PREVALENCE, AND FACTORS INFLUENCING SOIL TRANSMITTED HELMINTHS (STH) AMONG SCHOOL AGE CHILDREN (5–14 YEARS AGE) IN A RURAL AREA OF COIMBATORE DISTRICT

DISSERTATION SUBMITTED FOR

M.D. COMMUNITY MEDICINE

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY, CHENNAI

DEPARTMENT OF COMMUNITY MEDICINE

PSG INSTITUTE OF MEDICAL SCIENCES & RESEARCH

PEELAMEDU, COIMBATORE - 641004

TAMILNADU, INDIA

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DECLARATION

I hereby declare that this dissertation entitled “PREVALENCE, AND FACTORS INFLUENCING SOIL TRANSMITTED HELMINTHS (STH) AMONG SCHOOL AGE CHILDREN (5–14 YEARS AGE) IN A RURAL AREA OF COIMBATORE DISTRICT” was prepared by me under the guidance and supervision of Dr.M.Sivamani Professor, Department of Community Medicine, PSGIMS&R, Coimbatore.

This dissertation is submitted to The Tamilnadu Dr.MGR Medical University in partial fulfillment of the university regulations for the award of MD Degree in Community Medicine.

Dr.V.Xavier Christu Rajan

Post-Graduate student
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My parents and wife for making me who I am and for making it all worthwhile.
LIST OF ABBREVIATIONS

STH  Soil Transmitted Helminthiasis
WHO  World Health Organization
CDC  Center for Disease Control
NTD  Neglected Tropical Disease
FEC  Formalin Ether Concentration
DALY Disability Adjusted Life Years
CPI  Consumer Price Index
SES  Socio Economic Status
MDA  Mass Drug Administration
NDD  National Deworming Day
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1. INTRODUCTION

Soil Transmitted Helminthiasis (STH) is a term widely used to refer to a group of parasitic diseases caused by nematode worms that are transmitted to humans by soil contaminated with fecal matter. The soil-transmitted helminthes causing major illness among human beings are Ascaris lumbricoides, Trichuris trichiura, Necator americanus and Ancylostoma duodenale. These parasites are spread through contact with soil contaminated with human feces. STH commonly occurs in places with poor sanitation and poverty. They are widely distributed in tropical and subtropical areas.

STH are considered Neglected Tropical Diseases (NTDs), because they have been largely wiped out in the more developed parts of the world and persist only in the poorest, most marginalized communities and conflict areas. NTDs inflict tremendous disability and suffering yet can be controlled or eliminated.

Ascaris lumbricoides is the "giant roundworm" of humans. This is the most common and important parasitic worm affecting human beings. The disease caused by Ascaris lumbricoides is termed as Ascariasis. This is also called as large roundworm, and the name actually refer to its shape. Ascariasis was found since ancient times. There are lot of evidences confirmed the existence of these worms in old world.

Infection caused by Hookworm is also called as hookworm disease. Hookworm is one of the causes of anemia. Anemia is a leading killer of mother and child. By causing anemia hookworms are indirectly contributing to maternal and child morbidity. Hookworm infections include both Ancylostomiasis and Necatoriasis.
Theodore Bilharz found out connection between intestinal helminth and Tropical chlorosis (Anaemia) in Egypt. Italian pathologists identified the silent cause of anaemia among those who were involved in the construction of Saint Gothard railway tunnel in Swiss Alps\textsuperscript{5,6} as *Ancylostoma duodenale*.

The public health importance of hookworm was realized in the beginning of twentieth century. During 1901, hyper endemicity of hookworm on the island of Puerto Rico, was associated to the death of people\textsuperscript{7}.

In 1740 Italian scientist, Morgani\textsuperscript{8}, discovered the adult human whipworm in the colon. In 1761, the German physician, Roedere described the morphology of whip worm. Similar to other STH, these whipworm infection were also found in prehistoric man.

STH is an infectious disease. The life cycle of Soil Transmitted Helminthes follow a general pattern\textsuperscript{9}. The adult parasites usually live in human intestine. Adult worms survive for more years. The female worms lay eggs. The eggs laid in the intestine were passed in human faces thus transferred and deposited in the external environment. Round worm and whip worm eggs enter the human body through accidental ingestion of eggs. Hookworm larvae penetratethe skin and enter the body. The transmission of STH can be summarized by Basic reproductive number (R\textsubscript{0}). The value of R\textsubscript{0} among various Soil Transmitted Helminths varies. *A.lumbricoides* values ranges between 1to5. For *T.trichiura* the value ranges between4to 6. For Hookworm the values ranges between2 to 3\textsuperscript{10}.
1.1 Global extent of the problem

Soil Transmitted Helminths affects more than one fourth of the world’s population. More than 438.9 million people\textsuperscript{11} are infected with soil-transmitted helminth infections. A meta-analysis was done in 2010 to estimate the global prevalence STH. It showed that around 480 million were infected with hookworm, around 819 million with A. lumbricoides and 464 million with T. trichiura. Over 270 million preschool-age children and over 600 million school-age children live in areas where sanitation is poor and these parasites are intensively transmitted\textsuperscript{12}. Infections are widely distributed throughout the globe however it is reported more in tropical and subtropical areas. The greatest number of cases are occurring in sub-Saharan Africa, the Americas, China and East Asia\textsuperscript{13}.

1.2 Extent of the problem in India

India is having more STH burden, more than 241 million children at risk of parasitic worm infections. In India so many studies were conducted and the reported prevalence of STH infection varied from 7.8 % to 92.6%. The reported prevalence varies according to the place and time of the study conducted\textsuperscript{14-18}.

1.3 Extent of the problem in South India

There are many studies available regarding the prevalence of STH in Tamilnadu. A very recent one was conducted by Deepthi Kattula\textsuperscript{17} in 2014. The study was conducted among 3706 School Aged Children of 6 to 14 years in Vellore and the reported prevalence of STH was 7.8%. Kaliappan et al\textsuperscript{19} in 2013 conducted a cross sectional study among tribal population including school aged children (SAC) in Thiruvanamalai, Tamilnadu, the overall prevalence was estimated as 39%.
Latha et al.\textsuperscript{20} conducted a cross-sectional study in 2010 among 1172 school children (5-14) in Puducherry and the prevalence was 34.56\%. Mani et al.\textsuperscript{21} conducted a cross-sectional study in Villupuram, Tamilnadu in 2002 among 646 school age children (9 to 10 years) and the prevalence was reported as 53.9\%. Kang et al.\textsuperscript{22} conducted a cross-sectional study in 1998 among rural population in Vellore and the prevalence of STH was 61.5\%.

1.4. Seriousness of the problem

STH is a public health problem. Ascariasis causes sixty thousand deaths per year. Hookworm causes sixty-five thousand deaths per year\textsuperscript{23}. Trichuris trichiura causes ten thousand deaths per year. Hookworms are commonly reported among children, women of reproductive age, and pregnant women. Hookworms affect physical and mental development in children by causing irritation and anaemia\textsuperscript{24,25}. The worms increase malabsorption of nutrients. Roundworms cause vitamin A deficiency. STH affects all age groups. The highest intensity of soil transmitted helminths occur more in school age children\textsuperscript{26}. The morbidity caused by soil transmitted helminthes among them include malnutrition, growth retardation, vitamin A deficiency, anemia, etc.\textsuperscript{27-29}. Anemia is highly prevalent in south India and 52.8\% of the school age children are found anemic\textsuperscript{30}. STH infections are considered as an important cause of sickness absenteeism. They are accounting for loss of 12.3\% and 11.4\% of disability adjusted life years (DALY) in girls and boys respectively\textsuperscript{31}. 
1.5 Risk factors

Risk factors associated with STH are demographic factors like age, male gender, low educational level of mother, poor socio-economic status, kutcha house, not using safe drinking water, sanitary latrine, lack of personal hygiene like not washing the hands with soap before eating and after coming from toilet, habit of picking and eating foods fallen on the ground, habit of eating unwashed vegetables, not clipping the nails frequently, not wearing footwear, non consumption of deworming tablets etc.,

1.6 Lab Diagnosis of STH:

Infection with STH can be readily diagnosed by detection eggs of STH in stool samples using microscopic techniques. There are different techniques available to detect the helminth eggs in stool samples. The concentration methods are recommended by CDC. The concentration method generally improves sensitivity at the cost of reducing the ability to assess infection intensity. WHO recommended use of formol-ether concentration (FEC) method in remote areas where microscopy is often unavailable, and this allows the fixation of stool samples for later examination. The most widely used other methods are Kato-Katz technique, McMaster, FLOTAC, and Mini-FLOTAC. Harada Mori technique is used to differentiate Ancylostoma duodenale from Necator americanus by microscopic examination of the mouthparts of hookworm larvae.
1.7. Intervention

STH infections are treated using regular periodic chemotherapy using Benzimidazole anthelmintics. These interventions are considered as logistically feasible and cost effective intervention strategy. The school-aged children were delivered deworming tablets through the school system. WHO recommended to use a single generic tablet of 400 mg Albendazole or 500 mg Mebendazole for school aged children. The cost of drugs should be considered as little as 0.02 US$. Ministry of Health and Family Welfare (MoHFW), Government of India launched the National Deworming Day (NDD) on Feb 10, 2015. NDD aims to deworm all children between the ages of 1 to 19 years. The tablets were supplied to children through Government, Government-aided and private schools, and anganwadi centers. Cost effectiveness studies regarding deworming in India showed 0.02 to 0.04$ per child per year.
2. NEED FOR THE STUDY

There is a need to understand better ecology, epidemiology, of helminthes and to develop low cost ways to identify target populations for treatment. The wide variation in the prevalence of different species of STH in India needs further epidemiological details at the national level\(^\text{42}\).

There is no recently published article on prevalence of soil transmitted helminthes in Coimbatore. However, a health survey conducted among 34,534 school children studying in 85 schools located within Coimbatore Corporation in 2013 reported 14.97\% of children gave history suggestive of STH.

Open air defecation is a common practice in rural Coimbatore. As per 2011 census, 46\% of the households in Coimbatore district lack toilets. Children in their schooling age do not fully understand the connections between illness and behavior\(^\text{38}\). It has been demonstrated that children often than adults tend to go barefoot\(^\text{34}\), resulting in more contact with soil, and fail to use sanitary facilities even when they are present.

In rural India it was documented that 64\% school going children (6-14 years) practiced hand washing with soap after defecation and had unclean and uncut nails and lack of hygiene education\(^\text{43}\). Another study conducted in 392 schools in seven Indian states revealed that only one third (32 per cent) of the children wash hands with soap before eating\(^\text{44}\). These factors facilitate spread of STH.

Coimbatore is situated in rain shadow area\(^\text{45}\). Even though environmental factors like clay soil suitable for the roundworm eggs or sandy moist soil suitable for the hook worm eggs are there in some areas,
Coimbatore has predominantly red, loamy black soil\textsuperscript{46}. Pediatricians treat children empirically and periodically with Albendazole. These factors are unfavourable for the transmission of soil transmitted helminthes in Coimbatore.

Since Coimbatore has both favourable and unfavourable factors for presence of soil transmitted helminthes and no recently published studies on it, a cross sectional study was conducted with the objective of finding the prevalence and risk factors associated with soil transmitted helminth infections in school age children (5-14 yr) in the field practice area of the Rural Health Training Centre (RHTC), Vedapatti under Department of Community Medicine, PSG Institute of Medical Sciences & Research, Coimbatore.
3. OBJECTIVES

1. To find the prevalence of Soil Transmitted Helminth infections in school age children (5-14 yr) in the field practice area of PSGRHTC Vedapatti.

2. To find the risk factors associated with Soil Transmitted Helminthic infection among school age children in the field practice area of PSGRHTC Vedapatti.
4. REVIEW OF LITERATURE

4.1 Definition of STH

Soil-transmitted helminthiasis (STH) is a term referring to a group of parasitic diseases caused by nematode worms that are transmitted to humans by fecal-contaminated soil. Ascaris lumbricoides, Trichuris trichiura, Necator americanus, and Ancylostoma duodenale are the Soil transmitted helminths. These soil-transmitted helminths are of major health concern to humans. These STHs are considered Neglected Tropical Diseases (NTDs) because they inflict tremendous disability and suffering yet can be controlled or eliminate.

4.2 History of STH

4.2.1. History of Round worm

Ascaris lumbricoides is the "giant roundworm" of humans. This is the most common and important parasitic worm affecting human beings. In the animal kingdom classification they are classified under phylum Nematoda and ascarid nematode. The disease caused due to Ascaris lumbricoides is termed as Ascariasis. Ascariasis was found since ancient times. The actual name of this worm was given by Linnaeus. This is also called as large roundworm, because of its shape. There are lot of evidences confirmed the existence of these worms in old world. The Ascaris lumbricoides eggs were found from ancient human coprolites. Egyptian mummy dating from BC 1938 to 1600 showed evidence for this.

4.2.2. History of hook worm
Infection caused by Hookworm is also called as hookworm disease. Hookworm is an important cause of anemia. Anemia is a leading killer of mother and child. Thus hook worm contribute to mortality and morbidity of mother and children. Hookworm infections include both Ancylostomiasis and Necatoriasis.

The scientific studies regarding hookworm were stated at the beginning of twentieth century. For more than a hundred years the scientists were trying to understand the pathophysiology and epidemiology of human hookworm infection. It was amazing that people working in Gothard railway Tunnel work were often reported as anemic. The cause of tropical chlorosis (anaemia) remain unidentified for more than a hundred years. Theodore Bilharz found out the connection between intestinal helminth and tropical chlorosis in Egypt. Italian pathologists identified the cause of anemia among the people in Swiss Alps who were involved in the construction of Saint Gothard railway tunnel. The silent cause of anaemia among them was due to infection with Ancylostomaduodenale. Looss in 1901, was the first who described about the life cycle of A. duodenale. Necatoramericanus, another worm causing of hook worm disease.

Public health importance of hookworm was realized in the beginning of twentieth century. During 1901, hyper endemicity of hookworm on the island of Puerto Rico, was associated to the death of people. The United States appointed Rockefeller Sanitary Commission to look into the health issues related to hook worm caused around 12,000 deaths annually in Islands of Puerto Rico. During this period hookworm was also a problem in overseas. In order to look into the International health issues due to this worm, Health Commission was formed. The first Department of
Helminthology was started in Johns Hopkins School of Hygiene and Public Health in 1916. This establishment is an important step in the study of hookworm.

Chandler used an index used to identify the importance of hookworm infestation as a public health problem in a community. It is calculated based on average number of hookworm eggs / gram of stool as given in the following Table 1.

Table 1: Chandler’s index

<table>
<thead>
<tr>
<th>Average no. of hookworm eggs/gm of stool</th>
<th>Significance of hookworm infestation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;200</td>
<td>Not much significance</td>
</tr>
<tr>
<td>200-250</td>
<td>Potential danger</td>
</tr>
<tr>
<td>250-300</td>
<td>Minor public health problem</td>
</tr>
<tr>
<td>&gt;300</td>
<td>Major public health problem</td>
</tr>
</tbody>
</table>
4.2.3. History of whipworm

In 1740, Italian scientist, Morgani discovered the adult worms of human whipworm in the colon. In 1761, the German physician, Roeders redescribed the morphology of whip worm. Whipworm infections were found in prehistoric man.

4.3. Morphology of STH

4.3.1. Morphology of Hook worm

A. duodenale worms are grayish white or pinkish in color. The head is bent slightly. The rest of the body is in axial line. The head bent looks like a hook. The hook shape is found at the anterior end of worm. Due to this hook like appearance of head bent they are called as hookworms. The mouth is well developed. The mouth has two pairs of teeth. Male worm measure approximately one centimeter and 0.5 millimeter. Females worms are often longer but they are stouter. Male worms can be easily differentiated from females by prominent posterior copulatory bursa.

There are lot of similarities between N. americanus and A. duodenale in morphology. N. americanus is generally smaller than A. duodenale. Male worm of N. americanus usually measures 5 to 9 mm length. Female worm of N. americanus usually measures about 1 cm in length. Important difference in A. duodenale is extra pairs of teeth of cutting plates in the buccal capsule. N. americanus possesses only one pair. Hook shape is much more defined in Necator and in Ancylostoma it is ill defined.

