The prevalence of soil-transmitted helminthiasis among Filipino pregnant women determined by fecalysis*

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ABSTRACT

Background: The Philippines is endemic to soil-transmitted helminthiasis, a neglected tropical disease which is inadequately diagnosed and treated especially in the pregnant and lactating population. It is important that the prevalence of STH is monitored routinely to assess the effectiveness of control programs and the provision of adequate treatment, hence decreasing its associated adverse outcomes.

Objective: To determine the prevalence of STH among pregnant patients consulting for antenatal care in a tertiary provincial hospital using microscopic stool analysis.

Methods: This is a cross-sectional study performed on 270 patients attending antenatal care from a tertiary provincial hospital. Microscopic stool analysis using the Kato-Katz technique was the diagnostic tool used to identify presence of intestinal parasites. Data were analyzed using Stata 15. Chi Square and Mann U Whitney Tests were utilized to determine statistical significance. Variables under the adverse perinatal outcomes were subjected to odds ratio to determine correlation among those tested positive for STH.

Conclusion: The cumulative prevalence rate of STH is 20.7% and the most common organism identified is A. lumbricoides. Factors related to a high suspicion of STH are: older individuals; higher obstetric score; greater number of living children; increased maternal weight; anemic; underweight; lived in a family with higher number of household members; lived in a family with member treated with antihelminthics; lived in houses without water and toilet; lived in the areas of Maragondon, Mendez, Bailen, Cavite City, Noveleta and Bacoor. Moreover, preterm labor and small for gestational age fetus are the adverse perinatal outcomes identified suggestively related to STH.

Keywords: adverse perinatal outcomes, STH

INTRODUCTION

It was estimated that about 1.5 billion individuals around the world are affected by soil-transmitted helminthiasis (STH) also known as intestinal worm infection.[1] STH is most prevalent in sub-tropical and tropical regions and most of these areas are low to middle income countries. The Philippines is endemic to STH and about 25 million Filipinos are at increased risk of having the disease.[2] Considered as a neglected tropical disease, STH, is inadequately diagnosed and treated especially in the pregnant and lactating population. According to a study conducted in 2011, among 1474 pregnant Filipino women 465 or 31.5% had STH.[3]

Poorly diagnosed and treated pregnant women with helminthic infection can cause several adverse maternal and fetal outcomes. Helminth-infected women are typically found with protein-energy malnutrition and deficiencies of micronutrients, especially iron.[4] These nutritional deficiencies in the setting of pregnancy where there is increased nutritional need can have devastating effects on both the mother and the fetus.

In endemic areas, it was recommended that alongside with hematinics are administration of antihelminthics.[5] Although recommendations have been released from various health organizations and societies that antihelminthics should be routinely given, most of the health care providers are hesitant to follow due to reasons such as: perceived adverse effects of drugs, lack of diagnostic test supporting the treatment, and limited supply of medications.[6] On the other hand, stool examination or fecalysis is not routinely requested in pre-natal consultation despite of the fact that STH is endemic in the country.

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It is important that the prevalence of STH is monitored rigorously and routinely to assess the effectiveness of the control programs and the provision of adequate treatment of infected individuals. Several microscopy-based techniques are available and widely used for identification and quantification of STH eggs and larvae. The most widely used technique is the Kato-Katz (KK) thick smear technique, recommended by the World Health Organization (WHO) for assessing both the prevalence and intensity of infection in helminth control programs.[7]

REVIEW OF RELATED LITERATURES

Overview of Soil-Transmitted Helminthiasis

Helminths are broad range of organisms that include intestinal parasitic worms: roundworms (Ascaris lumbricoides), whipworms (Trichuris trichiura), and hookworms (Necator americanus and Ancylostoma duodenale). According to the Department of Health, all these three parasitic worms are the major causes of STH in the Philippines. Each species has their own life cycle but has many commonalities: infected individuals excrete helminth eggs in their feces, which then contaminate the soil and infect people by ingesting eggs or larvae in contaminated food and fomites (roundworms) and/or through penetration of the skin by larvae in the soil (hookworms). Infection of these organisms can cause morbidity, and sometimes mortality, by compromising nutritional status, affecting cognitive processes, inducing tissue inflammatory reactions, and provoking intestinal obstruction or rectal prolapse.[1]

