RESEARCH

Soil Transmitted Roundworm Infection on Grade Two Students

Louella Brion
Natural Science Area Coordinator
DLSU-College of St. Benilde
2544 Taft Avenue, Manila 1004 Philippines

Stool specimen from 239 randomly-selected Grade II students of General Tiburcio de Leon Elementary School were collected to determine the prevalence and intensity of soil-transmitted roundworm infection among these students, and to correlate this with their academic achievement. The formalin-ether concentration technique (FECT) was used to process these specimen.

Ascaris and Trichuris were the predominant parasites detected. Trichuriasis was detected in 46% of the students, while ascariasis was detected in 36% of the respondents. Most of the respondents had light parasitic infection, while only 1.8% had moderate infection. There is higher prevalence of these infections among males as compared to females, but the difference in prevalence was not significant.

The students' GPAs as measure of their academic achievement were correlated with the existence of infection. A significant negative correlation was found ($r = -0.204$, $p < 0.05$) between these two variables. This means that students without infection have the tendency to have higher grade.

INTRODUCTION

The soil-transmitted roundworms—*Ascaris lumbricoides* (giant roundworms), *Trichuris trichiura* (whipworm), and hookworms, are among the most prevalent of all the infectious disease agents of man. The World Health Organization (WHO) estimates that at least one-fourth of the world's population is infected with these parasites.[1] In the Philippines, data from researches done as early as 1908 up to the present show prevalences ranging from 44% to 83% for *Ascaris* infections, 52-60% for *Trichuris* infections and 30-33% for hookworm infections.[2,3]

Ascariasis and *trichuriasis* have been found to be most prevalent among children. Claveria[4] observed high prevalence among children between 7-10 years old. Chan et al.[5] claimed it is between 7-12 years, and Elkins[6] observed peak prevalence of this form of parasitism among 9-year-old children. Elkins et al.[6] and Holland et al.[7] also reported higher prevalence of *Ascaris* and *Trichuris* infections among female children compared to male children, and also showed reinfection occuring more rapidly among females compared to males.

Ascaris lumbricoides inhabits the host's intestine and feeds on the liquid contents in

the host's intestinal lumen, thus "robbing" the host of nourishment and subsequently making the child malnourished and underdeveloped.[8] Enhanced sensitivity to *Ascaris* material may also trigger the development of asthma-like attacks and other immune response.[9] Because of the migratory habit of the *Ascaris* larvae, damage to the lungs and other organs is possible.[10]

Trichuris trichiura parasitizes the host's intestinal tract. Adult worms live for several years, up to five years, so large numbers may accumulate in a person. Heavy *Trichuris* infection results in anemia,[12] chronic diarrhea[13] and fluid malabsorption in the large intestine.[14]

The ability of these parasites to cause illness has been found to be highly related to the intensity of infection. This means that the greater the number of worms parasitizing the person, the greater the symptoms and the negative physiological effects.[14, 5, 7]

This then leads to one further effect of this type of parasitism that has not been given much attention—its association with a person's intellectual performance. From the few researches done about the topic, it has been observed that persons parasitized with these worms have lower or decreased productivity[15], and most are found to be mentally dull.[15, 7, 16]

Since infection with these roundworms persists and is most intense among growing children, then the physical and intellectual development of these children are greatly compromised.

This investigation attempts to determine the prevalence of *Ascaris* and *Trichuris* infections among male and female Grade II students of General Tiburcio de Leon Elementary School, and whether parasitism is correlated to the academic achievement of these school children.

MATERIALS AND METHODS

The subjects of this study were Grade II students of General Tiburcio de Leon Elementary School, located in Karuhatan, Valenzuela, Metro Manila. Two hundred thirty nine (239) students were chosen through simple random sampling ($N = 571$; $\alpha = 0.05$). Stool samples were collected from each respondent and the specimen were processed using the formalin ether concentration technique (FECT). Microscopic examination of the specimen was done and identification of parasitic eggs was based on shape, size, thickness of shell, color and other distinct characteristics. The intensity of each parasitic infection was determined by actual counting of the eggs observed.

The chi square (x^2) test of significance was used to test the difference in the frequency of infections between males and females. The significance level was set at $\alpha = 0.05$.

The students' grade point averages (GPA) for the school year were used as basis for measuring the students' academic achievement. The Pearson product moment correlation coefficient, or Pearson *r*, was used to correlate the GPAs of the students with prevalence of infection, that is, with or without infection. This was also used to correlate the GPAs of three groups of students—those without infection, those with single infection (parasitized by either *Ascaris* or *Trichuris*), and those with mixed infection (parasitized by both *Trichuris* and *Ascaris*). The significance level was also set at $\alpha = 0.05$.

RESULTS AND DISCUSSIONS

Examination of the 239 stool samples showed that 36% of the respondents had *Ascaris* infection and 46% had *Trichuris* infection. These results validate studies done by Claveria[4], Cross and Basaca-Sevilla[3] and Cabrera[2] that *Ascaris* and *Trichuris* are the two most common intestinal roundworms that parasitize children. The percentage of infection, however, is quite low compared to previous studies with prevalence of *Ascaris* infection ranging from 40 to 90%, and *Trichuris* infection ranging from 52 to 70%.[16,10,3,2,5] A higher prevalence of these infections would have been observed had there

been multiple stool sample collection, considering that this study involved only a single stool sample collection.[17]

Among the infected respondents, 53% had single infection, that is, they are infected by either *Ascaris* or *Trichuris* worms. Sixty-four percent (64%), however, had mixed infection. This means that the respondents were infected with both *Trichuris* and *Ascaris* worms. Cabrera[2] had also observed that the most common combination in a mixed infection of intestinal parasites is *Ascaris* plus *Trichuris*.