4.3.2. Morphology of Round worm

A. lumbricoides looks big in size. The diameter of male worms is usually 2 to 4 mm. The Male worms are 15 to 31 cm in length. The male worms possess a
curved posterior end. Female worms are 3 to 6 mm in width and their length ranges from 20 to 49 cm. The vulva is located at the anterior end. Female worms lay 200,000 eggs per day. The uterus of worm contain up to 27 million eggs at a time. The fertilized eggs are oval to round in shape. The fertilized eggs are measuring 45 to 75 µm in length and 35 to 50 µm in width. Fertilized eggs possess a thick outer shell. Unfertilized eggs measure 88 to 94 µm in length and 44 µm in width.54

4.3.3. Morphology of Whip worm.

Trichuristrichiura is commonly called as the whipworm.8 The name refers to the shape of the worm. These are pinkish-white in color. This worm looks like tread. This worm has a narrow anterior esophageal end. The posterior anus end is shorter and thicker whereas anterior end is slender. Whip worm possesses wider "handles" at the posterior end. They attach to the host through anterior end. They feed on tissue secretions using anterior end. They feed secretions instead of blood.

The adult worms are fixed in intestinal locations, with the anterior portions. Female worms of Trichuris are larger when compared to male worms. The length of female and male worms is ranging from 35 to 50 mm and 30 to 45 mm respectively.8 The female T. trichiura produces approximately 2,000 to 10,000 single-celled eggs per day. Their eggs are barrel-shaped and brown in colour. They have bipolar protuberances.
4.4: Epidemiology and Transmission of STH

The life cycle of soil transmitted helminths is following a general pattern. The adult parasit stages usually live in some part of human (host) intestine. A. lumbricoides and hookworm live in the small intestine. T. trichiura live in the colon. These worms reproduce by sexual method. The female worms lay eggs. Adult worms survive for more years and lay large numbers of eggs. The egg production varies from parasites to parasites. The eggs laid in the intestine are passed in human faces thus get transferred and deposited in the external environment. Eggs of A. lumbricoides remain active in the soil for so many years and T. trichiura can be active in the soil for months. The larvae of hookworms remain only for several weeks. The usual mode of transmission of soil transmitted helminths is through accidental ingestion of eggs for example A. lumbricoides and T. trichiura. Hookworm larvae penetrate the skin and enter the body through different routes. A. duodenale larvae can undergo arrested development and retained in the human body. This is called “hypobiosis” and this occur under certain environmental conditions.

The incubation periods of A. lumbricoides, N. americanus, A. duodenale and trichuristrichiura are in the range of 18 days to several weeks, 7 weeks, 9 months and in the range of 60 to 90 days respectively.

The transmission of soil transmitted helminths can be summarized by Basic reproductive number (R0). The R0 means the number of secondary infectious persons from one infectious person following their introduction into a totally susceptible population. It was found ranging from 1 and $6^{10,55}$. R0 values for
A. lumbricoides ranging between 1 to 5. For T. trichiura the value ranges between 4 to 6. For hookworm the values ranges between 2 to 3.

4.5: The burden of disease

STH causes significant burden. Ascariasis causes 60 thousand deaths per year. Hookworm causes 65 thousand deaths per year. Trichuristromendala causes 10 thousand deaths per year. Hookworm disease is the condition in which the iron deficiency anemia is associated with hookworm burden. Hookworms are commonly reported among children, women of reproductive age, and pregnant women.

Soil transmitted helminths affect health and nutritional status of individuals. The worms have the habit of feeding host tissues, like blood and intestinal secretions. Thus the worm infection leads to a protein and iron loss. Loss of iron leads to anemia. The worms increase malabsorption of nutrients. Roundworm causes vitamin A deficiency.

Some soil-transmitted helminths cause loss of appetite and lead to reduced nutritional intake. T. trichiura causes diarrhoea.

4.6: Lab Diagnosis of STH:

Infection with STH is routinely diagnosed by detection of eggs of STH in stool samples using microscopic techniques. There are different techniques available to detect the helminths eggs in stool samples. The concentration methods are recommended by CDC. The concentration step generally improves the sensitivity at the cost of reducing the ability to assess infection intensity. WHO recommended the use of formol-ether concentration (FEC) method in remote areas where microscopy often not available. This requires the fixation of stool samples for later examination.
Some of the widely used other methods are Kato-Katz technique, McMaster, FLOTAC, and Mini-FLOTAC. Harada Mori technique used to differentiate Ancylostomaduodenale from Necatoramericanus by microscopic examination of the mouthparts of hookworm larva. Some commonly used methods and their sensitivity specificity are shown in table 2. Each technique shows different sensitivity and specificity. Kato-katz method has better sensitivity compared to other methods. However, hookworm eggs may lyse if samples are not examined within thirty minutes of preparation of slide. Sensitivity can be increased by examining slides from multiple stool samples.

Currently no highly sensitive antigen or antibody based tests available for diagnosis of STH. Assays based on polymerase chain reaction (PCR) have been developed, however these do not have good sensitivity than microscopic techniques. PCR-based diagnosis of hookworm infection has been developed, however is under trail.
4.7: Sensitivity and Specificity of various methods for detection of STH

Table no2: Various Diagnostic Tests used to detect STH (Adopted from Yimer M et al)\textsuperscript{60}

<table>
<thead>
<tr>
<th>Techniques</th>
<th>Sensitivity (95 % CI)</th>
<th>Specificity (95 % CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEC</td>
<td>63.1 (62.9–63.3)</td>
<td>94.5 (94.4–94.7)</td>
</tr>
<tr>
<td>Wet mount</td>
<td>48.9 (48.8–49.1)</td>
<td>94.5 (94.4–94.7)</td>
</tr>
<tr>
<td>Kato Katz</td>
<td>93.7 (93.6–93.7)</td>
<td>94.5 (94.4–94.7)</td>
</tr>
</tbody>
</table>

4.8: Formalin Concentrate Procedure For Cysts and Eggs

The formalin-ethyl acetate concentration was developed by Ritchie. It is considered as an essential procedure in order to complete ova and parasite examination in stool sample with low intensities of STH\textsuperscript{112}. There may be lot of chances of missing detection of STH while using only a direct wet smear. This method allows the fine detection of STH even small numbers of organisms are found. During concentration procedure centrifugation step will recover protozoa, eggs and larvae present in the sample. Ethyl acetate (Diethyl ether) is used as an extractor. This extracts and allows the parasites to suspend at the bottom of the suspension. This removes debris and fat from the feces. This method is least subject to technical error and easy to perform. Hence Formalin Ether concentration (FEC) Concentration using formalin-ethyl acetate sedimentation is recommended in recent days. This method has a sensitivity of 63.1%
[95%CI (62.9%–63.3%)] and specificity of 94.5 [95%CI(94.4%–94.7%)] for detecting STH from one stool sample

**4.9. Prevalence of STH:**

The major distribution of Soil-transmitted helminths infections occur in countries located in tropical and subtropical areas. Lack of sanitation causes STH. Poverty is highly linked with STH.

**4.9.1 Global Scenario:**

STH Infections are widely distributed throughout the globe. They affect more than one fourth of the world’s population. More than 438.9 million people are infected with soil-transmitted helminth infections. It was evident from a meta analysis conducted in 2010 that globally around 480 million, 819 million and 464 million people were infected with hookworm, A. lumbricoides and with T. trichiura respectively. Over 270 million preschool-age children and over 600 million school-age children live in tropical and subtropical areas. These areas have more poverty and contribute excessive risk. The greatest number of cases are occurring in sub-Saharan Africa, the Americas, China and East Asia.

**4.9.2 Prevalence of STH in America:**

Starr MC et al done a review on epidemiology of soil-transmitted helminth infections in United States and showed that prevalence of Hookworm, T. trichiura and A. lumbricoides were 19.6%, 55.2% and 49.4% respectively.

Britto, Barreto et al conducted a study in Brazil, South America in 2006, The prevalence of Hookworm, Ascaris lumbricoides and Trichuris trichiura was 15.7%, 63%, and 78.4% respectively.
Rosewell et al\textsuperscript{64} in 2005 conducted a cross-sectional study among 880 children in Nicaragua. Nearly 46\% of the children were infected with soil-transmitted helminths. Trichuristrichiura was identified as the most common infective species. The prevalence was reported as 34.7\%.

4.9.3 Prevalence of STH in Asia.

In Asia over the last forty years\textsuperscript{65} some countries, notably Taiwan, South Korea and Japan had reported less prevalence. They successfully achieved and gained sustained control of STH infections\textsuperscript{65}. Sri Lanka more recently had showed STH prevalence of less than five percent. However prevalence of STH remains still high in China and India. The highest prevalence rates of STH were reported from the northern regions of southeast Asia and the Pacific Islands of southern China\textsuperscript{66}.

Anantaphruti MT\textsuperscript{67} et al conducted a cross-sectional study in 2004 among school children in Thong PhaPhum district of Kanchanaburi Province, Thailand. The STH prevalence was reported as 15.6\%. Hookworm infection was the most commonest found (9.8\%). Prevalence of Trichuristrichiura and Ascaris lumbricoides were 6.2\% and 2.2\% respectively.

Al-Mekhlafi MS\textsuperscript{68} et al conducted a cross-sectional study among 292 rural Orang Asli primary school children (age 7-12 years), in Malaysia. Stool samples were examined by Kato-Katz technique. The prevalence of ascariasis, trichuriasis, and hookworm infections were 67.8\%, 95.5\% and 13.4\%, respectively.

Pegelow K et al\textsuperscript{69} conducted a cross-sectional study among children aged 8 to 10 years from ten schools located in the rural district Sukaraja, West Java, Indonesia in December 1995. Totally 348 stool samples were examined by using modified
Kato-Katz thick smear technique. Trichuristriichiura was found with a prevalence of 76% followed by Ascaris lumbricoides 44%. Hookworm was found less only (9%).

**Antonio Montresor**\(^{70}\), et al conducted across sectional survey in Myanmar from June 2002–to June 2003 to assess the STH prevalence among school age children of Myanmar. The overall prevalence of infection was reported as 69%.

The same author along with **Tun.A, et al**\(^{71}\) conducted a cross sectional study after seven years in Myanmar and showed less prevalence of STH (21%). Ascariasis was only 5.8% reported and trichuriasis was 18.6%. Prevalence of hookworm infection was found very less 0.3%.

**Tai-Soon Yong**\(^{72}\) et al conducted study on STH in two rural villages (Chitrasar, Jerona) in Chitwan District, Nepal in 1999. This was a cross sectional study involved 300 stool samples from schoolchildren. This was using formalin-ether sedimentation technique. The results showed that hookworm was the most prevalent 13.0% followed by Trichuristriichiura (3.0%) and Ascaris lumbricoides (1.7%).

**Martin J**\(^{73}\) et al conducted a cross sectional study among children aged six months to 15 years northern Bangladesh. From the 203 stool samples examined, the prevalence of Ascaris lumbricoides, Trichuristriichiura, hookworm and were estimated as 68%, 56%, 53% respectively.
4.9.4 Prevalence of STH in Africa.

The neglected tropical diseases (NTDs) are the most common conditions affecting more than 500 million poorest people living in sub-Saharan Africa (SSA). Approximately 85% of the NTD disease burden was due to helminth infections. Hookworm infection occurs in 50% of poorest people living in SSA. Of the estimated Almost one-half of the school-aged children in SSA, were infected STH infections.

Kelechi Kenneth Odinaka, et al conducted a cross-sectional study in a rural community, in Southeastern Nigeria in 2012. The overall prevalence of soil-transmitted helminthic infection (STHI) was 30.3%. The hookworm was the commonest STH found in the study.

Appleton CC et al conducted a cross-sectional study among young children aged 2 to 10 years in urban slums located in Durban, South Africa. The prevalence of A. lumbricoides were in the range of 81.7% to 96.3%, T. trichiurawas 54.5% to 86.2% and hook worm was 0% to 20.1%.

4.9.5 Indian Scenario:

India is having more STH burden, more than 241 million children at risk of parasitic worm infections. In India so many studies were conducted and the reported prevalence of STH infection varied from 7.8% to 92.6%. The reported prevalence varies according to the time and place of the study conducted.
Deepthi Kattula\textsuperscript{17}\textit{et al} estimated STH prevalence by a cross sectional study in 2014 among 3706 school aged children (aged 6-14 yr), in Vellore and Thiruvanamalai districts and reported the prevalence of STH as 7.8 per cent.

Saravanakumar\textit{et al}\textsuperscript{19} conducted a cross-sectional study among 1237 tribal population including 620 tribal children in Tiruvanamalai in 2013. Using Formalin Ether Concentration method the prevalence of STH was 39%. Hookworm was the highest 38% and Ascaris lumbricoides 1.5%. No Trichuris trichiura infection was reported.

Wani\textit{et al}\textsuperscript{77} conducted a cross sectional study among 2256 children from rural as well as urban areas of the Kashmir valley during 2007. The samples were examined by simple smear and zinc sulphate concentration methods. The prevalence of Ascaris lumbricoides was 68.30% and Trichuris trichiura was 27.92%.

Wani\textit{et al}\textsuperscript{78} conducted a school based cross sectional study among 514 students from four middle schools in Kashmir during 2007. The stool samples were processed with the use of both simple smear and zinc sulphate concentration methods. Prevalence of STH was 46.7%. Prevalence of Ascaris lumbricoides was the highest (28.4%), followed by Trichuris trichiura (4.9%).

Another study conducted Wani\textit{et al}, in 2007\textsuperscript{79} among 312 Kashmir rural school going children in the age group of 4-15 years, revealed the highest frequency of STH 69.23% for Ascaris lumbricoides followed by Trichuris trichiura 30.76% (96/312).

LathaRagunathan\textit{et al}\textsuperscript{20} conducted a cross sectional study of soil transmitted helminthic infections in 1,172 children in public schools in Puducherry (Pondicherry),
South India, between March and September 2006. The stools collected were concentrated using the formol–ether sedimentation technique, screened using conventional iodine and saline wet mounts, and examined by direct microscopy. The prevalence of STH was 34.56% among school children. In this study Ascaris lumbricoides constituted 43.21% of total infections; Ancylostoma duodenale (hookworm) 28.89% and Trichuris trichiura, 10.87%.

Bora D, Meena VR\textsuperscript{80} conducted a cross sectional study in 2005 among 257 school children of 9-10 year age group in of Pauri Garhwal District, Uttaranchal state using Kato-Katz technique for stool sample examination. The prevalence of STH was 31.5%.

Bora D, Meena VR\textsuperscript{81} conducted a cross sectional study in UT of Lakshadweep during February-March 2004. Soil Transmitted Helminthes survey was done using WHO sampling methodology and Kato-Katz technique. Around 83% out of 387 stool samples were found positive for one or more STH.

Naish S et al\textsuperscript{18} conducted a study in 2004 on prevalence of STH among 204 children aged 5-9 years attending school in the PedaJalaripet, Visakhapatnam, South India. The prevalence was found as 92.6%. The predominant parasite was Ascaris lumbricoides (91%).

Mani et al\textsuperscript{21} conducted an interventional study on efficacy of Albendazole in Villupuram District of Tamil Nadu State, India among children 1 to 15 years of age. Kato-Katz technique was used. The prevalence was found twice. First was immediately before MDA and the second one was 3 weeks after the MDA. A pre-treatment cross-sectional survey included 646 school children. And the pre MDA
prevalence was 60%. The overall prevalence rates for Ascaris lumbricoides, hookworms and Trichuris trichiura, were 53.9%, 12.4% and 5.7% respectively. Following deworming the prevalence came down to 15.56%.

Fernandez MC al\textsuperscript{82} conducted across sectional study in 2002, among school aged children in Chennai. This was a comparative study among rural and urban regarding the prevalence of STH and other intestinal parasites. Stool samples were examined by microscopy using saline mount, iodine mount, saturated sodium chloride flotation technique and zinc sulphate concentration (for suspicious case). In rural area the prevalence of Ascaris lumbricoides, Trichuris trichiura and Ancylostoma duodenale were 52.8%, 45.6%, and 37.6% respectively. In contrast under urban settings, T. trichura and A. lumbricoides were found 2.01%, 0.50% respectively. Study showed that much lower STH prevalence in urban area when compared with rural area.