Soil-Transmitted Helminthiasis and the Pregnant Woman

The burden of the disease among pregnant and lactating women is more common in helminthiases endemic areas. Most of these endemic areas are afflicted by poverty and most of the inhabitants already exhibits signs of malnutrition. The overall effect of all these factors have exacerbated the impacts of nutrient deficiency and its consequences. Stephenson and colleagues (2000) pinpoint the presence of anorexia as the most important mechanism by which intestinal nematodes cause malnutrition.[4] In addition, intestinal infections may also cause diarrhea, intestinal inflammation and obstruction, and impairment in nutrient digestion and absorption. STHs also have been shown to directly contribute to severe anemia through blood loss and other micronutrient deficiencies.[8] One plausible mechanism of blood loss was the attachment of hookworms in the inner wall of the small intestine, where they induce mechanical laceration and enzymatic damage to the mucosa of small intestines. It was noted that each individual parasite leads to 0.05-0.25 mL of blood loss daily.[9] In a prospective cross-sectional study done in India, most of the pregnant women with helminthiasis had anemia as compared to women without the infection (88.7% vs 56.4%).[10] Similar findings was also noted in local study done in a public tertiary hospital in the city of Manila.[11] Among other parasites, hookworms and Trichuris trichiuria are highly associated in causing anemia in pregnancy.[12]

Theoretically, pregnant women are in an immuno-compromised state. Helminth infections on the other hand is thought to modulate host immune response.[13] The effect of this immune modulation especially in pregnant women was correlated to their susceptibility to heterologous infections such as malaria.[14] In one cross-sectional study done on the Thai-Burmese border, where both STH and malaria is endemic, pregnant women infected with hookworm had more incidence of malaria and lower birth weights than women without the infection.[15]

Soil-Transmitted Helminthiasis and the Fetus

The most important potential impact of helminth infections during pregnancy is on the long-term outcomes on the fetus. Most infants born to infected mothers are often delivered prematurely, with low birth weight, and may have poor growth and development throughout childhood.[16] In a one-year prospective study done by Mireku and colleagues, children of mothers who were infected with hookworms had lower mean gross motor scores compared to those whose mothers were not infected with hookworms.[17] Furthermore, it has also been postulated that intrauterine or perinatal exposure to parasites promotes fetal immune system down regulation making them susceptible not only to future helminth infections but to other infections in general. Such was the case in the Entebbe Mother and Baby Study (EMaBS) cohort in Uganda wherein infants born to women with symptomatic and asymptomatic hookworm parasitemia during their second or third trimesters had increased likelihood of childhood malaria.[18] There is also an increasing evidence that prenatal exposure to helminths may influence the offspring's susceptibility to allergy-related diseases.[19]

Diagnosis of Soil-Transmitted Helminthiasis

Most parasitic diseases cannot be diagnosed by physical examination alone, and laboratory investigations are necessary. There are two ways to detect parasitic infections: conventional and molecular methods. Conventional method includes gross stool examination, microscopy, egg counting, and cultures whereas molecular-based techniques includes serology and coproantigen detection. Unfortunately, not all these methods are being utilized due to lack of trained personnel and appropriate technologies. Among all these tests the most reliable,

sensitive, and practical way to identify helminth infections is through stool analysis or fecalysis by microscopic examination. Therefore, the WHO recommends microscopy-based examination using the Kato-Katz method, a low-cost, simple, and standardized tool that provides sufficient sensitivity for morbidity control programs aiming to reduce prevalence of moderate- and heavy-intensity infections to less than 1%.[7]

