"PREVALENCE OF INTESTINAL PARASITE IN PEOPLE OF BHOJAD AREA OF CHITWAN DISTRICT"

A DESSERTATION SUBMITTED
IN PARTIAL FULFILLMENT OF THE REQURIMENTS FOR THE
MASTER'S DEGREE IN ZOOLOGY

SUBMITTED BY
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SUBMITTED TO
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LETTER OF RECOMMENDATION

This is to certify that **Mrs. Sirjana Adhikari** has carried out the thesis work entitled **"Prevalence of intestinal parasites in people of Bhozad area"** as a partial fulfillment of the M.Sc. Degree in Zoology (Parasitology) under my supervision and guidance. It is my Pleasure to recommend this original work for the partial fulfillment of M.Sc. Degree in Zoology at Tribhun University.

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LETTER OF APPROVAL

On the recommendation of supervisior **Mr. Janak Raj Subedi**, this thesis of **Mrs. Sirjana Adhikari** is approved for examination and submitted to the Tribhuvan University in partial fulfillment of the requirements for the Master's degree of Science in Zoology with parasitology as a special paper.

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DECLARATION

I hereby declare that the work presented in this thesis has been done by myself and has not been submitted elsewhere for the award of any degree. All sources of information has been specifically acknowledged by references to the authors or institutions.

Date: Name:

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ABBREVIATION

CDZ : Central Department of Zoology
cm : Centimeter
df : Degree of Freedom
FPA : Family Planning Association
gm : Gram
ICIMOD : Integrated Centre for Integrated Mountain Development
IFPPCP : Integrated Family Planning and Parasite Control Project
inf : Infection
mg : Milligram
ml : Milliliter
mm : Millimeter
nm : Nanometer
rpm : rounds Per Minute
sp : Species
T.U. : Tribhuvan University
WHO : World Health Organization

CHAPTER-ONE
INTRODUCTION

1.1 Background

Healthy citizen is the backbone of the nation. Parasites are a major invader of people in developing countries like Nepal. People are more susceptible to parasites due to ignorance, illiteracy, malnutrition and unhygienic lifestyle.

Environmental factors, social customs and habits of person greatly influence the distribution of parasites and accordingly each parasite has got a specific distribution. An organism living in or on another living organism (host) is known as parasite (from Greek, Para=besides, site=food). The host provides food and shelter for parasites without compensation (Craig and Faust 1943). In most cases, parasites damage or cause disease in the host. The parasites remain closely associated with their hosts biologically and ecologically. In its medical usage, it is an association in which one animal, the host, is injured in some degree through the activities of the parasites. In such condition, the parasites are called pathogens and the condition that results from the damage constitutes diseases. Intestinal parasites caused 5119 mortality of people due to diarrhea and cholera in Nepal during 12 months (2001/2002) of period (National population census, 2001).

In past, the prevalence of intestinal parasitosis has sharply decreased (from over 70% to less than one percent) in Japan (Yokogawa *et al*., 1983) and recently in Korea (chai *et al*.,1993) and in Taiwan (chen *et.al*.,1991) as a result of various control measures applied. Recently, significant differences on some nutritional parameters including vitamin-A, have soon observed among intestinal parasites infected and non-infected and a significant improvement after the treatment among infected Nepalese (Rai *et al.*, 1998 and 2000). WHO estimated that nearly one forth of world's population harbors one or more intestinal parasites in their gastro-intestinal tract.

Intestinal parasitic infection is a major cause of morbidity and mortality among school aged children in developing countries (WHO1987).

Low economic status is not the sole factor for parasitic infection but, also the increased water pollution is one of the major public health issues in Nepal. Intestinal parasitic disease is ranked among twenty most fatal infections in tropical countries of Asia, Africa and Latin America in 1977-1978 (Davis 1980). Fifty different species of intestinal parasites can infect human being. The five important groups of intestinal parasites are roundworm, hookworm, tapeworm, *Amoeba* and *Giardia*. Roundworm infects 1×10^8 people and killed 20000 people per year, Hookworm infect 9×10^8 people killing 60000 people per year 4×10^8 people get infected by *Amoeba* killing 30000 per year and 9×10^8 people get infected by tapeworm and kill 50000 per year (WHO 1981).

People in the lowest socio-economic status have the highest rate of morbidity and mortality. Factors such as inadequate medical care, unemployment, low income, race, poor nutrition, housing and education may account for higher rates of parasitic diseases. Race influences behaviors, how people interact with one another, where people live, what jobs they have, how they live, how there was strong association between giardial infection and under nutrition of many primary school children (Loewenson *et.al*.,1986).

Parasitic infection, diarrhea of gastro-intestinal diseases are the result of environmental, particularly, the water pollution. In Kathmandu, 78% of solid water is biodegradable and 22% non-biodegradable that lead to water pollution (CEDA, 1989). Diarrhea (10%) is the disease caused by contaminated water in Nepal (DOHS, 1989 and SAEHN, 2002) Roundworm linked to food borne illness in humans include *A. lumbricoides*, *T. trichiura* and *E. vermicularis*. Among food borne cestodes, *H. nana* is also a major problem. Protozoa like *E. histolytica*, *C. parvum* and *G. lamblia* cause a

large number of food-borne outbreaks each year leading to dysentery like illness that can be fatal. Those food contacted faces or contaminated water are common vehicle for intestinal parasites (Wallace and Doebbling 1998).