Paul I\textsuperscript{83} conducted a cross sectional study among school aged children among 7-13 years in Relliveedhi, Visakhapatnam, Andhra Pradesh. Those children belonged to low socio-economic status. Round worm (75%) was the most common helminthic parasite detected followed by whip worm (66%) and Hook worm (9%).

Kang et al\textsuperscript{22} in 1998 studied the prevalence of intestinal helminthic infection in a rural area. Multiple stool samples were collected from each individual and stools were examined by formalin ether concentration. Hookworm infections were found highly prevalent (61.5%).

Mani GG et al\textsuperscript{84} conducted a study during 1990-91 to determine the prevalence of hookworm infection in primary schoolchildren living in fishermen slum in Jalaripet, Andhra Pradesh. Samples were processed by a modified formalin-ethyl acetate
sedimentation technique. The overall prevalence of hookworm infection was reported as 45%.

4.10. DEMOGRAPHIC FACTORS

4.10.1. Age

Epidemiological data showed that infections occur at very young age between one and two years and intensity and prevalence increase with age. A study showed that children aged ten more than 10 years of age were generally more infected than less than 10 year-old children (p=0.015). Risks associated with STHs are high in children below 14 years compared to other younger age groups due to their less mature immune system and high nutritional requirements. Representations of typical relationships between age and the prevalence of infection is shown in (Fig 1) with the 3 most common species of intestinal helminths.

Fig. 1. Relationships between age and the prevalence of STH (Data modified from Bundy et al. 1987; Bradley et al., 1991 and Hall et al., 1992)
Kattula et al. showed that risk in children more than 10 yr of age were generally more infected than 7–10 year-olds (p = 0.015). Another study in 2013 by Sanchez et al. in School-age Children from Rural Communities in Honduras showed children more than 10 years of age had twice the odds of being infected with any of the three STH than younger children (OR = 2.146, 95% CI = 1.2–4.0).

4.10.2. Sex.

Sex is a significant risk factor for prevalence of intestinal parasitic infections. Kelechi Kenneth et al. showed that the males, (38.4%), were more infected than the females, (21.1%). This difference was statistically significant. Kabiru Mohammed et al. study showed that males were more susceptible to parasitic infection [OR 2.66, 95% CI; 1.39, 5.11] than females.
4.10.3. Mothers educational status.

Low educational level of mothers was a significant risk factor for STH. Tilahun Alelign et al\textsuperscript{89} showed that low educational level of mothers was associated with STH [OR 1.61 (95% CI 1.06, 2.44)]\textsuperscript{70}. Menzies SK\textsuperscript{90} et al study also showed that low educational level of mothers was associated with STH.

4.10.4. Family number.

Families with four members and above showed high risk for STH when compared to less than four members in a family. Tilahun Alelign et al\textsuperscript{89} showed that family with total number of people living more than four were at high risk for STH [OR 2.26 (95% CI 1.43, 3.60)].

4.10.5. Socio economic factors.

Low socioeconomic status (Class IV & V) was found to be at higher risk of getting STH when compared to those from higher socioeconomic status (Class I, II & III). Ahmed Fathy Hamed et al\textsuperscript{91} showed that low Socioeconomic status was associated with high rate of infectious diseases and parasitic infections, [OR 12.60, (95% CI 5.66-28.08)]. Ngui R\textsuperscript{92} et al showed that low SES [OR=7.60; (95% CI=5.30–11.13)] was associated with intestinal parasites.

4.10.6. Housing factors:

House is an important risk factor for STH. Kattula\textsuperscript{17}, et al showed people living in Hut or Kutcha houses were at higher risk of STH than others [OR 2.25; (95% CI 1.16 - 4.37)].
4.10.7: Open air defecation:

Open air defecation is the practice of people defecating outside and not into a designated toilet. Kattula\textsuperscript{17} et al showed high risk for STH in people living in households without toilet [OR 6.18, 95%CI (2.09 - 19.61)]. Open defecation behavior may be due to traditional cultural practices or lack of access to toilets, or both\textsuperscript{93}. Deepthi Kattula\textsuperscript{17}, et al also showed that open air defecation (OR=5.37, \(P<0.01\)) was associated with high risk for STH.

4.10.8. Source of safe drinking water:

Filtered and chlorinated water supplied by the TWAD could still be dangerous in the case of cross contamination. Studies have shown use of treated water (RO or UV or boiled) was associated with lower odds of STH infection compared to piped water. A metaanalysis by Strunz EC\textsuperscript{94} et al showed that treated /boiled water was associated with lesser risk to get STH OR 0.46 (95% CI 0.36–0.60).

4.10.9. Habit of eating unwashed vegetables:

Eating unwashed vegetables and fruits were risk factors for STH infection. WorkuMeleset\textsuperscript{95} et al showed that children who ate unwashed vegetables and fruit were more likely to get STH infection than those who did not. Risk of STH for those eating vegetables and fruits was high compared to others. [OR = 4.095(95% CI: 2.176 – 7.704)].

4.10.10: Habit of picking and eating foods fallen on the ground:

Children do not mind eating food fallen on ground. Habit of picking and eating foods fallen on the ground was important risk for STH. Kattula\textsuperscript{17} et al showed that the risk was high among them for STH. [OR 2.17 (95%CI (1.17 - 4.04)].
4.10.11: Washing Hands with soap before eating:

Human STHs are fecal-borne infections, and transmission occurs either directly (hand-to-mouth) or indirectly (through food and water). Improvement of sanitation standards always decreases infection and re-infection levels\(^{96,97,98}\). Strunz EC\(^{94}\) et al showed that washing hands with soap before eating was protective (OR 0.38, 95% CI 0.26–0.55).

4.10.12. Washing Hands with soap with soap after defecation:

Saravanakumar\(^{19}\) et al. showed that who did not wash their hands with soap after defecation (OR 1.84, 95% CI 1.27–2.67) had higher risk of STH infection. A metaanalysis by Strunz EC\(^{94}\) et al showed that handwashing after defecation with soap was protective [OR 0.47, (95% CI 0.24–0.90)]. Nasr NA\(^{99}\) et al reported significantly lower prevalence of STH infections among children who washed their hands after defecation as compared to others.

4.10.13. Use of footwear:

BayehAbera, et al\(^{34}\) showed that not wearing footwear or lack of footwear was positively associated with helminth infection in rural schools [OR = 2.5 (95% CI: 1.5-4.1)]. Shiferaw MB, et al\(^{104}\) showed that children walking bare foot are at higher risk of STH than others. [AOR 2.21, (95% CI: 1.11–4.41)]

4.10.14: Keeping untrimmed nails

Unhygienic practices like keeping untrimmed nails are important risk factors for STH. DeepthiKattula\(^{17}\) et al studied that Unhygienic practices like keeping
untrimmed nails and its association with STH. (OR=2.53, \( P=0.01 \)) Bayeh\textsuperscript{34} et al conducted a study in Ethiopia showed that children with untrimmed fingernails were at higher risk of getting intestinal helminthes. [OR = 1.58 (95% CI: 1.03-2.5)]

4.10.15. Knowledge, attitudes regarding STH

Knowledge, attitudes, and practices (KAP) of soil Transmitted Helminths were very important for understanding the disease and thus helps in effective control\textsuperscript{101}. Local Health education regarding STH and promotion campaigns alters the health behavior\textsuperscript{102-103}. MJ Saka\textsuperscript{85} conducted a study in an urban Nigerian community and showed that poor health awareness is associated with STH.. Franziska A\textsuperscript{104} et al showed that incidence of soil-transmitted helminth infection was 50% lower in the children in whom the health education was delivered (4.1% vs. 8.4%, \( P<0.001 \)).

4.10.16: Deworming during past three months

Deworming gives protection against STH. Deepthi Kattula\textsuperscript{17} showed that Consumption of deworming tablets (OR=0.25, \( P<0.01 \)) has given protection. Deworming was given to entire population or targeting a high-risk groups.

This reduces the morbidity of STH in different countries\textsuperscript{105,106}. Preventive chemotherapy is single-dose anthelmintic treatment, administered to high-risk groups, usually without prior diagnosis.\textsuperscript{107}. Chemotherapy decreases the egg excretion and, therefore it reduces environmental contamination and transmission.

4.11. National Programme to control STH:

STH infections are treated using regular periodic chemotherapy using Benzimidazole-ethelminthics. These interventions are considered as logistically
feasible and cost effective intervention strategy. The school-aged children were delivered deworming tablets through the school system\textsuperscript{38}.

WHO recommended\textsuperscript{39} to use a single generic tablet of 400 mg Albendazole or 500 mg Mebendazole for school aged children. The cost of drugs should be considered as little as 0.02 US$.

Ministry of Health and Family Welfare (MoHFW), Government of India launched the National Deworming Day\textsuperscript{40} (NDD) on Feb 10, 2015. NDD aims to deworm all children between the ages of 1 to 19 years. The tablets were supplied to children through Government, Government-aided and private schools, and anganwadi centers. Cost effectiveness studies regarding deworming in India showed 0.02 to 0.04$ per child per year\textsuperscript{41}.
5. METHODOLOGY

5.1 Study setting

The study was conducted in the field practice area of the Rural Health Training Centre (RHTC) Vedarattu under Department of Community Medicine, PSG Institute of Medical Sciences & Research, Coimbatore. RHTC caters to a total population of 23,841 distributed in 14 villages of Thondamuthur and Madukarai block of Coimbatore. The number of school aged children (aged 5–14 years) in each area of the village was obtained from the data collected by household survey conducted by the RHTC field workers during the year 2011. The total number of school aged children (aged 5–14 years) is 3266. The following picture shows the study area within the field practicing area.
Fig: 2 Picture of the field practice area and the selected village area
5.2 Methodology:

5.2.1 Inclusion Criteria:

School-age children (aged 5–14 years) who were permanent residents of field practice area of PSG RHTC, Vedapatti

5.2.2 Exclusion Criteria:

School-age children (aged 5–14 years) who were absent for subsequent 3 visits within a week.

Any parent of the school-age child who had not given survey.

Any school-age child who had not given adequate stool sample.

5.3 Study design: Cross sectional study

5.4 Study Period: Study was carried out from December 2015 to July 2016

5.5 Study Area: Vedapatti field practice area of PSG RHTC

5.6 Sample size determination

Prevalence of Soil Transmitted Helminths according to survey in South India is 34.5%\(^{20}\)

Prevalence was taken as 34.5%

\[
n = (1.96)^2 \frac{PQ}{d^2} \text{ Precision } = (d = 15\% \text{ of } P)
\]

\[
= (3.84 \times 34.5 \times 66.5) / (5.2 \times 5.2)
\]

\[
= 326
\]

Since five clusters were selected, design effect should be considered

\[
= n \times \text{design effect}
\]

\[
= 326 \times 2
\]

\[
= 652
\]
Expected non-response rate = 20%  

= 652 *100/80

Sample size = 815

5.6.1. Sampling Method

Cluster design

Field practice area of PSG RHTC Vedapatti contain 14 villages as shown in Table(1). Totally 3266 children of 5 to 14 years (School age children) were living in these 14 villages. Against the name of each village, the individual population is noted, and the cumulative population determined. It was decided to take five clusters. The sampling interval (653) was determined by dividing the total cumulative population by number of clusters.

A random number (440) which was less than or equal to, the sampling interval was then selected. This identified the first village (Nagarajapuram) in which the first cluster was located. The cluster (Sundapalayam) in which second village located was obtained by adding the sample interval to the Random number. Similarly, subsequent clusters were identified. The selected villages were highlighted in Table(3).

As per 2011 survey there were 1357 school aged children in the selected villages. However when house to house survey was conducted in the selected five villages during the study period (November 2015-July 2016) there were only 819 children available for the study. Village-wise distribution of these children were shown in Table(4).
Table 3: Village-wise distribution of School Aged Children (5-14 yrs) in the field practice area of RHTC as per 2011 survey.

<table>
<thead>
<tr>
<th>NO</th>
<th>Village Name</th>
<th>Number of School aged children</th>
<th>Cumulative Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Nambialaganpalayam</td>
<td>164</td>
<td>164</td>
</tr>
<tr>
<td>2.</td>
<td>Nagarajapuram</td>
<td>282</td>
<td>446</td>
</tr>
<tr>
<td>3.</td>
<td>Vedapatti</td>
<td>595</td>
<td>1041</td>
</tr>
<tr>
<td>4.</td>
<td>Sundapalayam</td>
<td>401</td>
<td>1442</td>
</tr>
<tr>
<td>5.</td>
<td>Kalikanaickenpalaiyam</td>
<td>396</td>
<td>1838</td>
</tr>
<tr>
<td>6.</td>
<td>Kurumbapalayam</td>
<td>407</td>
<td>2245</td>
</tr>
<tr>
<td>7.</td>
<td>Vanniyampalayam</td>
<td>65</td>
<td>2310</td>
</tr>
<tr>
<td>8.</td>
<td>Kembanoor</td>
<td>156</td>
<td>2466</td>
</tr>
<tr>
<td>9.</td>
<td>Ajjanoor</td>
<td>140</td>
<td>2606</td>
</tr>
<tr>
<td>10.</td>
<td>Poochiyur</td>
<td>96</td>
<td>2702</td>
</tr>
<tr>
<td>11.</td>
<td>Onapalayam</td>
<td>204</td>
<td>2906</td>
</tr>
<tr>
<td>12.</td>
<td>Deenampalayam</td>
<td>113</td>
<td>3019</td>
</tr>
<tr>
<td>13.</td>
<td>Dhaliyur</td>
<td>122</td>
<td>3141</td>
</tr>
<tr>
<td>14.</td>
<td>Ulliampalayam</td>
<td>125</td>
<td>3266</td>
</tr>
</tbody>
</table>
Table 4. Village-wise distribution of School Aged Children (5-14 yrs) as per house to house survey conducted in 2015 in the selected clusters.

<table>
<thead>
<tr>
<th>Village</th>
<th>Number of school age children (5to14 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nagarajapuram</td>
<td>197</td>
</tr>
<tr>
<td>Sundapalaym</td>
<td>247</td>
</tr>
<tr>
<td>kalikanaichenpalaiyam</td>
<td>170</td>
</tr>
<tr>
<td>Kembanoor</td>
<td>119</td>
</tr>
<tr>
<td>Dhaliyur</td>
<td>86</td>
</tr>
<tr>
<td>TOTAL</td>
<td>819</td>
</tr>
</tbody>
</table>

5. 7 Steps in data collection:

The study was started after getting approval from the Institutional Human Ethics Committee (IHEC).

5.7.1 Pilot study:

Pilot study conducted among school aged children in few villages near field practice area and based on the feedback, questionnaire was modified.

5.7.2 Data collection Tools:

5.7.2.1 Questionnaire:

At the home setting, after getting consent from the parent and assent from the child any one of the parent of the child was interviewed in the evening hours of the day. A structured questionnaire was used to collect information on demographic,
socioeconomic and environmental information like availability of type of safe drinking water and availability of functioning sanitary toilet etc.,

Few questions were asked regarding the knowledge and attitude of the parents on STH. Respondent was asked to give comment on the personal hygiene practices of child like washing hands with soap before taking food and after defecation, eating fallen foods on the floor, wearing foot wear outside the house and intake of deworming tablets in the last three months.

Observations were also made regarding the personal hygiene of the children related to STH like clipped nails etc., Knowledge and attitude score was generated from the correct responses for the knowledge and attitude questions. The correct responses were given a score of one, and maximum score one could get was nine. Score five and above was considered as adequate knowledge and attitude score.

5.7.2.2. Stool Collection

At the end of survey a screw-capped plastic container with identification of the child was given to collect the stool sample from child next day morning. Instructions regarding stool collection were given. Next day, stool samples were collected and kept in an icepack and transported to microbiology lab of PSGIMSR within four hours of sample collection. Stool samples were examined. All Samples were re-examined by formalin-ether sedimentation method (FES). To reduce human error, duplicate slides were prepared from each sample and the slides were read by two different microbiologists. Senior microbiologist opinion was considered final.

Those children who had given one adequate stool sample and whose parents participated in survey were taken into account for analysis.
5.7.3. Stool Examination

5.7.3.1. Microscopic Examination-Staining Methods\textsuperscript{108}.

The recognition of intestinal parasites was observed by using a binocular microscope under 10x and confirmed by observing under 40x [19–30]. The working distance was 0.5-0.20 mm. Direct microscopic examination of faces in saline or iodine suspension was done to detect ova and cysts.