Treatment of Soil-Transmitted Helminthiasis

Long-term solutions to soil-transmitted helminth infections will need to address many factors, including improvements in water supply, sanitation and hygiene. Provision of these basic services is fundamental, to break the cycle of infection and reinfection and sustainably control STH. Collaboration between different programs is essential especially in areas that are endemic to soil-transmitted helminths. Encouraging healthy behaviors, such as hand washing, use of footwear and proper disposal of feces together with preventive chemotherapy, or the periodic large-scale administration of anthelminthic medicines to populations at risk, can dramatically reduce the burden of disease.[20] Though the 2009 Cochrane review of nine studies did not show enough evidence to recommend the use of antihelminth medications after the first trimester of pregnancy and highlighted the need for larger-scale randomized controlled trials.[21] Later, in 2010, a large study in Uganda showed a maternal benefit in preventing anemia with administration of albendazole during the second and third trimesters of pregnancy only in women with moderate to heavy hookworm infection.[22] Hence, the WHO recommends preventive chemotherapy (deworming), using single-dose albendazole (400 mg) or mebendazole (500 mg), as a public health intervention for pregnant women on their second and third trimesters, living in endemic areas.[20] In the Philippines, the Department of Health commissioned the Integrated Helminth Control Program (IHCP) Strategic Plan which outlined mass treatment strategies among high risk groups which includes pregnant women in the second and third trimesters.[23]

OBJECTIVES

General Objective

To determine the prevalence of STH among pregnant patients consulting for pre-natal check-up in the out-patient department using microscopic stool analysis.

Specific Objectives

1. To describe the clinical profile of the study subjects.
2. To identify the species in the stool sample with positive results.
3. To document any adverse peri-natal outcomes related to the presence of helminthiases.

Research Question

What is the prevalence of soil-transmitted helminthiases among pregnant patients receiving antenatal care in the out-patient department of a tertiary hospital in the province of Cavite?

METHODOLOGY

Study Design

This is a single center, local, prospective, descriptive and analytic cross-sectional study design.

Study Period

The study was conducted last February to May 2019 (4 months).

Selection of Subjects

All pregnant women who consulted for antenatal care and consented for a free fecalysis regardless of their age, social status, obstetric scores and comorbidities.

Inclusion Criteria

All pregnant women consulted for prenatal check-up.

Exclusion Criteria

1. Pregnant patients already at term (>37 weeks age of gestation).
2. Pregnant patients with history of antihelminthic use within a year from the current pregnancy.
3. Pregnant patients without consent.

Sample Size

To estimate the prevalence of STH at 95% confidence interval with 5% margin of error, with the assumption that it is present in 31.5%% of Filipino pregnant patients, a sample size of 271 is needed (Figure 1).

Operational Definition of Terms

1. **Adverse Perinatal Outcomes** refers to conditions correlated with helminthiasis which includes but not limited to anemia, low pregnancy weight gain, coexisting infections, fetal growth retardation and preterm labor.
2. **Anemia** is defined as hemoglobin of ≤ 110 mg/dL.
3. **Antihelminthics** refers to medications used to treat intestinal parasitism. Mebendazole and Albendazole are examples.
4. **Fomites** are objects or materials which are likely to carry infection.
5. **Hematinics** any substance that tends to increase the

Sample Size for Frequency in a Population

Population size(for finite population correction factor or fpc)(*N*):	1474
Hypothesized % frequency of outcome factor in the population (*p*):	31.5%+/-5
Confidence limits as % of 100(absolute +/- %)(*d*):	5%
Design effect (for cluster surveys-*DEFF*):	1

Sample Size(*n*) for Various Confidence Levels

ConfidenceLevel(%)	Sample Size
95%	271
80%	130
90%	202
97%	319
99%	413
99.9%	573
99.99%	693

Equation

Sample size $n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$

Results from OpenEpi, Version 3, open source calculator--SSPropor
Print from the browser with ctrl-P
or select text to copy and paste to other programs.

Figure 1. Sample Size for Frequency in a Population

amount of hemoglobin in the blood. Ferrous sulfate and iron sucrose are examples.