The infection rate of different intestinal parasites may differ in different communities or caste of people since they have different traditional habit and habitat.

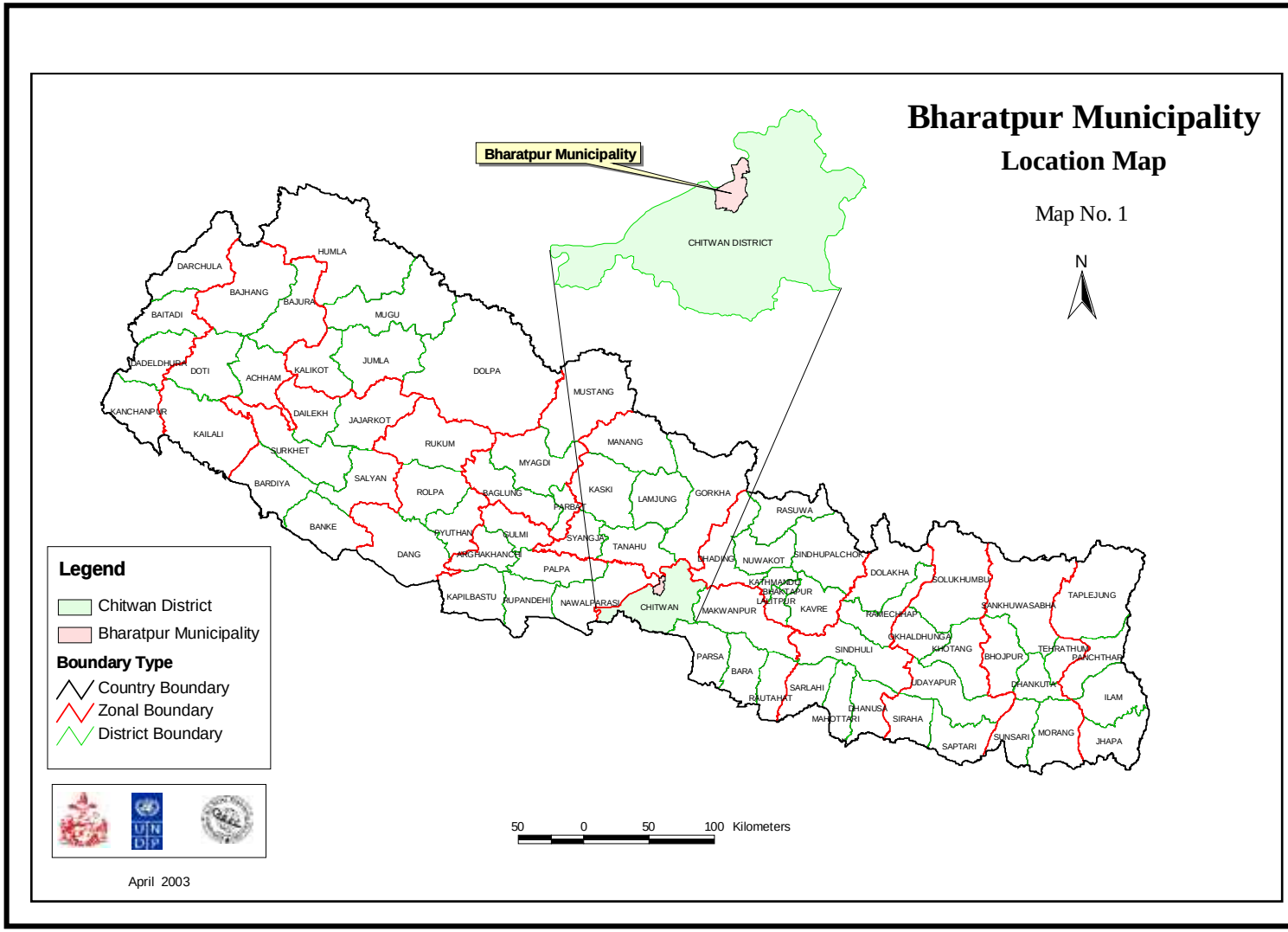
1.2 Introduction to the Study Site

Nepal is a landlocked Himalayan country in South Asia, bordering the People's Republic of China to the north and India to the south, east and west. Nepal varies topographic, social and cultural characteristics. Nepal is one of the least developed nations in the world. Poverty, ignorance and diseases characterize life in Nepal like in the most of the Third world countries.