5.7.3.2. Saline wet mount examination:

The stool sample was emulsified in normal saline and a large drop was placed on a glass slide and was then covered with a cover slip. Then it was examined under a light microscope. The condenser was kept down and the intensity of the light low for proper visualization of the ova and cysts. The thickness of the film was in such a way that one could see the printed letters of the newspaper through it.

5.7.3.3. Iodine Preparation:

Iodine preparation was done next for better visualization of morphological details of ova and cysts as it stains the glycogen in them and it was used. One gram of iodine and two gram of potassium iodide was mixed in 100 ml of distilled water. Potassium iodide was mixed in water and then the iodine crystals were added and it was shaken vigorously. The solution was then filtered into a dark glass bottle and kept away from light.
5.7.3.4. Formalin-ether sedimentation.

5.7.3.4.1. Formalin Concentrate Procedure For Cysts and Eggs

5.7.3.4.1. Principle:

The formalin-ethyl acetate concentration was developed by Ritchie. It is considered as an essential procedure in order to complete ova and parasite examination in stool samples with low intensities of STH. There may be a lot of chances of missing detection of STH while using only a direct wet smear. This method allows the fine detection of STH even when small numbers of organisms are found. During concentration procedure, centrifugation step will recover protozoa, eggs, and larvae present in the sample. Ethyl acetate (Diethyl ether) is used as an extractor. This extracts and allows the parasites to suspend at the bottom of the suspension. This removes debris and fat from the feces. This method is least subject to technical error and easy to perform. Hence, Formalin Ether concentration (FEC) Concentration using formalin-ethyl acetate sedimentation is recommended in recent days. This method has a sensitivity of 63.1% [95% CI (62.9%–63.3%)] and specificity of 94.5 [%CI (94.4%–94.7%)] for detecting STH from one stool sample.

5.7.3.4.2. Specimen:

In this lab procedure, stool specimen was mixed with 10% formalin and allowed to fix for at least 30 minutes prior to examination. This procedure was performed under aseptic precautions and caution.
5.7.3.4.3. Steps

1. One gram of faces was emulsified in 7ml of 10% formal saline and kept for 10 minutes.

2. It was strained through wiregauze and the filtrate was collected in a centrifuge tube.

3. To the filtrate 3 ml of ether was added and the mixture was shaken vigorously for 1 min

4. Then it was centrifuged at 2000 r.p.m for 2 minutes and the contents were allowed to settle.

5. The debris was loosened with stick, the upper part of the test tube was cleared of fatty debris, and the supernatant fluid was decanted, leaving one or two drops.

6. The deposit after shaking was poured on a glass slide, a cover slip was placed over and the specimen was examined.

Systematically scanning was done with the 10X objective. 40X objective was used for a more detailed study. The entire cover slip was examined. Addition of Lugol’s iodine was done in addition to enhance morphological detail such as the inner structures of cysts.
5.8 Operational definition :

5.8.1 Dependant variable :

Soil transmitted Helminthiasis

Presence of ova or cysts of STH like Ascaris lumbricoides, Trichuris trichiura, Necator americanus and Ancylostoma duodenale by microscopic examination of faeces in Formalin ether concentration method using ethyl acetate was considered as dependent variable.

5.8.2 Independent variable :

Age (Age less than 10, Age 10 and above), Sex (Male, Female), Type of family (Nuclear family, Extended family), Total number of family members (4 or Less, 4 and above), House Category (Kutcha, Others), Mothers Educational status (Illiterate, Literate), Socio Economic Status (Lower SES, High SES), Open air defecation (Yes, No), Type of Safe Drinking water (Pipe Water, Others like Boiled/UV/RO), Unwashed Vegetables (Yes, No), Eating foods fallen on ground (Yes, No), Washing with soap before food (No, Yes), Washing with soap after Toilet (No, Yes), Always using foot wear (No, Yes), De-worming medication during past 3 months (No, Yes), Nail Clipping (No, Yes), Knowledge Attitude score (Inadequate, Adequate) was considered independent variable.

5.9. ANALYSIS

Data entry was made in the Microsoft Excel software and analysis was done with SPSS-19 computer package. Prevalence is expressed in percentage with 95% Confidence interval (CI). Univariate analysis and Multivariate analysis were
performed to find the associations between independent variables and dependent variables. Strength of association was expressed in terms of odds ratio and adjusted odds ratio with 95% confidence interval. P value <0.05 was considered as statistically significant.
6. RESULTS

6.1. Prevalence of STH

The study was conducted to find the prevalence and risk factors associated with STH infection in school age children (5-14 yr) in the field practice area of the Rural Health Training Centre (RHTC)-Vedapatti, PSGIMSR. Five villages were selected out of 14 villages of field practice area of the Rural Health Training Centre (RHTC) Vedapatti using cluster sampling method. House to house survey was conducted in the five villages during November 2015-July 2016. Survey enumerated 819 school aged children of 5-14 years. Children and their parents were invited for the study. Among them only 610 children had given one adequate stool sample and their parents participated in the survey.

6.2. The distribution of study population and their risk factors (Table 5&6)

The mean age of the study population was 8.92±2.68. Among the participants, children below ten years were more. Similarly, female participants (52.1%) were more. More children (62.1%) belonged to nuclear family. Majority of the households had 4 or less people (54.9%).

Majority of mothers studied up to high school (40.5%). However, 20.2% of mothers were illiterate. Many of the mothers were homemakers (40.4%) or involved in unskilled works (33.0%). Most of the fathers were studied up to high school (45.6%) but 16.1% were illiterate. Most of the fathers were doing skilled work (50.2%). Few of them remained unemployed (0.05%).

Majority of the children (52.3%) belonged to low socio economic status (Class IV and V according to modified Prasad classification). Majority of the children drank
tap water supplied by the local civic body. Regarding the toilet usage only 50.7% of the children were using the toilets in the home. However 33.4% were going for open air defecation. Majority of them washed the vegetables before eating (70.3%). However 14.9% ate raw vegetables without washing.

Majority of the study children (96.4%) were not having the habit of eating foods fallen on the ground. Around 66% did not wash their hands with soap before taking food. And 44.6% did not wash their hands with soap after coming from toilet. Around 63.4% children regularly used foot wear and around 70% of the children had trimmed nail during the visit. Nearly half of the parents of children were having adequate knowledge on STH. Only 59% took deworming tablets in the last three months.

Table 5: Distribution of Socio Economic and Demographic factors of the study participants:
<table>
<thead>
<tr>
<th>S No</th>
<th>Variable</th>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Age category</td>
<td>Age 10 and above</td>
<td>253</td>
<td>41.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age below 10</td>
<td>357</td>
<td>58.5</td>
</tr>
<tr>
<td>2.</td>
<td>Sex of the child</td>
<td>Male</td>
<td>292</td>
<td>47.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>318</td>
<td>52.1</td>
</tr>
<tr>
<td>3.</td>
<td>Type of Family</td>
<td>Nuclear</td>
<td>410</td>
<td>67.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended</td>
<td>200</td>
<td>32.8</td>
</tr>
<tr>
<td>4.</td>
<td>Total family number</td>
<td>Above 4</td>
<td>275</td>
<td>45.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 or Less</td>
<td>335</td>
<td>54.9</td>
</tr>
<tr>
<td>5.</td>
<td>Mother's Educational status</td>
<td>Professional</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Graduate/Post Graduate</td>
<td>52</td>
<td>8.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Higher secondary/Diploma</td>
<td>59</td>
<td>9.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High school</td>
<td>247</td>
<td>40.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Middle school</td>
<td>22</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Primary school</td>
<td>106</td>
<td>17.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Illiterate</td>
<td>123</td>
<td>20.2</td>
</tr>
<tr>
<td>6.</td>
<td>Mother's occupation</td>
<td>professional</td>
<td>4</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semiprofessional</td>
<td>6</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clerical/shop owner/farmer</td>
<td>25</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skilled</td>
<td>91</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semiskilled</td>
<td>37</td>
<td>6.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unskilled</td>
<td>201</td>
<td>33.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Home maker</td>
<td>246</td>
<td>40.4</td>
</tr>
<tr>
<td>7.</td>
<td>Father's Educational status</td>
<td>Professional</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Graduate/Post Graduate</td>
<td>47</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Higher secondary/Diploma</td>
<td>58</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High school</td>
<td>278</td>
<td>45.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Middle school</td>
<td>23</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Primary school</td>
<td>105</td>
<td>17.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Illiterate</td>
<td>98</td>
<td>16.1</td>
</tr>
<tr>
<td>8.</td>
<td>Father's occupation</td>
<td>Professional</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semiprofessional</td>
<td>25</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clerical/shop owner/farmer</td>
<td>63</td>
<td>10.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skilled</td>
<td>306</td>
<td>50.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semiskilled</td>
<td>42</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unskilled</td>
<td>169</td>
<td>27.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unemployed</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td>9.</td>
<td>Socio Economic Status (Modified Prasad Scale)</td>
<td>Class I (5707 and Above)</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------------</td>
<td>--------------------------</td>
<td>---</td>
<td>----</td>
</tr>
<tr>
<td></td>
<td>Class II (2853-5706)</td>
<td>108</td>
<td></td>
<td>17.7</td>
</tr>
<tr>
<td></td>
<td>Class III (1712-2852)</td>
<td>181</td>
<td></td>
<td>29.7</td>
</tr>
<tr>
<td></td>
<td>Class IV (856-1711)</td>
<td>244</td>
<td></td>
<td>40.0</td>
</tr>
<tr>
<td></td>
<td>Class V (Below 855)</td>
<td>75</td>
<td></td>
<td>12.3</td>
</tr>
</tbody>
</table>

| 10. | Type of house | Kutcha | 119 | 19.5 |
|     |               | Semipucca | 366 | 60.0 |
|     |               | Pucca | 125 | 20.5 |
Table 6: Distribution of Risk factors of Soil Transmitted Helminthes among participants

<table>
<thead>
<tr>
<th>S No</th>
<th>Variable</th>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Open air defecation</td>
<td>Yes</td>
<td>204</td>
<td>33.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Using Toilet in Home</td>
<td>309</td>
<td>50.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Using Public Toilet</td>
<td>97</td>
<td>15.9</td>
</tr>
<tr>
<td>2</td>
<td>Pipe water as drinking water</td>
<td>Yes</td>
<td>463</td>
<td>75.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Using Boiled Water</td>
<td>141</td>
<td>23.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Using RO water</td>
<td>4</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Using Filtered water</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>3</td>
<td>Habit of Eating unwashed vegetables</td>
<td>Always</td>
<td>21</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Usually</td>
<td>69</td>
<td>11.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rarely</td>
<td>91</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Never</td>
<td>429</td>
<td>70.3</td>
</tr>
<tr>
<td>4</td>
<td>Habit of eating foods fallen on the ground</td>
<td>Always</td>
<td>8</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Usually</td>
<td>7</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rarely</td>
<td>7</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Never</td>
<td>588</td>
<td>96.4</td>
</tr>
<tr>
<td>5</td>
<td>Washing the hands with soap before eating</td>
<td>Never</td>
<td>182</td>
<td>29.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Always</td>
<td>270</td>
<td>44.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Usually</td>
<td>59</td>
<td>9.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rarely</td>
<td>99</td>
<td>16.2</td>
</tr>
<tr>
<td>6</td>
<td>Washing the hands with soap after defecation</td>
<td>Never</td>
<td>120</td>
<td>19.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Always</td>
<td>338</td>
<td>55.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Usually</td>
<td>86</td>
<td>14.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rarely</td>
<td>66</td>
<td>10.8</td>
</tr>
<tr>
<td>7</td>
<td>Regular foot wear usage</td>
<td>No</td>
<td>223</td>
<td>36.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>387</td>
<td>63.4</td>
</tr>
<tr>
<td>8</td>
<td>Nail Clipped</td>
<td>No</td>
<td>186</td>
<td>30.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>424</td>
<td>69.5</td>
</tr>
<tr>
<td>9</td>
<td>De worming during past three months</td>
<td>No</td>
<td>250</td>
<td>41.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>360</td>
<td>59.0</td>
</tr>
<tr>
<td>10</td>
<td>Knowledge ,Attitude Score regarding STH</td>
<td>Inadequate</td>
<td>289</td>
<td>47.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adequate</td>
<td>321</td>
<td>52.6</td>
</tr>
</tbody>
</table>
6.3. PREVALENCE OF SOIL TRANSMITTED HELMINTHS

Table 7: Prevalence of Soil Transmitted Helminthes among the study participants

<table>
<thead>
<tr>
<th>Sample Population</th>
<th>STH positive (Stool Sample positive for ova cyst by formalin ether method)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>610</td>
<td>47</td>
<td>7.70</td>
</tr>
</tbody>
</table>

The prevalence of STH among 610 children who had given one adequate stool sample and whose parents participated in survey was 7.70%(5.58-9.82). (Table 7)

6.3.1. Cluster wise prevalence of Soil Transmitted Helminthes among the study participants

Table 8: Cluster wise prevalence of Soil Transmitted Helminthes among the study participants:

<table>
<thead>
<tr>
<th>Cluster Name</th>
<th>Total</th>
<th>STH Positive</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>KalikanayakanPalayam</td>
<td>115</td>
<td>13</td>
<td>11.30</td>
</tr>
<tr>
<td>Kembanoor</td>
<td>93</td>
<td>9</td>
<td>9.68</td>
</tr>
<tr>
<td>Dhalioor</td>
<td>69</td>
<td>5</td>
<td>7.25</td>
</tr>
<tr>
<td>Sundapalayam</td>
<td>184</td>
<td>12</td>
<td>6.52</td>
</tr>
<tr>
<td>Nagarajapuram</td>
<td>149</td>
<td>8</td>
<td>5.37</td>
</tr>
</tbody>
</table>
The prevalence of STH among 610 children who had given one adequate stool sample and whose parents participated in each cluster was shown in Table 8.

6.3.2: Prevalence of individual Soil Transmitted Helminthes among the study participants

Table 9: Prevalence of individual Soil Transmitted Helminthes

<table>
<thead>
<tr>
<th>Type of STH</th>
<th>No.</th>
<th>%</th>
<th>95 %CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascaris Lumbricoides</td>
<td>42</td>
<td>6.9</td>
<td>4.89% to 8.91%</td>
</tr>
<tr>
<td>Hook worm</td>
<td>4</td>
<td>0.7</td>
<td>0.04% to 1.36%</td>
</tr>
<tr>
<td>Trichuris Trichura</td>
<td>1</td>
<td>0.2</td>
<td>0.15% to 0.55%</td>
</tr>
</tbody>
</table>

The prevalence of individual parasites of STH among 610 children who had given one adequate stool sample and whose parents participated in each cluster is shown in Table 9. Ascaris lumbricoides was highly prevalent 6.9% (4.89% to 8.91%) followed by hook worm 0.2 (0.15% to 0.55%) and trichuris trichura 0.7% (0.04% to 1.36%).
### 6.4. Factors Influencing Prevalence of STH

Table 10: Association of STH with the risk factors by univariate analysis.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Category</th>
<th>STH</th>
<th>Unadjusted odds ratio (95% Confidence Interval)</th>
<th>Adjusted odds ratio(95% Confidence Interval)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Num.</td>
<td>Num.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(%)</td>
<td>(%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Age 10 and above</td>
<td>24</td>
<td>229</td>
<td>1.52 (0.80-2.90)</td>
<td>1.45 (0.78-2.7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(9.49)</td>
<td>(90.51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age less than 10</td>
<td>23</td>
<td>334</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6.44)</td>
<td>(93.56)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>24</td>
<td>268</td>
<td>1.15 (0.60-2.18)</td>
<td>1.07 (0.58-2.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8.21)</td>
<td>(91.78)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>23</td>
<td>295</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7.23)</td>
<td>(92.77)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number of family members</td>
<td>&gt;4</td>
<td>22</td>
<td>253</td>
<td>1.08 (0.56-2.05)</td>
<td>1.21 (0.64-2.27)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8.00)</td>
<td>(92)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 or Less</td>
<td>25</td>
<td>310</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7.46)</td>
<td>(92.54)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of House</td>
<td>Kutcha</td>
<td>4</td>
<td>115</td>
<td>0.36(0.09-1.03)</td>
<td>0.34 (0.10- 0.91)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.36)</td>
<td>(96.64)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>43</td>
<td>448</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8.76)</td>
<td>(91.24)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother’s</td>
<td>Illiterate</td>
<td>10</td>
<td>113</td>
<td>1.08 (0.46-2.29)</td>
<td>1.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8.13)</td>
<td>(91.87)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational status</td>
<td></td>
<td></td>
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<td>267</td>
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<td>(92.39)</td>
<td></td>
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<td>0.7482</td>
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</tbody>
</table>
There was no significant association between STH and factors influencing STH like Age (Age less than 10, Age 10 and above), Sex (Male, Female), Type of family (Nuclear family, Extended family), Total number of family members (4 or Less, 4 and above), House Category (Kutcha, Others), Mothers Educational status (Illiterate, Literate), Socio Economic Status (Lower SES, High SES), Open air defecation (Yes, No), Type of Safe Drinking water (Pipe Water, Others like Boiled/UV/RO), Unwashed Vegetables (Yes, No), Eating foods fallen on ground (Yes, No), Washing with soap before food (No, Yes), Washing with soap after Toilet (No, Yes), Always using foot wear (No, Yes), De-worming medication during past 3 months, (No, Yes), Nail Clipping (No, Yes), Knowledge Attitude score (Inadequate, Adequate) was considered independent variable.