6. **Heterologous Infections** refers to infections caused by unrelated pathogen.
7. **Neglected Tropical Disease** diverse group of tropical infections which are common in low-income populations in developing regions they are caused by a variety of pathogens such as viruses, bacteria, protozoa and helminths.
8. **Nematodes** or round worms constitutes the phylum nematoda. Ascaris lumbricoides is an example.
9. **Parasite** refers to the helminths.
10. **Preventive Chemotherapy** approach of treating populations at risk of human helminth diseases, to prevent transmission using antihelmithic drugs either alone or in combination.
11. **Soil-transmitted Helminthiases (STH)** refers to the intestinal worms infecting humans that are transmitted through contaminated soil.

Study Procedure

The study was conducted in coordination with the residents and allied healthcare providers of the out-patient clinic of the institution. All patients were oriented and given informed consent. Upon signing the consent, patients were automatically included in the study and patient data form was accomplished by the resident in-charge. Fecalysis was included as part of the routine antenatal laboratory tests. In order to standardize and limit bias, all stool examination was sent to the laboratory of the institution. Fecalysis results were followed-up on subsequent check-ups. Resident-in-charge informed the principal investigator of the test result for subject interview, documentation and tabulation. Adverse perinatal outcomes were reported and documented. Gathered data was subjected for analysis.

Outcome Measures

The primary outcome was the prevalence of STH among pregnant patients consulting for antenatal care in the out-patient department using microscopic stool analysis.

Secondary outcomes included: identification of parasite species and correlation of parasitism to any adverse peri-natal outcomes.

Statistical Analysis

Descriptive statistics was used for demographic and clinical data. These included mean +/- standard deviation, median, and percentage.

Statistical analyses were carried out using Stata version 15 and Microsoft Excel 2016. The prevalence of helminth infections, including the 95% confidence intervals (95% CIs) derived from the KK was calculated using the proportion command in Stata. The association of age group, age of gestation, obstetric scores and BMI with the STH prevalence derived from KK technique was analyzed using Chi-square test, and P values <0.05 were considered statistically significant.

Ethical Considerations

Informed consent was given, and procedures of the study were thoroughly explained. Information regarding the result of the fecalysis was disclosed to the subjects by their attending physician. Positive results and any adverse perinatal outcomes noted during the study that requires medical management was referred to and will be given appropriate treatment by the attending physician.

Subjects' name was not to disclosed outside the research clinic and was only available to the following people or agencies: the principal investigator and staff; and authorized representatives of the principal investigator; ethics committees and health authority inspectors. The principal investigator replaced subject's name with a special code that identifies them.

Participation of subjects was voluntary. Subjects was given the privilege to refuse participation if whole or any part of the study were not clear and fully understood. Subjects who were not able to read or write participated through her nearest kin.

The benefits of participating in this study included identification of helminthic infection and timely referral for appropriate treatment. There were no monetary costs given to subjects for participating in this study nor charged of the study procedures performed.

RESULTS AND DISCUSSION

A total of 270 pregnant patients consulting for antenatal visit were consented and participated in the study. Table 1 summarized the demographic, socioeconomic, and clinical profile of the subjects. The mean age was 24.42 ± 8.09 (14-47 years old). In terms of obstetrical profile, mostly were primigravid 130 (48.1%), 59 (21.9%) were on the second, 37 (13.7%) were on the third, 10 (3.7%) were on the fourth and 34 (12.59%) were on the fifth or more pregnancy. Most of the participants were on the second trimester 124 (45.9%) followed by those who are on their third trimester 121 (44.80%) and first trimester 25 (9.30%). Majority, 180 (66.7%) had no comorbidities and the remaining 99 (33.3%) had comorbidities. The most common comorbidities were: anemia 55 (20.4%), gestational diabetes mellitus 19 (7%) and 5 preeclamsia (1.9%) respectively. One hundred fifty participants (55.6%) had a normal body mass index, 64 (23.70%) were overweight, 34 (12.60%) were underweight and 22 (8.1%) were obese.

In terms of civil status, 180 (66.7%) were single and 90 (33.30%) were married. The mean number of household members was 5.29 ± 1.94 (2 to 14 persons). Majority, 249 (92.20%) had household members without history of antihelminthic treatment. All, 270 (100%) participants claimed they have water source in their house and majority, 262 (97%) had their own toilets. Only 8 (3%) claimed that their houses don't have toilets. The topmost areas where the respondents reside were as follows: Trece Martires City 50 (18.5%), General Trias 49 (18.1%) and Tanza 34 (12.6%).

