and mental activities for individuals. The majority, making up 58.51%, showed below average BMI, 40.0% showed normal and just 1.48% had high BMI among infected children. Worm infections in the population substantially affected the body mass index in study area. The greatest group of non-infected children (57.1%) had a normal BMI, compared to 31.76% below normal and 11.17% above normal.

Childhood stunting greatly affects a child's ability to grow properly. Around 162 million kids under 5 years old are living with the consequences of malnutrition across the world. Stunting in young children means they are shorter by more than two standards deviations compared to World Health Organization's child growth standards median. It is mostly an end result from a lack of nutrients and repeated illnesses. As a result of early stunting, societies can see people suffer from physical and mental changes, poor work skills, sickness and diabetes among other illnesses. If the ongoing trends persist, we can expect about 127 million children to show stunted growth by 2025. As a result, additional efforts and expenditure will be necessary to accomplish the WHO goals [14]. Nearly one third of the observed children had intestinal worms and more than two thirds had a lower body mass index, both according to WHO guidelines. To reach the WHO targets in the studies area, interventions using both medicines and health education are necessary. Where worm-infected children were identified, teachers were informed at the spot and parents were told at their next parent teachers' meeting.

6. Conclusions

The findings of the present study show that intestinal worms reduce important measurements in school children. Factors affecting health include how individuals look after themselves, what they eat, the type of drinking water, their pets and overcrowding.

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