Since none of the factors came as significant in Univariate analysis, all independent variables were subjected to bivariate logistic regression analysis. However none of them came significant.
7. DISCUSSION

Study was conducted with the objective to find the prevalence and factors influencing STH infection among school age children (5 -14 yr) in the field practice area of RHTC, Vedapatti, Coimbatore district. House to house survey was conducted in the five of the fourteen villages selected using cluster sampling method during the period November 2015 -July 2016. There were 819 children available for the study. Consent from parents and assent from child were obtained. Even though parents of 819 children participated in the survey, only 610 children gave one adequate stool sample. Hence only 610 children were taken into account for analysis. Non response rate was 24.42%. More number of older children (29.13%) were found among the non responders compared to younger children (22.72%, P=0.023). Surveys involving bio samples showed high non response rate when compared to simple questionnaire based surveys. Shubha D et al conducted a study involving stool collection in Karnataka among school aged children in 2010 and showed non-response rate as 30.9%.

7.1 Prevalence of STH:

The prevalence of STH in the study population is 7.7% (95%CI 5.58-9.82%). Results of current study were lesser than other studies conducted in the nearby areas. Prevalence of STH depends upon the time, place of the study, methodology of the study etc. Coimbatore is located in rain shadow area and the predominant soil variety is neither clay nor sandy soil which favors STH. Current study used single stool sample to assess the prevalence of the STH. Modified Formol-ether concentration (FEC) has sensitivity of 63.1% [95%CI (62.9%–63.3%)].
Mass Deworming is another important factor influencing the prevalence of STH. Coimbatore first round of National De-worming Day was just completed and second round was ongoing at the time of the survey (2016- Feb). Around sixty percent of the children had taken de-worming tablet in the previous three months. Even before NDD, Albendazole was given to school children under school health program for the last few years in Tamilnadu.40

Other than this, study area being RHTC Field practice area, many number of health camps and health education had gone into community which also might have influenced the low prevalence of STH. However there is no sufficient data to compare prevalence before de-worming to support the statement.

Similar prevalence (7.8%) was reported by Deepthi Kattula17 in 2014 in Vellore using the same method. Authors had mentioned yearly MDA (DEC + Albendazole) which was started on 2004, could be the reason for low prevalence. However other studies done after 2004 in selected districts of Tamilnadu had shown higher prevalence.

Kaliappan et al 19 in 2013 conducted a cross sectional study among school aged children in Thiruvanamalai. The overall prevalence was 39%. The increased prevalence could be due to five stool samples collected among tribal population where open air defecation and bare foot walking were common practice.

Study by Latha et al 20 in 2006 in Puducherry with FEC method with single stool sample among school aged children showed a prevalence of 34.56%. The author mentioned that it was due to poor hygienic practices among the participants.
Mani et al\textsuperscript{21} conducted an interventional study on efficacy of Albendazole in Villupuram District of Tamil Nadu State, India among children 1 to 15 years of age. Kato-Katz technique was used. The prevalence was found twice. First was immediately before MDA and the second one was 3 weeks after the MDA. A pre-treatment cross-sectional survey included 646 school children. And the pre MDA prevalence was 60%. The prevalence rates for Ascaris lumbricoides, hookworms and Trichuris trichiura, were 53.9%, 12.4% and 5.7% respectively. Following deworming the overall prevalence came down to 15.56%.

Kang et al\textsuperscript{22} conducted a cross-sectional study in Vellore and 993 stool samples examined, from 15 families including 28 school aged children. The prevalence was 61.5%. Last study was conducted using the FEC methodology and much before MDA. This study used multiple samples. Authors had mentioned reported increased prevalence could be due to the above said reasons.

Wanietal in Srinagar city Kashmir during 2007\textsuperscript{78} using zinc Sulphate concentration method found the prevalence of STH as 46.7%. Another study by the same author in Kupwara district (rural area) in 2007\textsuperscript{83} revealed the high frequency of STH (69.23%) 

Bora D\textsuperscript{80} et al conducted a cross-sectional study in Uttaranchal statein 2005 with Kato-Katz technique for stool sample examination. The prevalence of STH was 31.5%. Same author\textsuperscript{81} conducted a similar study in UT of Lakshadweep during February-March 2004 and reported prevalence of STH as 83.2%.
Naish S, et al\textsuperscript{18} conducted a study in 2004 among school children in the fishing village of PedaJalaripet, Visakhapatnam, South India. Totally 92.6% children were infected with one or more soil transmitted helminths.

7.2. Prevalence in individual helminths

Current study showed the most common soil transmitted helminth as Ascaris lumbricoides with the prevalence of 6.9% (CI 4.89% to 8.91%) followed by Hookworm 0.7% (CI 0.04% to 1.36%) and Trichuris trichura 0.2% (CI 0.15% to 0.55%). Studies showed that Ascaris and Trichuris were more commonly seen among urban children and hookworm among rural children\textsuperscript{17,82}.

Fernandez MC et al\textsuperscript{82} conducted a cross sectional study in 2002, among school aged children in Chennai. This was a comparative study among rural and urban regarding the prevalence of STH and other intestinal parasites. In rural area the prevalence of Ascaris lumbricoides, Trichuris trichura and Ancylostoma duodenale were 52.8%, 45.6%, and 37.6% respectively. In contrast under urban settings, T. trichura and A. lumbricoides were found 2.01%, 0.50% respectively. Study showed that much lower STH prevalence in urban area when compared with rural area.

In Nepal Tai-Soon Yong\textsuperscript{72}, et al conducted across sectional study in 1999 and showed that Hookworm was the most prevalent intestinal helminth (13.0%) followed by Trichuris trichura (3.0%) and Ascaris lumbricoides (1.7%). Martin J\textsuperscript{73}, et al conducted a cross sectional study in Bangladesh, the prevalence of Ascaris lumbricoides, Trichuris trichura, hookworm and amoebic infections were estimated as 68%, 56%, 53% respectively. Pegelow K et al\textsuperscript{69} conducted a cross
sectional study in Indonesia. Author found Trichuristrichiura was the most common infection with a prevalence of 76%, followed by Ascarislumbricoides (44%) and Hookworm 9%. Anantaphruti MT et al conducted a cross sectional study in 2004 Thailand. The STH prevalence was 15.6%. Among them Hookworm infection was the most prominent (9.8%), followed by Trichuristrichiura (6.2%), and Ascarislumbricoides (2.2%).

Antonio Montresor reported in 2003 overall prevalence of STH infection in Myanmar as 69%. Tun, A had shown that prevalence had come down to 21% following seven years of MDA throughout the country.

In Asia, several countries, notably Japan, South Korea and Taiwan, showed that they have achieved sustained and successful control of STH infections over the last forty years (WHO, 1996). More recently, Sri Lanka has reduced prevalence to less than five percent.

Kelechi Kenneth Odinaka, et al conducted a cross-sectional study in Nigeria in 2012. The overall prevalence of soil-transmitted helminthic infection (STHI) was 30.3%. Of all STH infections, hookworm was the commonest STH reported, (94.2%).

Appleton CC, et al conducted a cross-sectional study in Durban, South Africa. The prevalence of A. Lumbricoides was 96.3%, T. trichiura was 86.2% and hook worm was 20.1%.

Systematic review on epidemiology of soil-transmitted helminth infections in United States by Starr MC, Montgomery SP et al showed that prevalence, of individual STH infections like Hookworm, T. trichiura and A. lumbricoides were 19.6%, 55.2%, and 49.4% respectively.
Britto, Barreto et al. conducted a cross-sectional study in Brazil, South America, and showed the prevalence of Hook worm as 15.7%, Ascaris lumbricoides as 63% and Trichuris trichiura as 78.4%.

It is evident from our results that soil-transmitted helminth (STH) infections are relatively less prevalent but still it constitute a public health problem among school age children in a rural area of Coimbatore.

7.3 Factors influencing the prevalence of STH

7.3.1 Age vs STH

Kattula et al. study showed that children of more than 10 years of age were generally more infected with STH than 7–10 year-olds (p=0.015). Another study by Sanchez et al. 2013 in school-age children from rural communities in Honduras showed children more than 10 years of age had twice the odds of being infected with any of the three STH than younger children (OR=2.146, 95% CI=1.2–4.0, p=0.016). However in the current study there was no statistically significant association found between age and STH in the current study and this could be due to smaller sample size.

7.3.2 Sex vs STH

Sex is a significant risk factor for prevalence of intestinal parasitic infections. Kelechi Kenneth et al. showed that the males (38.4%) were more infected than the females (21.1%). This difference was statistically significant. Kabiru Mohammed et al. study showed that males were more susceptible to parasitic infection [OR 2.66, 95% CI; 1.39, 5.11] than females. However in the current study male gender was not
significantly associated with STH [OR 1.5(0.60-2.18)]. Similar finding was reported by Kattula, et al [OR 1.58 95%CI (0.83 - 3)].

7.3.3. Mothers educational status vs STH

Low educational level of mothers is a significant risk factor for STH. Tilahun Alelign et al [OR 1.61 (95%CI 1.06, 2.44)]. Menzies SK et al study also showed that low educational level of mothers was associated with STH. However in the current study there was no association between mothers education and STH.

7.3.4 Total number of person in family vs STH

Families with four members and above showed high risk for STH when compared to less than four members in a family. Tilahun Alelign et al [OR 2.26 (95%CI 1.43, 3.60)]. However current study did not reveal any statistically significant association between number of persons in the family and STH.

7.3.5 Socioeconomic status vs STH

Low socioeconomic status (Class IV & V) was found to be at higher risk of getting STH when compared to those from higher socioeconomic status (Class I, II & III). Ahmed Fathy Hamed et al showed that low Socioeconomic status was associated with high rate of infectious diseases and parasitic infections, [OR 12.60, (95%CI 5.66-28.08)]. Ngui R et al showed that low household income [OR=7.60; (95% CI=5.30–11.13)] was associated with intestinal parasites. However the current study did not reveal any association between Socioeconomic status and STH.

7.3.6. Housing factors vs STH
House is a important risk factor in STH. Kattula\textsuperscript{17}, Gagandeep Kang et al showed people living in Hut/Kutcha OR 2.25, 95\%CI (1.16 - 4.37) were at risk of STH. However the current study did not reveal any association between housing factors and STH.

### 7.3.7 Open air defecation vs STH

Practice of open air defecation can lead to worm infection. Deepthi Kattula\textsuperscript{17} study showed open air defecation (OR=5.37, \(P< 0.01\)) was associated with high risk for STH. Kattula\textsuperscript{17}, et al also showed high risk for STH in people living in households without toilet OR 6.18, 95\%CI (2.09 - 19.61). However in the current study it was not statistically significant.

### 7.3.8 Type of safe drinking water vs STH

Filtered and chlorinated water supplied by the TWAD could still be dangerous in the case of cross contamination. Studies reported use of safe drinking water like water treated with UV, RO or boiled was associated with lower odds of STH infection compared to piped water. A metaanalysis by Strunz EC\textsuperscript{94} et al showed that boiled water has lower odds ratio for STH. [OR 0.46 (95\% CI 0.36–0.60)]. However current study did not show any statistically significance between piped water and STH

### 7.3.9 Eating unwashed vegetables vs STH

Eating unwashed vegetables and fruits were risk factors for STH infection. WorkuMeles et al\textsuperscript{95} showed that children who ate unwashed vegetables and fruit were more likely to get STH infection than those who did not. Risk of STH for those eating versus not eating unwashed vegetables and fruits was [OR = 4.095(95\% CI:}
2.176 – 7.704). However the current study did not show any statistically difference between who wash or do not wash vegetables before eating.

7.3.10: Habit of picking and eating foods fallen on the ground.

Habit of picking and eating foods fallen on the ground was important risk for STH. Kattula et al showed that the risk was high among them for STH. [OR 2.17, (95%CI (1.17 - 4.04)]. The current study did not show any association between eating foods fallen on the ground and STH.

7.3.11. Hand washing before eating

Habit of not washing the hands with soap before eating is a important risk factor for STH. Strunz EC et al showed that washing hands with soap before eating was protective(OR 0.38, 95% CI 0.26–0.55). Current study found that this was not statistically significant in univariate analysis and logistic regression.

7.3.12. Hand washing after defecation:

Not washing the hands with soap after defecation is an important risk factor for STH. Saravanakumar et al, showed that children who did not wash their hands with soap after defecation had higher risk of STH infection(OR 1.84, 95% CI 1.27–2.67). A metaanalysis by Strunz EC et al showed that handwashing after defecation with soap was protective[OR 0.47, (95% CI 0.24–0.90)]. In the current study there was no association between habit of washing hands with soap after defecation and STH.

7.3.13. Walking barefoot vs STH

BayehAbera, et al showed that lack of footwear was positively associated with helminth infection in rural schools [OR = 2.5 (95% CI: 1.5-4.1)].
ShiferawMB\textsuperscript{100}, et al showed that walking bare foot are risk of STH (AOR: 2.21; 95% CI: 1.11–4.41). In the current study it was found not significant.

7.3.14. Not clipping the nail vs STH

Unhygienic practices like keeping untrimmed nails are important risk factors for STH. Deepthi Kattula\textsuperscript{14} et al studied that and its associated with STH. (OR=2.53, \(P=0.01\)) Bayeh\textsuperscript{34} et al conducted a study in Ethiopia showed that having dirty fingernails and untrimmed fingernails were positively associated with the prevalence of intestinal helminths [OR = 1.58 (95% CI: 1.03-2.5)]. However this was not statistically significant.

7.3.15. Knowledge about STH

MJ Saka\textsuperscript{85} conducted a study in an urban Nigerian community and showed that poor health awareness is associated with STH. Franziska A\textsuperscript{104} et al showed that incidence of soil-transmitted helminth infection was 50% lower in the children in whom the health education was delivered (4.1% vs. 8.4%, \(P<0.001\)). In the current study it was found not significant.

7.3.16. Deworming Medications:

Deworming offers protection against STH. Deepthi Kattula,\textsuperscript{17} showed that Consumption of deworming tablets (OR=0.25, \(P< 0.01\)) offered protection. In the current study it was found that not significant.
Soil-transmitted helminthiasis (STH) refers to a group of parasitic diseases caused by nematode worms. They are *Ascaris lumbricoides*, *Trichuris trichiura*, *Necator americanus* and *Ancylostoma duodenale*. They are transmitted to humans by fecal-contaminated soil and are widely distributed in tropical and subtropical areas. They are considered as Neglected Tropical Diseases (NTDs).

STH is a public health problem. *Ascariasis* causes sixty thousand deaths per year. *Hook worm* causes 65 thousand deaths per year. *Trichuris trichiura* causes 10 thousand deaths per year. Hook worms are commonly reported among children, Women of reproductive age, and pregnant women. Hookworms affect physical and mental development in children by causing irritation and anaemia. The worms increase malabsorption of nutrients. Roundworms cause vitamin A deficiency. STH affects all age groups. The highest intensity of soil transmitted helminths occur more in school age children.