In terms of educational background, majority 114 (42.20%) reached high school level followed by elementary level 112 (41.50%) and college level 44 (16.30%). Moreover, most of the participants were unemployed 166 (61.50%) and only 104 (38.50%) were employed. Among the employed participants, majority were factory workers 30 (11.10%). Majority, about 221 (81.90%) had monthly income of <10,000 pesos, 48 (17.80%) with income of 11,000-20,000 pesos and only 1 (0.40%) with income of 21,000-30,000 pesos.

Two hundred fourteen (79.30%) had a negative result while 56 (20.7%) had a positive result for parasites. Among the positive results, the most common identified parasite was Ascaris lumbricoides, 49 (87.5%); followed by Trichuris trichuria, 7 (12.5%); Gardia lamblia, 5 (8.9%); Entamoeba histolytica, 4 (7.1%), Blastocystis hominis 2 (3.6%) and 1 (1.8%) for Ancylostoma duodenale, Trichomonas hominis and Entamoeba coli. Thirteen (23.21%) specimens were mixed infections as shown in Table 2.

Table 3 summarized the association of clinical data with the fecalysis result. Using either the Chi Square Test and Mann U Whitney Tests, fecalysis result had a statistically significant association between all the independent variables except for the age of gestation, trimester, height, employment status, family monthly income and occupation ($p>0.05$). Generally, older individuals, higher obstetric scores, greater number of living children, and higher number of household members tend to have positive than negative fecalysis result and vice versa (Table 4). Moreover, individuals who were anemic (60.7%); underweight (33.9%); lived in a family with member treated with antihelminthics (21.4%); lived in the areas of Maragondon (10.7%), Mendez (7.1%), Bailen (3.6%), Cavite City (3.6%), Noveleta (1.8%) and Bacoor (1.8%) tend to have a higher positive fecalysis results. Individuals who had water source and a household toilet had a higher chance of negative results and vice versa. In terms of perinatal outcomes, those with positive fecalysis results were 4.1 times more likely to have adverse perinatal outcome of preterm labor (95% CI 1.44-11.7) and were 9.5 times more likely to have an ultrasound findings of small for gestational age fetuses (95% CI 3.01-29.9) as compared to those with negative results.

DISCUSSION

The Prevalence of Soil Transmitted Helminthiasisis

The inception of this study was based from a mortality case complicated by soil-transmitted helminthiasis admitted in the institution. The result showed a prevalence of 20.7%, although lower compared to the country's prevalence rate of 31.5% the result still belongs to the WHO Community Category II (medium infection).[1] The findings was however slightly higher compared to the 19% prevalence found in a study done in a local hospital in Manila.[12] Association of older age, higher obstetrical score, greater number of living children, and increased number of household members were attributed to the increased likelihood of exposure to parasite. In local literatures, the cumulative prevalence rate of pre-school and school age children were 43.7% and 54% respectively, which were the common age group of children of STH positive mothers who participated in the study.[24] Interestingly, there were areas in the Cavite Province with higher positive results: the agricultural mountainous areas of Maragondon, Mendez, and Bailen; and the flood-prone lowlands of Cavite City, Bacoor, and Noveleta. Theoretically, STH cases are common in agricultural lands and in lowland areas that are prone to flooding.[24]

Species Identified by Routine Fecalysis

The most common soil-transmitted helminth identified was *A. lumbricoides* with an overall prevalence of 89.28% followed by *T. trichuria* (14.28%). These findings were consistent with several local and international

Table 1. Demographic, socioeconomic, and clinical profile of subjects.