In this study, male children had higher infection rates (*ascariasis* = 41%, *trichuriasis* = 48%) compared to female children (*ascariasis* = 33%, *trichuriasis* = 44%). In previous studies, females were shown to be more predisposed to these kinds of parasitism.[5,18] A chi square test, however, revealed that there was no significant difference in infection rates between the two genders. (*Ascaris* infection : x^2 (1, $\underline{N}$ = 239) = 1.5, $p > 0.05$: *Trichuris* infection : x^2 (1, $\underline{N}$ = 239) = 0.3 $p > 0.05$). This suggests that gender-related behavior or immunity did not significantly contribute to the transmission of these parasites in this specific study area.

Children infected with *Ascaris* all had light infections, since the *Ascaris* eggs counted from the stool samples taken were less than 50,000 EPG (eggs per gram). Majority of the children with *Trichuris* infection likewise had light infection. *Trichuris* eggs counted from the stool samples were less than 1,000 EPG. Two stool samples, however, had more than 1000 EPG and were classified under moderate *Trichuris* infection. This result agrees with previous studies which show that more people carry light infections, whereas a small percentage of the population carry moderate to heavy infections.[6]

Based on the respondents' answers to the questionnaires, it can be deduced that children who failed to wash their hands before eating all had parasitic infections. Of those who ate with bare hands, 48% had the infection. The portal of entry of the parasite eggs is through the mouth, and so the hands play an important role in the transmission of infection.[19,20]

Another behavior which could have possibly contributed to the prevalence of parasitic infection was the habit of playing on bare ground. Among the children who did play on bare ground, 61% had the infection. *Ascaris* and *Trichuris* use the soil for egg development and thus this habit increases the risk of getting the infection, particularly if the soil was heavily infected with the parasites' eggs.[21,22]

The Pearson *r* was used to correlate the GPA of the respondents with the presence or absence of infection. A correlation coefficient of -0.196 and a probability of 0.0024 resulted. This means that there is an inverse or negative relationship between academic achievement and infection. Students with infection tend to have lower grades and, conversely, students without infection tend to have higher grades. This relationship was found to be significant ($p < 0.05$).

Table 1. Prevalence of Soil-Transmitted Roundworm Infection among Grade II Students

	Single Infection *Ascariasis* or *Trichuriasis*		Mixed Infection *Ascariasis* and *Trichuriasis*		Total Prevalence *Ascariasis*		*Trichuriasis*	
	Number	Prevalence	Number	Prevalence	Number	Prevalence	Number	Prevalence
Male	23		31		42		49	
Female	48		33		45		60	
Total	71	53%	64	47%	87	36%	109	46%

To further confirm this, GPA of students without infection, with single infection (parasitized by either *Ascaris* or *Trichuris*), and with mixed infection (parasitized by both *Trichuris* and *Ascaris*) were compared. The correlation coefficient was -0.204 and the probability was 0.0075.This shows that there is also an inverse relationship between the GPA and the three conditions. Students with single and with mixed infection tend to have progressively lower grades. This relationship was found to be significant at the 0.05 level. The possible explanation for this is that *Ascaris* and *Trichuris* are different parasites, each having its own distinct effect on the human host. Hence, having two distinct species of roundworms as parasites is worse than having just one.

The correlation coefficients (r = -0.196 and r = -0.204) that resulted from the statistical treatment of data are quite low. This could be attributed to the fact that majority of the subjects had low infection intensities, there being only 2 subjects with moderate infection. It has been observed that the intensity of infection reflects the morbidity state.[1] The higher the number of worms that parasitize a person, the greater the disease condition. Had there been more subjects with moderate or even heavy infections, then the relationship between these two variables could have been more clearly seen.

The result of the study — that soil-transmitted roundworm infection correlates significantly with academic achievement — confirms what other researchers have observed in previous studies. Sinniah[15] claims that *Ascaris* infection retards the growth and intellectual development of children. Nokes[23] also demonstrated this relationship. When school children were grouped according to academic ability, he found that prevalence of infection was consistently highest among children who were least academically able. He also observed that children who perform poorly in class have heavy intensities of infection.

Evidences showing the predisposition to these parasitic infections highlight the importance of controlling this health problem.[6,7] Infected children who are treated frequently reacquire the same level of infection after a few months. Also, infection with one roundworm parasite predisposes one to parasitism with another roundworm parasite.[24] This means that children parasitized with *A. lumbricoides* are predisposed to *Trichuris* infection, and vice versa. In such case, improvement in the academic achievement of the students concerned will be difficult to achieve unless these parasitic infections are controlled.

The findings of this study do not imply causality, since this is not an experimental research. Parasitic infection with these soil-transmitted roundworms and academic achievement are covariates of a number of social factors. The results of this study, however, emphasize the important role of health in the education of the school child.

SUMMARY AND CONCLUSIONS

From the investigation made, *Ascaris* and *Trichuris* parasites were found to be the most prevalent parasites among the Grade II children. *Trichuris* infection had a 46% prevalence, while *Ascaris* infection had a 36% prevalence. More males had the infections compared to females, although the difference in the prevalence was found to be not significant. Most of the infected students had light *Ascaris* and *Trichuris* infection intensities, except two students who had moderate *Trichuris* infection.

Soil-transmitted roundworm infection was found to be negatively correlated with academic achievement. This means that students with the infection have the tendency to have lower grades and conversely, those students without infection have the tendency to have higher grades. This relationship was found to be significant ($p < 0.05$).

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