STH infections are considered a leading cause of sickness, absenteeism, accounting for loss of 12.3% and 11.4% of disability adjusted life years (DALY) in girls and boys respectively.

As per 2011 census, 46% of the households in Coimbatore district lack toilets. Children more often than adults tend to go barefoot, resulting in more contact with soil, and they fail to use sanitary facilities even when they are present. In rural India it is documented that 64% school going children (6-14 years) practiced hand washing.
with soap after defecation and had unclean and uncut nails and lack of hygiene education.

STH infections are treated using regular periodic chemotherapy using Benzimidazoleanthelmintics. These interventions are considered as logistically feasible and cost effective intervention strategy. The school-aged children were delivered deworming tablets through the school system\textsuperscript{38}.

WHO recommended\textsuperscript{39} to use a single generic tablet of 400 mg Albendazole or 500 mg Mebendazole for school aged children. The cost of drugs should be considered as little as 0.02 US$. Ministry of Health and Family Welfare (MoHFW), Government of India launched the National Deworming Day\textsuperscript{40} (NDD) on Feb 10, 2015. NDD aims to deworm all children between the ages of 1 to 19 years. The tablets were supplied to children through Government, Government-aided and private schools, and anganwadi centers. Cost effectiveness studies regarding deworming in India showed 0.02 to 0.04$ per child per year\textsuperscript{41}.

India is having more STH burden, more than 241 million children at risk of parasitic worm infections. In India so many studies were conducted and the reported prevalence of STH infection varied from 7.8 % to 80.3%. The reported prevalence varies according to the places and time conducted\textsuperscript{14-18}.

Deepthi Kattula\textsuperscript{17} in 2014 conducted a cross sectional study in Vellore among 3706 school age children(6-14 years) the prevalence was 7.8%. Kaliappan et al \textsuperscript{19} in 2013 conducted a cross sectional study among tribal population including school aged children in Thiruvanamalai, the overall prevalence was 39%. Latha et al\textsuperscript{20} conducted a cross sectional study in 2010 among 1172 school children(5-14) in
Puducherry and the prevalence was 34.56%. Mani et al\textsuperscript{21} conducted a cross sectional study in Madurai in 2002 among 646 School Age Children (9 to 10 years) the prevalence was reported as 53.9\%. Kang et al\textsuperscript{22} conducted a cross sectional study in Vellore among 993 rural population and the prevalence was 61.5\%.

There is no recently published article on prevalence of Soil Transmitted helminthes in Coimbatore. Hence a cross sectional study was conducted from December 2015 to July 2016 with the objective of finding the prevalence and risk factors associated with Soil Transmitted Helminthic infection in school age children (5 -14 yr) in the field practice area of the Rural Health Training Centre (RHTC) Vedapatti under Department of Community Medicine, PSG Institute of Medical Sciences & Research, Coimbatore.

Rural Health Training Centre (RHTC), Vedapatti caters to a total population of 23,841 distributed in 14 villages of Thondamuthur and Madukarai block of Coimbatore. The number of School-age children (aged 5–14 years) in each area of the village was obtained from the data collected by household survey conducted by the RHTC field workers during the year 2011. The total number of School-age children (aged 5–14 years) was 3266.

The sample size was calculated to be 819 assuming 34.5\% as prevalence, relative precision of 15\%, design effect of 2, and non response rate of 20\%.

Ethical clearance was obtained from IHEC, PSGIMSR. Pilot study was conducted in nearby area. Five out of fourteen villages were selected by cluster sampling method. House to house survey was conducted in the five villages during November 2015 to July 2016. All school-age children (aged 5–14 years) who were
permanent residents of Vedapatti field practice area of PSG RHTC were included in the study. Children who were not available on three visits within a week time, children who had not given one adequate stool sample and whose parents not participated in survey were excluded from the study.

Consent of the parents and assent of the child were obtained. At the home setting, anyone of the parent of the child was interviewed in the evening hours of the day. A structured questionnaire was used to collect information on demographic, socioeconomic and environmental information like availability of type of safe drinking water and availability of functioning sanitary toilet etc. Few questions were asked regarding the knowledge and attitude of the parents on STH. Respondent was asked to give comment on the personal hygiene practices of child like washing hands with soap before taking food and after defecation, eating fallen foods on the floor, wearing foot wear outside the house and intake of de-worming tablets. Observations were also made regarding the personal hygiene of the children related to STH like clipped nails etc. Knowledge and attitude score was generated from the correct responses for the knowledge and attitude questions. The correct responses were given a score of one, and maximum score one could get was nine. Score five and above was considered as adequate knowledge and attitude score.

At the end of survey a screw-capped plastic container was given to collect the stool sample from children next day morning. Instructions regarding stool collection were given. The early morning stool samples were collected and were immediately transported to the laboratory of the PSG Hospitals from the field practice area within 4 hour of sample collection.
The formalin-ethyl acetate concentration was developed by Ritchie. It is considered as an essential procedure in order to complete ova and parasite examination in stool sample with low intensities of STH. There may be lot of chances of missing detection of STH while using only a direct wet smear. This method allows the fine detection of STH even small numbers of organisms are found. During concentration procedure centrifugation step will recover protozoa, eggs and larvae present in the sample. Ethyl acetate (Diethyl ether) is used as an extractor. This extracts and allows the parasites to suspend at the bottom of the suspension. This removes debris and fat from the feces. This method is least subject to technical error and easy to perform. Hence Formalin Ether concentration (FEC) Concentration using formalin-ethyl acetate sedimentation is recommended in recent days. This method has a sensitivity of 63.1% [95%CI (62.9%–63.3%)] and specificity of 94.5 [95%CI(94.4%–94.7%)] for detecting STH from one stool sample\textsuperscript{60}

The recognition of intestinal parasites was observed by using a binocular microscope under 10x and confirmed by observing under 40x [19–30]. The working distance was 0.5-0.20 mm. Direct microscopic examination of faces in saline or iodine suspension was done to detect ova and cysts.

The stool was emulsified in normal saline and a large drop was placed on a glass slide and was then covered with a cover slip. Then it was examined under a light microscope. The condenser was kept down and the intensity of the light low for proper visualization of the ova and cysts. Iodine preparation was done next for better visualization of morphological details of ova and cysts as it stains the glycogen in
them and it was used. Formal ether concentration method was performed under aseptic precautions and caution as mentioned in the methodology. One gram of faces was emulsified in 7 ml of 10% formal saline and kept for 10 minutes. It was strained through wiregauze and the filtrate was collected in a centrifuge tube. To the filtrate 3 ml of ether was added and the mixture was shaken vigorously for 1 min. Then it was centrifuged at 2000 r.p.m for 2 minutes and the contents were allowed to settle. The debris was loosened with stick, the upper part of the test tube was cleared of fatty debris, and the supernatant fluid was decanted, leaving one or two drops. The deposit after shaking was poured on a glass slide, a cover slip was placed over and the specimen was examined under microscope.

The Presence of ova and cysts of STH like Ascaris lumbricoides, Trichuris trichiura, Necator americanus and Ancylostoma duodenale by formalin ether concentration method was considered as dependent variable.

Age (Age less than 10, Age 10 and above), Sex (Male, Female), Type of family (Nuclear family, Extended family), Total number of family members (4 or Less, 4 and above), House Category (Kutcha, Others), Mothers Educational status (Illiterate, Literate), Socio Economic Status (Lower SES, High SES), Open air defecation (Yes, No), Type of Safe Drinking water (Pipe Water, Others like Boiled/UV/RO), Unwashed Vegetables (Yes, No), Eating foods fallen on ground (Yes, No), Washing with soap before food (No, Yes), Washing with soap after Toilet (No, Yes), Always using foot wear (No, Yes), De-worming medication during past 3 months, (No, Yes), Nail Clipping (No, Yes) and Knowledge Attitude score (Inadequate, Adequate) were considered independent variable.
Data entry was made in the Microsoft Excel software in codes and analysis was done with SPSS-19 computer package. Prevalence is expressed in percentage with 95% Confidence interval (CI). Univariate analysis and logistic regression were performed to find the associations between independent variables and dependent variables. Strength of association was expressed in terms of odds ratio and adjusted odds ratio with 95% confidence interval. P value <0.05 was considered as statistically significant.

Even though parents of 819 children participated in the survey, only 610 children gave one adequate stool sample. Hence only 610 children were taken into account for analysis. Non response rate was 24.42%.

The mean age of the study population was 8.92±2.68. Among the participants, children below ten years were more. Similarly, female participants (52.1% ) were more. More children (62.1% ) belonged to nuclear family. Majority of the households had 4 or less people (54.9% )

Majority of mothers studied up to high school (40.5%). However, 20.2% of mothers was illiterate. Many of the mothers were homemakers (40.4%) or involved in unskilled works (33.0%). Most of the fathers were studied up to high school (45.6%) but 16.1% was illiterate. Most of the fathers were doing skilled work (50.2%). Few of them remained unemployed (0.05%).

Majority of the children (52.3%) belonged to low socio economic status (Class IV and V according to modified Prasad classification). Majority of the children drank unboiled tap water supplied by the local civic body. Regarding the toilet usage only 50.7% of the children were using the toilets in the home. However 33.4% were going
for open air defecation. Majority of them washed the vegetables before eating (70.3%). However 14.9% ate raw vegetables without washing.

Majority of the study children (96.4%) were not having the habit of eating foods fallen on the ground. Around 66% did not wash their hands with soap before taking food. And 44.6% did not wash their hands with soap after coming from toilet. Around 63.4% children regularly used foot wear and around 70% of the children had trimmed nail during the visit. Nearly half of the parents of children were having adequate knowledge on STH. Only 59% took deworming tablets in the last three months.

The prevalence of STH among 610 children who had given one adequate stool sample and whose parents participated in survey was 7.70% (95% CI: 5.58-9.82). Among all STH, Ascarislumbricoides was highly prevalent 6.9% (4.89% to 8.91%) followed by hook worm 0.2 (0.15% to 0.55%) and Trichuristrichura 0.7% (0.04% to 1.36%).

There was no significant association between STH and factors influencing STH like Age (Age less than 10, Age 10 and above), Sex (Male, Female), Type of family (Nuclear family, Extended family), Total number of family members (4 or Less, 4 and above), House Category (Kutcha, Others), Mothers Educational status (Illiterate, Literate), Socio Economic Status (Lower SES, High SES), Open air defecation (Yes, No), Type of Safe Drinking water (Pipe Water, Others like Boiled/UV/RO), Unwashed Vegetables (Yes, No), Eating foods fallen on ground (Yes, No), Washing with soap before food (No, Yes), Washing with soap after
Toilet (No, Yes), Always using foot wear (No, Yes), De-worming medication during past 3 months (No, Yes), Nail Clipping (No, Yes), Knowledge Attitude score (Inadequate, Adequate).

Since none of the factors came as significant in Univariate analysis, all independent variables were subjected to multivariate logistic regression analysis. However all of them came insignificant.
9. LIMITATIONS

1. The study results were based on single stool sample which could have estimated the low prevalence.

2. The newer techniques with higher sensitivity would have given higher prevalence

3. Relatively high non response rate.

4. Sample size was not adequate to comment on factors influencing STH.

5. This is a cross-sectional study, hence the cause-effect relationship cannot be determined.
10. RECOMMENDATION

1. STH is still a public health problem in the field practice area of RHTC Vedapatti. The coverage of NDD was only 59%. Hence the coverage should be improved.

2. Open air defecation is around 33.4%. The children should be encouraged to use toilet facilities either private or public.

3. Our study revealed that 47.7% parents of children were having inadequate knowledge regarding STH. Hence health education is important to raise their awareness about these infections.
REFERENCES


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Chandler AC. The prevalence and epidemiology of hookworm and other helminthic infections in India. Indian J. med. Res. 1927, 14, 733-744


70. Montresor A, Zin T, Padmasiri E, Allen H and Savioli L: Soil-transmitted helminthiasis in Myanmar and approximate costs for countrywide control; Trop Med Internal Health; 9(9):1012-5.


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1. INTRODUCTION

Soil Transmitted Helminths (STH) is a term widely used to refer to a group of parasitic diseases caused by nematode worms that are transmitted to humans by soil contaminated with fecal matter.

The soil-transmitted helminths causing disease among human beings are Ascaris lumbricoides, Trichuris trichiura, Necator americanus and Ancylostoma duodenale. These parasites are spread through contact with soil contaminated with human feces. STH commonly occurs in places with poor sanitation and poverty. They are widely distributed in tropical and subtropical areas.

STH are considered Neglected Tropical Diseases (NTDs) because they have
To:
Dr Y Xavier Christu Rajan
Postgraduate
Department of Community Medicine
PSG IMS & R
Coimbatore

Ref: Project No. 14/431
Date: December 29, 2014

Dear Dr Xavier Christu Rajan,

Institutional Human Ethics Committee, PSG IMS&R reviewed and discussed your application dated 09.12.2014 to conduct the research study entitled “Prevalence and the factors influencing Soil Transmitted Helminths (STH) among school-age children (5-14 years) in a rural area of Coimbatore District” during the IHEC meeting held on 22.12.2014.

The following documents were reviewed and approved:

1. Project Submission form
2. Study protocol
3. Assent form
4. Parental consent form
5. Proforma
6. Permission letter from concerned Head of the department
7. Current CVs of Principal investigator, Co-investigators
8. Budget

The following members of the Institutional Human Ethics Committee (IHEC) were present at the meeting held on 22.12.2014 at IHEC Secretariat, PSG IMS & R between 10.00 am and 11.00 am:

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<th>Sl. No.</th>
<th>Name of the Member of IHEC</th>
<th>Qualification</th>
<th>Area of Expertise</th>
<th>Gender</th>
<th>Affiliation to the Institution</th>
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<td>1</td>
<td>Dr. P. Sathyam (Chairperson, IHEC)</td>
<td>DO, DNB</td>
<td>Clinician (Ophthalmology)</td>
<td>Male</td>
<td>Yes</td>
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<tr>
<td>2</td>
<td>Dr. S. Bhuvaneswar (Member-Secretary, IHEC)</td>
<td>MD</td>
<td>Clinical Pharmacology</td>
<td>Female</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Dr. S. Shanthakumari</td>
<td>MD</td>
<td>Pathology, Ethnol</td>
<td>Female</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>4</td>
<td>Mrs P Rama</td>
<td>M Pharm</td>
<td>Non-medical (Pharmacy)</td>
<td>Female</td>
<td>Yes</td>
<td>Yes</td>
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The study is approved in its presented form. The decision was arrived at through consensus. Neither PI nor any of proposed study team members were present during the decision making of the IHEC. The IHEC functions in accordance with the ICH-GCP/ICMR/Schedule Y guidelines. The approval is valid until one year from the date of sanction. You may make a written request for renewal / extension of the validity, along with the submission of status report as decided by the IHEC.

Page 1 of 2
Following points must be noted:

1. IHEC should be informed of the date of initiation of the study
2. Status report of the study should be submitted to the IHEC every 12 months
3. PI and other investigators should co-operate fully with IHEC, who will monitor the trial from time to time.
4. At the time of PI’s retirement/intention to leave the institute, study responsibility should be transferred to a colleague after obtaining clearance from HOD. Status report, including accounts details should be submitted to IHEC and extramural sponsors.
5. In case of any new information or any SAE, which could affect any study, must be informed to IHEC and sponsors. The PI should report SAEs occurred for IHEC approved studies within 7 days of the occurrence of the SAE. If the SAE is ‘Death’, the IHEC Secretariat will receive the SAE reporting form within 24 hours of the occurrence.
6. In the event of any protocol amendments, IHEC must be informed and the amendments should be highlighted in clear terms as follows:
   a. The exact alteration/amendment should be specified and indicated where the amendment occurred in the original project. (Page no. Clause no. etc.)
   b. Alteration in the budgetary status should be clearly indicated and the revised budget form should be submitted.
   c. If the amendments require a change in the consent form, the copy of revised Consent Form should be submitted to Ethics Committee for approval.
   d. If the amendment demands a re-look at the toxicity or side effects to patients, the same should be documented.
   e. If there are any amendments in the trial design, these must be incorporated in the protocol, and other study documents. These revised documents should be submitted for approval of the IHEC and only then can they be implemented.
   f. Any deviation Violation waiver in the protocol must be informed to the IHEC within the stipulated period for review.
7. Final report along with summary of findings and presentations/publications if any on closure of the study should be submitted to IHEC.