CHARACTERISTICS	FREQUENCY (n)	PERCENTAGE (%)
AGE		
≤18	94	34.8
19-35	139	51.5
≥36	37	13.7
GRAVIDITY		
1	130	48.1
2	59	21.9
3	37	13.7
4	10	3.7
≥5	34	12.59
PARITY		
0	139	51.5
1	51	18.9
2	38	14.1
3	11	4.1
4	10	3.7
≥5	21	7.7
LIVING CHILDREN		
0	139	51.5
1	52	19.3
2	36	13.3
3	13	4.8
4	11	4.1
≥5	19	7
CIVIL STATUS		
Single	180	66.7
Married	90	33.3
NUMBER OF HOUSEHOLD MEMBERS		
≤5	180	66.66
6-10	82	30.37
≥11	8	2.96
HISTORY OF ANTI-HELMENTIC TREATMENT AMONG HOUSEHOLD MEMBERS		
Yes	21	7.8
No	249	92.2
EDUCATIONAL BACKGROUND		
Elementary Level	112	41.5
High School Level	114	42.2
College Level	44	16.3
EMPLOYMENT STATUS		
Employed*	104	38.5
Unemployed	166	61.5
	PLACE OF RESIDENCE	
TRECE MARTIRES	50	18.5
GEN. TRIAS	49	18.1
TANZA	34	12.6
SILANG	33	12.2
GMA	17	6.3
INDANG	13	4.8
MARAGONDON	10	3.7
DASMARINAS	8	3

MENDEZ	8	3
NAIC	8	3
TERNATE	7	2.6
ROSARIO	5	1.9
TAGAYTAY	5	1.9
AMADEO	4	1.5
IMUS	4	1.5
CAVITE CITY	3	1.1
KAWIT	3	1.1
ALFONSO	2	0.7
BACOOR	2	0.7
BAILEN (GEA)	2	0.7
NOVELETA	2	0.7
CARMONA	1	0.4
COMORBIDITIES		
NONE	180	66.7
ANEMIA	55	20.4
GDM	19	7.0
CHRONIC HYPERTENSION	3	1.1
ASTHMA	4	1.5
PREECLAMPSIA	5	1.9
HEART DISEASE	1	.4
HEPATITIS B	3	1.1
BODY MASS INDEX (BMI)		
Underweight	34	12.6
Normal	150	55.6
Overweight	64	23.7
Obese	22	8.1
TRIMESTER		
First	25	9.3
Second	124	45.9
Third	121	44.8
TOTAL	**270**	**100**

Table 2. STH prevalence and species identified.

PARASITE	FREQUENCY	PERCENTAGE
Positive	56	20.7
Negative	214	79.3
Total	270	100.0
SINGLE-PARASITE INFECTION		
Ascaris lumbricoides	35	62.5
Trichuris trichuria	4	7.14
Entamoeba histolytica	2	1.78
Ancylostoma duodenale	1	1.78
Gardia lamblia	1	1.78
MIXED INFECTIONS		
Ascaris lumbricoides, Gardia lamblia	4	7.14
Ascaris lumbricoides, Trichuris trichuria	3	5.35
Ascaris lumbricoides, Blastocystis hominis	2	3.57
Ascaris lumbricoides, Entamoeba histolytica	2	3.57
Ascaris lumbricoides, Entamoeba coli	1	1.78
Ascaris lumbricoides, Trichomonas hominis	1	1.78

Table 3. Summary of the statistical association of the clinical variables with the fecalysis result.