Kindly note this approval is subject to ratification in the forthcoming full board review meeting of the IHEC.

Thanking You,

Yours Sincerely,

Dr S Bhuvaneshwari
Member-Secretary
Institutional Human Ethics Committee
Annexure III

Assent Form For children between 15-18 years old

Why are we meeting with you?

We want to tell you about something we are doing called a research study. A research study is when doctors collect a lot of information to learn more about something related to health and disease. DR.V.Xavier Christu Rajan, doing a study to learn more about Soil Transmitted Helminths (STH). After we tell you about it, we will ask if you’d like to be in this study or not.

Why are we doing this study?
To find out

1. Prevalence of Soil Transmitted Helminths (STH) among school-age children (5–14 years age) in a rural area of Coimbatore.

2. Association of various factors influencing Soil Transmitted Helminths among school-age children (aged 5–14 years) in a rural area of Coimbatore.

What will happen to you if you are in this study?

Only if you agree, two things will happen:

1. A single STOOL sample will be collected.

2. You will need to answer some questions about factors influencing Soil Transmitted Helminths

Will this study hurt?

Its mere a collection of single stool sample, it won't hurt.

Will everybody come to know about my condition? (Confidentiality)
We will not tell other people that you are in this research, and we won't share information about you to anyone who does not work in the research study.

Is this bad or dangerous for me? (Risks involved)
No it is not dangerous.

Do I get anything for being in the research?
If your stool sample is found with egg of parasites you will be informed.
Will you tell me the results?
If your stool sample is found with egg of parasites you will be informed immediately, and the results will be kept confidential.

Do you have any questions?
You can ask questions any time. You can ask now. You can ask later. You can talk to me or you can talk to someone else.

Do you have to be in this study?
No, you don’t. If you don’t want to be in this study, just tell us. Or if you do want to be in the study, tell us that. And, remember, you can say yes now and change your mind later. It’s up to you.

Who can I talk to or ask questions to?
You can question me at any time. My Contact No: 9884989899

SIGNATURE OF PERSON CONDUCTING ASSENT DISCUSSION
I have explained the study to ______________________ in language he/she can understand, and the child has agreed to be in the study.

__________________________________   _______________
Signature of Person Conducting Assent Discussion   Date

_______________________________
Name of Person Conducting Assent Discussion
Dr.V.Xavier Christu Rajan
Part 2: Certificate of Assent

I have read this information (or had the information read to me) . I have had my questions answered and know that I can ask questions later if I have them.

I agree to take part in the research.

OR

I do not wish to take part in the research and I have not signed the assent below. __________

(initialed by child/minor)

Only if child assents:
Print name of child ____________________
Signature of child: ____________________
Date: __________________
    day/month/year

If illiterate:

I have witnessed the accurate reading of the assent form to the child, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness (not a parent) ____________________ AND Thumb print of participant

Signature of witness ____________________

Date __________________
    Day/month/year

I have accurately read or witnessed the accurate reading of the assent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given assent freely.

Print name of researcher- Dr. V. Xavier Christu Rajan.
*Modified from the Informed Assent form template for children/minors – World Health organization.
Annexure III

பிரதாண்பாத்திரம் கூறுகள் பாதுகாப்புகள்

சுற்றுலாநுடைய நூற்றாண்டு பிட்டரவு நூற்றாண்டுகள் செயல்பாடு நூற்றாண்டுகள் சர்க்காரினை

அவர் துவங்கினார்,

பெண்கூற்று போர் நூற்றாண்டு போர்வழிய வலனத்தில் ஆவம் இந்த பிரதாண்பாத்திரம் கூறுகளின் சுற்றுலாவில் பாதுகாப்புகளை முதலில் பாதுகாப்புகளை தூண்டும். பொருள் அமைப்பு முல்லை இன்றைய முன்னைய நூற்றாண்டுகள். பெண்கூற்றில் பாதுகாப்பு வலனத்தின் நூற்றாண்டு சர்க்காரின் ஆவம் பாதுகாப்பு நூற்றாண்டு (STH) (5-14 மட்டுடன்) பாதுகாப்பு பாதுகாப்புகள்

ெம்பாத்திற்கு

சுற்றுலாவில் பாதுகாப்பு வலனத்தின் நூற்றாண்டு சர்க்காரின் ஆவம் பாதுகாப்பு

என்று முதலில் பாதுகாப்பு நூற்றாண்டு (STH) (5-14 மட்டுடன்) பாதுகாப்பு பாதுகாப்பு

அம்பாத்திற்கு

1. மேல் பாதுகாப்பு நூற்றாண்டு சுற்றுலாவில், சுற்றுலாவு கூறுகளின் ஆவம்

முதலில் பாதுகாப்பு நூற்றாண்டு (STH) (5-14 மட்டுடன்) பாதுகாப்பு பாதுகாப்பு.

2. சுற்றுலாவில் சுற்றுலாவு கூறுகள் (5-14 மட்டுடன்) ஆவம் முதலில்

பாதுகாப்பு நூற்றாண்டு பாதுகாப்பு நூற்றாண்டு சர்க்காரின் ஆவம் பாதுகாப்பு

சர்க்காரினை

மேல் பாதுகாப்பு நூற்றாண்டு பாதுகாப்பு ஆவத் சர்க்காரினைத்

சுற்றுலாவில் பாதுகாப்பு நூற்றாண்டு சர்க்காரினை

அம்பாத்திற்கு வரும் பாதுகாப்பு காரணிகள் : 815
ஆபுரவின் விளக்கம்

2. முன்னெடுத்த சென்றுசெல்வது, அடுத்து பின்புத்தது (STH), மாணவர் பயிற்சியின் காரணிகள் பாதுகாப்பு அறிக்கையில் சிறப்பான புகழ் பெற்றது. இறுதியில் என்ன பாதுகாப்பு செய்யாது அடுத்து பின்புத்த அறிக்கையில் (STH நூற்றாண்டில் அறிக்கையில் கிளையை கட்டியது).

மிகு ஆபுரவின் மாணவர் நம்பிக்கையிண்டு நிறைவேற்றும் முறையாக இங்குள்ளு. இலவசில் மிகு ஆபுரவின் போக்குப் பாதுகாப்பு போக்கு பாதுகாப்பாளர் அறிக்கையாளராக இருந்தார், தமிழ்நாட்டு அறிக்கையாளராக இருந்தார்.

மிகு ஆபுரவின் குழந்தைகள் வாழ்வாயிலில் அறிக்கையில் எங்கு அறிக்கைகள் இருந்து தொடர்வது. அவர்கள் பாதுகாப்பாளர்களுக்கு கூறுவதற்கு அரசு அறிக்கையாளராக இருந்தார்.

சிலேகணுண்டு, இன்னும் சிலேகணுண்டு. சிலேகணுண்டு மாணவர்கள் பாதுகாப்பாளராக இருந்து தொழில்நுட்ப கல்விலை பெற்றது. இவர்களுக்கு வாழ்வு கீழ் காட்டியுள்ள கிளையை கட்டியது. இது மேலும் முக்கியமான காரணமாக இருந்தது. இது மேலும் முக்கியமான காரணமாக இருந்தது.

ஆபுரவின் விளக்கம்

இந்த போட்டியில் மாணவர்கள் குழந்தைகள் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப் டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப் டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது. அவர்கள் இந்த போட்டியில் கல்வியில் பாதுகாப்பு நிலையில் இருந்தது. இது ஆபுரவின் நம்பிக்கையிண்டு மிகு ஆப்டுனில் தொடர்வது.
அங்கியில் இல்லை

நவீனத்திற்கு முன்னே வாதிக்க வேண்டும்:
Annexure IV

Parental Consent Form

Title of Study:
Prevalence and the factors influencing Soil Transmitted Helminths (STH) among school-age children (5–14 years age) in a rural area of Coimbatore district.

Name of the Principal Investigator: Dr. V. Xavier Christu Rajan
Department: Community Medicine

Your (son/daughter/child/infant/adolescent youth) is invited to participate in our study.

My name is Dr. V. Xavier Christu Rajan and I am a first year postgraduate student of Dept. of Community Medicine at PSG Institute of Medical Sciences and Research, Coimbatore.

I am asking for permission to include your (son/daughter/child/infant/adolescent youth) in this study.

Objectives of my study:
4. To study the association of various factors influencing Soil Transmitted Helminths among school-age children (aged 5–14 years) in a rural area of Coimbatore.

I expect to have 491 participants in the study.

If you allow your child to participate, few questions regarding factors influencing Soil Transmitted Helminths (STH) will be asked to collect a single stool sample.

Any information that is obtained in connection with this study and that can be identified with your (son/daughter/child/infant/adolescent youth) will remain confidential and will be disclosed only with your permission. His or her responses will not be linked to his or her name or your name in any written or verbal report of this research project.

Your decision to allow your (son/daughter/child/infant/adolescent youth) to participate will not affect your or his or her present or future relationship with PSGIMS&R or PSG Hospitals. If you have any questions about the study, please ask me. If you have any questions or concerns about your (son/daughter/child/infant/adolescent youth)’s participation in this study, call 9884989899

You may keep a copy of this consent form.

You are making a decision about allowing your (son/daughter/child/infant/adolescent youth) to participate in this study. Your signature below indicates that you have read the information provided above and have decided to allow him or her to participate in the study. If you later decide that you wish to withdraw your permission for your (son/daughter/child/infant/adolescent youth) to participate in the study, simply tell me.

You may discontinue his or her participation at any time.

Printed Name of (son/daughter/child/infant/adolescent youth)

Signature of Parent(s) or Legal Guardian with Date Signature of Investigator with Date
Annexure IV

பிரிவுப் பாதுகாப்பு காலநிலை தொடர்பில் வாழ்வூடாக்கக்
போட்டிகள் குறிப்பிட்டுள்ளன.

மூலக்குறிக்கை முதல் வரை இக்காலநிலை தொடர்பில் வாழ்வூடாக்கக்
போட்டிகள் குறிப்பிட்டுள்ளன. MD முதலானவை பாதுகாப்பு முதலிலும். இதன்
அடிப்புறமாக ஒன்றை குறிப்பிட்டு வாழ்வூடாக்கக்
போட்டிகள் குறிப்பிட்டுள்ளன. அந்ததை ஒன்றை குறிப்பிட்டு
சேராகிறார்கள்.

அண்புறாக குறிப்பிட்டு

தொடர்பில் மூன்றாம் கால குறிதெளிக்கும் பதிப்பில் பாதுகாப்பு
ஒன்றை குறிப்பிட்டு பாதுகாப்பு நூற்றூற்றகத்தில் (STH) (5-14 பாதுகாப்பு)
பாதுகாப்பு முதலிலும் குறிப்பிட்டுள்ளன.

அண்புறாக வழிகாட்டு

1. மூன்றாம் பாதுகாப்பு நூற்றூற்றகத்தில் தொடர்பில் குறிதெளிக்கும், குறிதெளிக்கும்
பாதுகாப்பு முதலிலும் பாதுகாப்பு நூற்றூற்றகத்தில் பாதுகாப்பு (STH) (5-14 பாதுகாப்பு)
பாதுகாப்பு முதலிலும் பாதுகாப்பு முதலிலும்.

2. தொடர்பில் குறிதெளிக்கும் பாதுகாப்பு (5-14 பாதுகாப்பு) பாதுகாப்பு
ஒன்றை குறிதெளிக்கும் பாதுகாப்பு முதலிலும் பாதுகாப்பு நூற்றூற்றகத்தில்
பாதுகாப்பு முதலிலும் குறிப்பிட்டுள்ளன.

அண்புறாக வழிகாட்டு

மூன்றாம் பாதுகாப்பு நூற்றூற்றகத்தில் பாதுகாப்பு முதலிலும் குறிதெளிக்கும்
பாதுகாப்பு முதலிலும் குறிப்பிட்டுள்ளன.
அப்பிரியம் பூங்கா போன்ற பொருள்கள் தொடர்ச்சிக் கட்டமைப்பு : 815

அப்பிரியம் கிளைகள்

2. முதல் குறியீடுகள் மென்பொழுது தன்மையான கால்வாய்ந்த விளக்கங்கள் என்பது அல்லது எகிப்தியர். இந்த குறியீடுகள் இருந்துகாக அடுத்தியுள்ள முக்கிய தொகுப்புகள். (STH) , மேலும் பற்றி பார்க்கவும் தொடர்ச்சிக் போன்ற முறுள் செய்யப்பட்டிருக்கும் காலை மற்றும் வேட்டி விளக்கங்கள்

இது அப்பிரியம் விளக்கம் கூறுவதற்கு அல்லது காலை பெயர் 5 முதல் பார்க்கப்பட்டிருக்கும். இவ்வாறு ஒருநாள் அப்பிரியத்தில் பார்க்கப்பட்டால் பெரும். காலை விளக்குவதற்கு கூறுவதற்கு ஒருநாள் பார்க்கப்பட்ட விளக்கத்தைப் பெரும் அல்லது காலை விளக்கம் கூறுவதற்கு பெரும்.

இந்த அப்பிரியம் விளக்கம் பார்க்கப்பட்ட விளக்கத்தைப் பெரும் காலை விளக்கத்தை காணக் கூறுவதற்கு பெரும். காலை விளக்கத்தைப் பார்க்கப்பட்ட அப்பிரியம் விளக்கத்தைப் பெரும் காலை விளக்கத்தைப் பெரும்.

இந்த அப்பிரியம் விளக்கத்தை பெரும் குறியீடுகள் தொடர்புள்ள. இந்த குறியீடுகள் காலை விளக்கத்தை பெரும் காலை விளக்கத்தை பெரும்.

இந்த அப்பிரியம் விளக்கத்தை பெரும் குறியீடுகள் தொடர்புள்ள. இந்த குறியீடுகள் காலை விளக்கத்தை பெரும் காலை விளக்கத்தை பெரும். காலை விளக்கத்தை பெரும் காலை விளக்கத்தை பெரும.

2.குறியீடு எண்ணியல் விளக்கம்:

அப்பிரியம் விளக்கங்கள் தொடர்ச்சிக் கட்டமைப்பாக செய்யப்பட்டுள்ள.
Annexure V

QUESTIONNAIRE

ID No: ________________

Informant Name: _____________________________________
Relationship to child: _____________________________________

DEMOGRAPHIC PROFILE

1. Name of the child: ____________________________________
2. Date of birth of the child:
3. Age: ______
4. Sex of the child: 1. male 2. Female
5. Address of the child: ___________________________________
6. Education of the child: __________________________________
   1. Illiterate
   2. Primary school
   3. Middle school
   4. High school

PERSONAL HYGINE

7. Is the child’s nails trimmed? Yes(1)/No(2)

SOCIO-ECONOMIC FACTORS

8. Type of Family: 1. Nuclear family
                  2. Extended family
9. Total no of family members

10. Mothers Educational status

1. Professional
2. Graduate/Post Graduate
3. Higher secondary /Diploma
4. High school
5. Middle school
6. Primary school
7. Illiterate

11. Mothers occupation

1. Professional
2. Semiprofessional
3. Clerical/shop owner/farmer
4. Skilled
5. Semiskilled
6. Unskilled
7. Unemployed

12. Fathers educational status

1. Professional
2. Graduate/Post Graduate
3. Higher secondary /Diploma
4. High school
5. Middle school
6. Primary school
7. Illiterate

13. Fathers occupation

1. Professional
2. Semiprofessional
3. Clerical/shop owner/farmer
4. Skilled
5. Semiskilled
6. Unskilled
7. Unemployed

14. Total Monthly income of the family( In Rs)
15. Socio Economic Status: (Modified Prasad Classification):
   1. Class I
   2. Class II
   3. Class III
   4. Class IV
   5. Class V

**HOUSING FACTORS:**

16. Type of house
   1. Pucca
   2. Semipucca
   3. Kutcha

**KNOWLEDGE:**

17. Do worms cause serious disease?
   1. Yes
   2. No
   3. Don’t know

18. Where do the worm live inside the body?
   1. Muscles
   2. Intestine
   3. Blood
   4. Don’t know

19. What is the main route of spread of worm infestation?
   1. Touching a infected person
   2. Through blood
   3. Open air defecation
   4. Don’t know

20. What is the simple test to find worm infestation?
   1. Blood test
   2. Urine test
   3. Stool test
   4. Don’t know

21. What happens if people are infested with worms?
   1. Overweight
   2. High blood pressure
   3. Slow growth
   4. Don’t know

22. How can you prevent/avoid a worm infestation?
   1. Eating too much food
   2. Doing exercise
   3. Using the latrine
   4. Don’t know

**ATTITUDE:**

23. Do you believe that your child is at risk of getting worm infestation?
   1. Agree
   2. Disagree
   3. Don’t know

24. Will you become anxious if your child is passing worms?
   1. Agree
   2. Disagree
   3. Don’t know

25. Will you allow your child to go for Open air defecation, while coming to know that it’s a important reason for worm infestation?
   1. Yes
   2. Rarely allow
   3. Never allow
   4. Don’t know
PRACTICE:

26. Where does the child defecate most of the days in a year?
   1. Toilet in home  2. Public toilet  3. Open air defecation  

27. From where does the child get drinking water most of the days of a year?

28. For the past 15 days, Is the child eating unwashed vegetables?

29. For the past 15 days, Is the child in the habit of eating foods fallen on the ground?

30. For the past 15 days, Is the child washing the hands with soap before taking food?

31. For the past 15 days, Is the child washing the hands with soap after defecation?

32. For the past 15 days, Is the child using footwear in the following circumstances?

HEALTH SEEKING BEHAVIOUR:

33. Did the child take deworming medications in the last 3 months?
   Yes(1)/No(2)  

34. STOOL EXAMINATION RESULTS:  

## Annexure V

### வளர்ப்புத்தகவல்

<table>
<thead>
<tr>
<th>ஆண்டுபாதை காலம் :</th>
<th>தொலைவு அளிப்பாவின் பெயர்</th>
<th>மண்டலம் :</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. குறுக்குவடிவத் போட்டியின் பெயர்</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>2. குறுக்குவடிவத் பிரிவு தரும் தலைமை</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>3. வண்டி :</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>4. குறுக்குவடிவத் பாரிசை :</td>
<td>1. அலிமன்</td>
<td>2. பெண்ணு</td>
</tr>
<tr>
<td>5.குறுக்குவடிவத் தொகுதி</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>6. குறுக்குவடிவத் தொகுதி :</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>1. பஞ்சகிரிம்மு</td>
<td>2. பஞ்சகிரிம்மு</td>
<td>3. பஞ்சகிரிம்மு</td>
</tr>
</tbody>
</table>

###குறிப்பிடுபவை

1. மாதம் குறிப்பிட்டு பி.பி.பி. பாட்டு? ஆன(1) / பி.பி.பி.பி. (2)

###செயல்பாடு பொருளானாறு காற்றிலியம்

<table>
<thead>
<tr>
<th>தொடர் திட்டம்</th>
<th>1. தொடர் திட்டம்</th>
<th>2. தொடர் திட்டம்</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. குறுக்குவடிவத் பதவி போட்டியின் பெயர்</td>
<td>:</td>
<td>:</td>
</tr>
</tbody>
</table>

###செயல்பாடு பொருளானாறு காற்றிலியம்

<table>
<thead>
<tr>
<th>தொடர் திட்டம்</th>
<th>1. தொடர் திட்டம்</th>
<th>2. தொடர் திட்டம்</th>
</tr>
</thead>
</table>
9. குடியரசு வடிப்பாட்டின் பணிபுறநிலைக் குறிப்பிட்டது: 

10. தலைவர் கோடை தேதி: 

<table>
<thead>
<tr>
<th>மத்தியு (7)</th>
<th>பிண்டிக்கு / பல வேலம் பை (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>பாணியிலை பல்பராத்தி/பல்பை (5)</td>
<td>பாணியிலை பல்பராத்தி (4)</td>
</tr>
<tr>
<td>அந்தமானப் பல்பராத்தி (2)</td>
<td>பலகத்தசம்பு (1)</td>
</tr>
</tbody>
</table>

11. தலைவர் வேலு: 

<table>
<thead>
<tr>
<th>மத்தியு (10)</th>
<th>பிண்டிக்கு (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>காண்டுக்கு / காடு கிளைமாந்தா / கிளைமாந்தா (5)</td>
<td>கிளைமாந்தா பிண்டிக்கு (4)</td>
</tr>
<tr>
<td>அந்த கிளைமாந்தா பிண்டிக்கு (3)</td>
<td>குடியரசு கிளைமாந்தா (2)</td>
</tr>
<tr>
<td>குடியரசு கிளைமாந்தா (1)</td>
<td></td>
</tr>
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</table>

12. குடியரசு வேலு: 

<table>
<thead>
<tr>
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<th>பிண்டிக்கு (6)</th>
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<td>பாணியிலை பல்பராத்தி (4)</td>
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<tr>
<td>அந்தமானப் பல்பராத்தி (2)</td>
<td>பலகத்தசம்பு (1)</td>
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</tbody>
</table>

13. குறுக்குச் சூட்டம்: 

<table>
<thead>
<tr>
<th>மத்தியு (10)</th>
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</thead>
<tbody>
<tr>
<td>குறுக்குச் சூட்டம் (6)</td>
</tr>
<tr>
<td>காண்டுக்கு / காடு கிளைமாந்தா / கிளைமாந்தா (5)</td>
</tr>
<tr>
<td>அந்த கிளைமாந்தா பிண்டிக்கு (3)</td>
</tr>
<tr>
<td>குடியரசு கிளைமாந்தா (2)</td>
</tr>
<tr>
<td>குடியரசு கிளைமாந்தா (1)</td>
</tr>
</tbody>
</table>

14. குறுக்குச் சூட்டம் பாணியிலை பலகத்தசம்பு (Rs): 

15. குறுக்கு பாணியிலை தேதி: 

<table>
<thead>
<tr>
<th>மருத்துவம் 2</th>
<th>மருத்துவம் III</th>
<th>மருத்துவம் III</th>
<th>மருத்துவம் IV</th>
<th>மருத்துவம் v</th>
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<td>பிரித் மாறி</td>
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<td></td>
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</tbody>
</table>
16.வண்ணம் எனது:
1.பக்கம் 2.அழக் பக்கம் 3.குறிப்பு
அறிவு

17.புதுக்கள் பிள்ளையார் முதல்முறை வருமாறு குறிப்பிடும்?
1.அழும் 2.கிளிக்க கி 3.விளக்கம்

18.புதுக்கள் வடிவால் முறைப்படுடன் வெளியே குறிப்பிடும்?
1.தலைக் கைல 2.கைல 3.விளக்கம் 4.விளக்கம்

19.புது செய்யலாம் பறவை பச்சையில் காற்று உண்டழை?
1.பரிக்கப்பட்ட நூலா வேலன் 2.விளக்கம் 3.சிறுத்துப்பாரி பொடி குறித்தல் 4.சிறுத்துப்பாரி

20.புது செய்யலாம் கல்லுறுப்பு வழியில் சுற்று உண்டழை உண்டை?
1.சிறுத்து புரிதரதன் பல 2.சிறுத்து புரிதரதன் பல புரிதரதன் 3.பல புரிதரதன்

4.சிறுத்துப்பாரிசெய்யலாம்

21.புதுக்கள் புதுக்களம் பாரிக்கால் கல்லுறு விளக்கால் குறிப்பிடும்?
1.சுளர் சிறுத்துப்பாரிசெய்யலாம் 2.கைல சிறுத்துப்பாரிசெய்யலாம் 3.சிறுத்துப்பாரிசெய்யலாம் விளக்கால் 4.சிறுத்துப்பாரிசெய்யலாம்

22.புது செய்யலாம் தின்கால் தேவதை தேவதை குறிப்பிடும் பதிவு?
1.சிறுத்துப்பாரி சுளர் சிறுத்துப்பாரிசெய்யலாம் 2.சிறுத்துப்பாரி பொடி சிறுத்துப்பாரி முப்பலானது 3.சிறுத்துப்பாரிசெய்யலாம்

4.சிறுத்துப்பாரிசெய்யலாம்

மேல்பாராட்டம்

23.வெளி செய்யலாம் புது செய்யலாம் அப்பதில் புலம் பலம் பலம் வருமாறு குறிப்பிடும்?
1.அழும் 2.கிளிக்க கி 3.விளக்கம்

24.வெளி செய்யலாம் புது செய்யலாம் அப்பதில் பலம் பலம் பலம் குறிப்பிடும்?
1.அழும் 2.கிளிக்க கி 3.விளக்கம்
25. கிளையிலையின் புள்ளி குறுக்கு பார்வை ஒரு பார்வை கால பழுது வேலை பிட்டு நடனா கருநாயகா எனும் தங்கத்தன்று. தொடர்ந்து போற்றும் விளக்கம் அதிசயிட்டத்தலா? 

1. ஆயம் 2. அருகியது 3. குறிப்பிட்டது மாடல் 4. துவாரம்

26. (தையின் ரோ அன்றி பொழுதையான கிளையிலை மூலம் குடிப்பு வந்த?

1. முறை குறிப்பிட்டது 2. போர் குறிப்பிட்டது 3. கிளையிலை குறிப்பிட்டத்தலாம்

27. தையின் ரோ அன்றி பொழுதையான கிளையிலை குறிப்பிட்டது பார்வை வந்த?

1. குறுக்கு தந்தியார் 2. குறுக்கு தந்தியார் 3. குறுக்கு தந்தியார்
4. முன்னையார் தந்தியார்

28. முன்னையார் காதலின் தையின் ரோ அன்றி பொழுதையான குறிப்பிட்டது கூறல்களை முடிக்கும் பிரபலாக்களை 2 காலங்கள்?

1. முறை 2. போர் 3. குறிப்பிட்டது 4. துவாரம்

29. பார்வையின் ஏற்பாட்டு 2 காலங்கள் முடிக்கும் பிரபலாக்களை 2 காலங்களும் பொழுதையான குறிப்பிட்டது கூறல்களை 2 காலங்களை?

1. முறை 2. போர் 3. குறிப்பிட்டது 4. துவாரம்

30. அவர் காரணியான போற்றும் தையின் ரோ அன்றி காலங்கள் குறுக்கு பொழுதையான கூறல்களை முடிக்கும் பிரபலாக்களை 2 காலங்களை?

1. முறை 2. போர் 3. குறிப்பிட்டது 4. துவாரம்

31. காரணியான போற்றும் பிரபலாக்களை தையின் ரோ அன்றி காலங்கள் குறுக்கு பொழுதையான கூறல்களை முடிக்கும் பிரபலாக்களை 2 காலங்களை?

1. முறை 2. போர் 3. குறிப்பிட்டது 4. துவாரம்

32. பகுதிமாதி பிரபலாக்களை குறுக்கு காலங்கள் மற்றும் பொழுதையான கூறல்களை முடிக்கும் பிரபலாக்களை 2 காலங்களை?

1. முறை 2. போர் 3. குறிப்பிட்டது 4. துவாரம்

குறைக்கும் கட்டுப்பாடு பொழுதையான

33. கல்வி 3 மாடல்களை குறுக்கு கட்டுப்பாடு முடிக்கும் கட்டுப்பாடு நிகழ்த்து காலங்கள்? ஆயம்(1) / திண்டுலம்(2)
Annexure VI

Modified Prasad’s classification

Value of Consumer Price Index – Industrial Workers (CPI – IW) for November 2015= 250 (for Coimbatore; Base 2001 =100)
The calculation as per Modified Prasad’s classification has to be done using the following formula:
To convert the March 2014 CPI of 219
\[ = 250 \times 4.63 = 1157.5 \]
The calculation as per Modified Prasad’s classification was done using the following formula:
Multiplication factor = \( \frac{\text{Value of CPI X 4.63}}{100} \times 4.93 \)
\[ \frac{1157.5 \times 4.93}{100} = 57.07 \]

<table>
<thead>
<tr>
<th>Socio-economic Status</th>
<th>Per capita monthly income limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS I</td>
<td>Rs. ≥5707</td>
</tr>
<tr>
<td>CLASS II</td>
<td>Rs 2853- 5706</td>
</tr>
<tr>
<td>CLASS III</td>
<td>Rs1712-2852</td>
</tr>
<tr>
<td>CLASS IV</td>
<td>Rs 856-1711</td>
</tr>
<tr>
<td>CLASS V</td>
<td>Rs &lt; 855</td>
</tr>
</tbody>
</table>
Annexure VII
Coding sheet for master chart
CODE FOR MASTER SHEET

1.ID
2.AGE
3.SEX

5. Type of Family  1. Nuclear family 2. Extended family

6. Familyno: Total no of family members


11. Total Per capita income (Numeric Exact value)

12. Prasdses: Socio Economic Status


17. Test: (What is the simple test to find worm infestation?) 1. Blood test 2. urine test 3. Stool test 4. Don’t know


20. Believe: (Do you believe that your child is at risk of getting worm infestation?) 1. Yes 2. No 3. Don’t know

21. Anxious: (Will you become anxious if your child is passing worms?) 1. Yes 2. No 3. Don’t know

22. AllowOAD: (Will you allow your child to go for Open air defecation, while coming to know that it’s a important reason for worm infestation?) 1. Yes 2. Rarely allow 3. Never allow 4. Don’t know

23. Toilet: (Where does the child defecate most of the days in a year?) 1. Toilet in home 2. Public toilet 3. Open air defecation

24. Drinkingwater: (From where does the child get drinking water most of the days of a year?) 1. Tap water 2. Boiled water 3. RO water 4. Filtered water


65. Deworm: Deworming medications in the last 3 months 0. No 1. Yes


32. Agecat: Age category 1. Age 10 and above 2. Age less than 10

33. Fnocat: Total family number category, 1. More than 4 1. 4 or less

34. Medcat: Mothers Educational Category 0. Illiterate 1. Literate

35. SEScat: SES category 0. Lower 1. Upper

45. Discat: Serious Disease can a worm cause category 0. Incorrect response 1. Correct Response (Yes)


47. Spreadcat: Important reason for worm transmission? 0. Incorrect response 1. Correct Response (OAD)

49. Impactcat: What's the health impact of worms? 0. Incorrect response 1. Correct Response (Slow growth)

50. Preventcat: How to prevent worm infestation? 1. Toilet 0. Others

51. Believecat: Do you believe your child can get worm infestation? 0. Incorrect response 1. Correct Response (Yes)

52. Agitcat: Will you be tensed if your child gets worm infestation? 0. Incorrect response 1. Correct Response (Yes)

53. OADallowcat: Will you allow your child to go OAD even knowing its an important cause 0. Incorrect response 1. Correct Response (Never)

54. OADcat: Defecate most of the days in a year 0. OAD 1. Others

55. Drinkcat: Drinking water most of the days of a year 0. Pipe water 1. Others

56. Unwashcat: Eating unwashed vegetables 0. Others 1. Never

57. Fallfoodcat: Eating foods fallen on the ground 0. Others 1. Never

58. Soapbfcat: Washing the hands with soap before taking food 0. Others 1. Always

59. Soapatcat: Washing the hands with soap after defecation? 0. Others 1. Always

60. House cat: house cat 1. cutcha 2. Others

67. chappcat: 0. Occasionally 1. Always

69. TotKAscore = (diseasecat + Livecat + Spreadcat + Testcat + impactcat + Preventcat + Believevar + Agitvar + OADvar).

70. Medcat: category 0. Illiterate 1. Literate

71. STH category 0. Positive 1. Negative

72. KAScat 0. INADEQUATE 5 or less 1. Above 5 (in item 69)

<table>
<thead>
<tr>
<th>Case</th>
<th>IDno</th>
<th>AGE</th>
<th>Sex</th>
<th>Agecat</th>
<th>Housetype</th>
<th>Deworm</th>
<th>Organism</th>
<th>Livecat</th>
<th>Testcat</th>
<th>Believecat</th>
<th>Drinkcat</th>
<th>Chappcat</th>
<th>STHstatus</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>a001</td>
<td>10</td>
<td>1</td>
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**Note:** The table represents a snippet of data, and the actual values are not clearly legible.