INDEPENDENT VARIABLES	CHI SQUARE/ MANN U WHITNEY VALUE	P-VALUE	DECISION	CONCLUSION
AGE	3758.000	0.000	Reject Null Hypothesis	There is statistically significant association between the results (negative/ positive) and age
GRAVIDITY	3020.000	0.000	Reject Null Hypothesis	There is statistically significant association between the results (negative/ positive) and obstetric score - gravida
PARITY	2904.000	0.000	Reject Null Hypothesis	There is statistically significant association between the results (negative/positive) and obstetric score - para
LIVING CHILDREN	2886.000	0.000	Reject Null Hypothesis	There is statistically significant association between the results (negative/positive) and living children
CIVIL STATUS	10.826	0.001	Reject Null Hypothesis	There is statistically significant association between the results (negative/positive) and civil status
COMORBIDITIES	72.980	0.000	Reject Null Hypothesis	There is statistically significant association between the results (negative/positive) and comorbidities
TRIMESTER	5377.500	0.190	Accept Null Hypothesis	There is no statistically significant association between the results (negative/ positive) and trimester
BMI	39.618	0.000	Reject Null Hypothesis	There is statistically significant association between the results (negative/ positive) and maternal anthropometric measurements - bmi
EDUCATIONAL BACKGROUND	9.208	0.010	Reject Null Hypothesis	There is statistically significant association between the results (negative/positive) and educational background
EMPLOYMENT STATUS	0.018	0.506	Accept Null Hypothesis	There is no statistically significant association between the results (negative/ positive) and employment status
FAMILY INCOME	2.722	0.256	Accept Null Hypothesis	There is no statistically significant association between the results (negative/ positive) and family income
NUMBER OF HOUSEHOLD MEMBERS	3140.500	0.000	Reject Null Hypothesis	There is statistically significant association between the results (negative/positive) and number of household
HOUSEHOLD MEMBER TREATED WITH ANTIHELMINTHICS	18.355	0.000	Reject Null Hypothesis	There is statistically significant association between the results (negative/positive) and “household member treated with antihelminthics?”
AVAILABILITY OF TOILET IN HOUSE	14.756	0.001	Reject Null Hypothesis	There is statistically significant association between the results (negative/positive) and availability of toilet in house
ADDRESS/ RESIDENCE	37.086	0.016	Reject Null Hypothesis	There is statistically significant association between the results (negative/positive) and address/ residence
OCCUPATION	27.016	0.135	Accept Null Hypothesis	There is no statistically significant association between the results (negative/ positive) and occupation

Table 4. Summary of the statistical association of the clinical variables over positive fecalysis result.

VARIABLES	MEAN RANK	
	POSTIVE	NEGATIVE
Age	175.39	125.06
Gravidity	188.57	121.61
Parity	190.64	121.07
Living Children	190.96	120.99
Number of Household Members	186.42	122.18
CROSSTABULATION		
VARIABLES	**RESULT n (%)**	**TOTAL**
	POSTIVE	**NEGATIVE**	
CIVIL STATUS			
Single	27 (48.2%)	153 (71.5%)	180 (66.7%)
Married	29 (51.8%)	61 (28.5%)	90 (33.3%)
COMORBIDITIES			
None	18 (32.1%)	162 (75.7%)	180 (66.7%)
Anemia	34 (60.7%)	21 (9.8%)	55 (20.4%)
GDM	2 (3.6%)	17 (7.9%)	19 (7.0%)
Chronic hypertension	1 (1.8%)	2 (0.9%)	3 (1.1%)
Asthma	1 (1.8%)	3 (1.4%)	4 (1.5%)
Preeclampsia	0	5 (2.3%)	5 (1.9%)
Heart disease	0	1 (0.5%)	1 (0.4%)
Hepatitis B	0	3 (1.4%)	3 (1.1%)
BMI			
Normal	33 (58.9%)	117 (54.7%)	150 (55.6%)
Underweight	19 (33.9%)	15 (7.0%)	34 (12.6%)
Overweight	4 (7.1%)	60 (28.0%)	64 (23.7%)
Obese	0	22 (10.3%)	22 (8.1%)
EDUCATIONAL BACKGROUND			
Elementary	24 (42.9%)	88 (41.1%)	112 (41.5%)
High school	30 (53.6%)	84 (39.3%)	114 (42.2%)
College	2 (3.6%)	42 (19.6%)	44 (16.3%)
HOUSEHOLD MEMBER TREATED WITH ANTIHELMINTHICS			
No	44 (78.6%)	205 (95.8%)	249 (92.2%)
Yes	12 (21.4%)	9 (4.2%)	21 (7.8%)
ADDRESS/ RESIDENCE			
Gen. Trias	5 (8.9%)	44 (20.6%)	49 (18.1%)
Maragondon	6 (10.7%)	4 (1.9%)	10 (3.7%)
Tagaytay	2 (3.6%)	3 (1.4%)	5 (1.9%)
Ternate	2 (3.6%)	5 (2.3%)	7 (2.6%)
Tanza	5 (8.9%)	29 (13.6%)	34 (12.6%)
Indang	1 (1.8%)	12 (5.6%)	13 (4.8%)
Cavite City	2 (3.6%)	1 (0.5%)	3 (1.1%)
Silang	7 (12.5%)	26 (12.1%)	33 (12.2%)
Trece Martires	9 (16.1%)	41 (19.2%)	50 (18.5%)
Rosario	1 (1.8%)	4 (1.9%)	5 (1.9%)
Dasmarinas	2 (3.6%)	6 (2.8%)	8 (3.0%)
Mendez	4 (7.1%)	4 (1.9%)	8 (3.0%)
Imus	1 (1.8%)	3 (1.4%)	4 (1.5%)
Bacoor	1 (1.8%)	1 (0.5%)	2 (0.7%)
Noveleta	1 (1.8%)	1 (0.5%)	2 (0.7%)
Gma	3 (5.4%)	14 (6.5%)	17 (6.3%)
Bailen	2 (3.6%)	0	2 (0.7%)
Naic	2 (3.6%)	6 (2.8%)	8 (3.0%)
Kawit	0	3 (1.4%)	3 (1.1%)
Amadeo	0	4 (1.9%)	4 (1.5%)
Alfonso	0	2 (0.9%)	2 (0.7%)
Carmona	0	1 (0.5%)	1 (0.4%)

Table 5. Identified adverse perinatal outcomes.

ADVERSE PERINATAL OUTCOMES	Odds Ratio	95% CI	p-Value
Preterm Labor	4.10	1.44, 11.7	0.0113
Small for Gestational Age Fetus*	9.49	3.01, 29.9	0.0001
Low Normal Amniotic Fluid Index*	2.64	0.23, 29.8	0.4124
*determined by ultrasound			

studies and with the data provided by the CDC which identifies roundworms as the most common followed by whipworms and hookworms.[25] On the other hand, there are also non-helminth organisms that were identified: Gardia lamblia with overall prevalence of 10.71% and Entamoeba histolytica 7.14%. About 23.21% of the subject was noted with mixed infestation which higher compared to the findings in one local study (11.46%) and a study done in Ethiopia (5.36%).[3,25]

Adverse Perinatal Outcomes Determined in the STH Positive Group

The association of STH and anemia had been noted on several studies. In this study, those with maternal anemia had 60.7% likelihood of STH-positive fecalysis result and only 9.8% likelihood of a negative result. On the other hand, it was found out in a local study that having anemia was 11 times more likely when exposed to intestinal parasitism ($p<0.00001$) and about 88.7% in one Indian study.[11,10]

There were two notable perinatal outcomes associated with STH: preterm labor (OR 4.1; 95% CI 1.44-11.7) and ultrasound findings of small for gestational age fetuses (OR 9.49; 95% CI 3.01-29.9). A foreign publication similarly described that most infants born to infected mothers are often delivered prematurely, with low birth weight, and have poor growth and development throughout childhood.[17] Unfortunately, there are no local studies to date describing similar findings.

CONCLUSION

The cumulative prevalence rate of STH was 20.7% and the most common organism identified was Ascaris lumbricoides. Generally, older individuals; higher obstetric score; greater number of living children; increased maternal weight; anemic; underweight; lived in a family with higher number of household members; lived in a family with member treated with antihelminthics; lived in houses without water and toilet; lived in the areas of Maragondon, Mendez, Bailen, Cavite City, Noveleta and Bacoor tend to have higher positive fecalysis results. Moreover, preterm labor and small for gestational age fetus were the two clinically significant adverse perinatal outcomes identified in the study.

LIMITATIONS OF THE STUDY AND RECOMMENDATIONS

The study only determined prevalence of STH, it is however better if the degree of parasite burden was also determined to put ascendancy on the results. Moreover, the study is limited only to those whom on follow-up are still pregnant. It is therefore recommended that further studies were needed to determine outcomes during the postpartum period to determine a wider array of clinical outcomes. Although there is no gold standard in determining STH prevalence, the simple and cost-effective use of routine fecalysis is recommended especially in areas and in individuals where the disease is highly suspected.

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