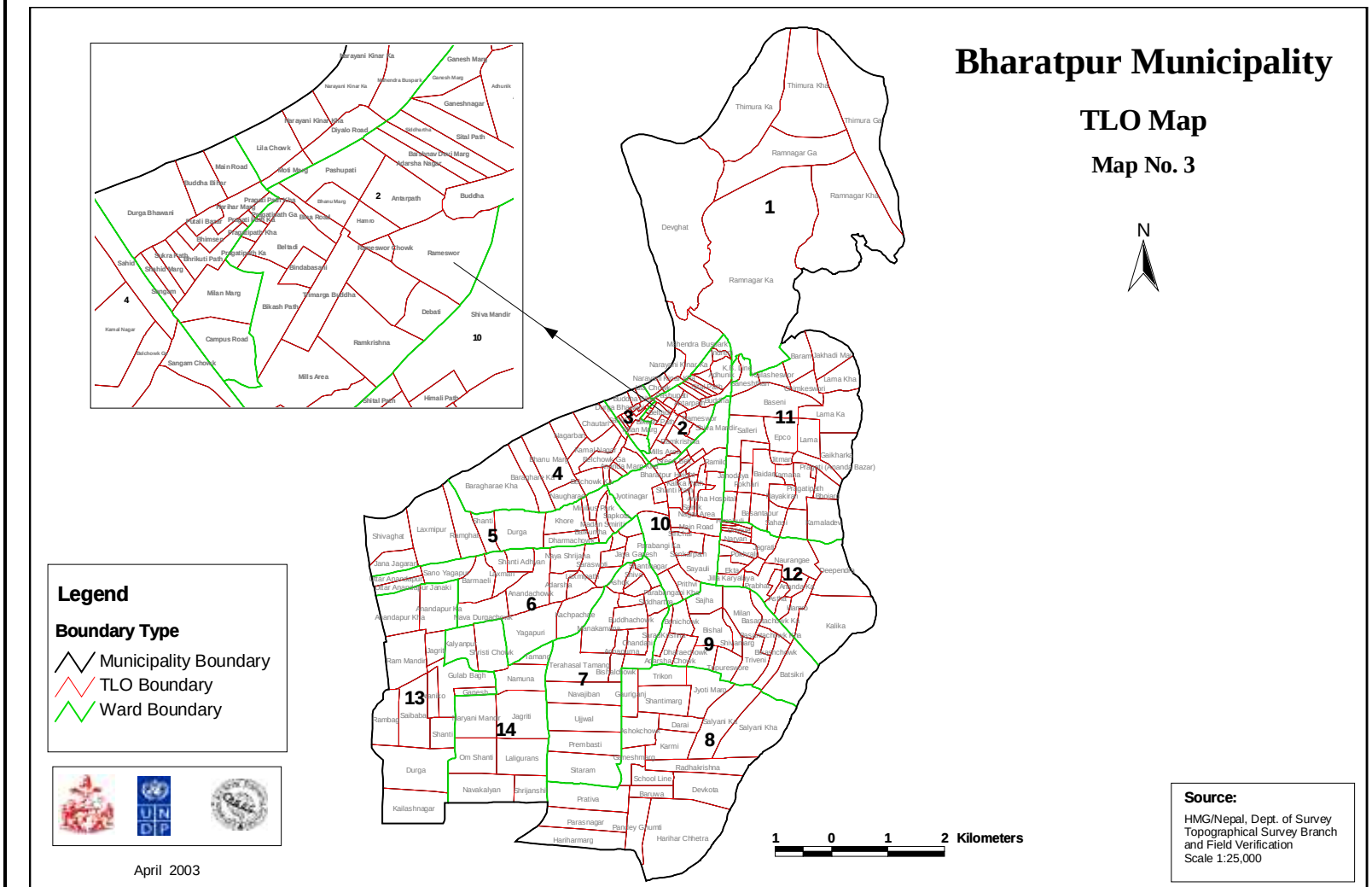
Chitwan District is one of the seventy-five districts of Nepal, a landlocked country of South Asia. The district is in the western part of Narayani Zone, Bharatpur (the seventh largest city of Nepal) is its district headquarters. Bharatpur is the commercial and service centre of central south Nepal, it is the merger destination for higher education health and transportation of the region. It covers an area of 2,218km² and has a population (2001) of 472,048.

At the foot of the Himalayas, Chitwan is one of the few remaining undisturbed vestiges of the Terai region, which formerly extended over the foothills of Nepal

CHITWAN DISTRICT



BHARATPUR-11, BHOJAD



Origin:

Currently there are three stories about the origin of the name Chitwan:

- The dense jungle there (before men started settlements there) was teeming with Cheetahs. And, the word for 'jungle' in Nepali is *van*. So, the people around started to call that locality as *Cheetah-van*, which was later modified as Chitwan.
- The dense jungle in the past was teeming with deer, and so they started to call it *Chitri-van* which gave way to the present word for the district.
- Long ago, the region was reigned by a kings descended from Chitra Vamsa. (*Vamsa* is a Sanskrit word for dynasty or lineage).

Climate

Bhojad is situated at an altitude of about 251 meters from the sea level. The temperature ranges from 15ºC to 40ºC. The coldest month is January and the hottest one is June. The average annual rainfall is 200 mm.

People

Bhojad is the city of the migrants. Almost all people, except some indigenous groups like Tharus, Darai, Kumals and Chepangs, are immigrated from different parts of the country. The migration had taken its root after the eradication of Malaria. Inception of the Rapti Valley Development Project, in the sixties, promoted another surge of migration by distributing land. So due to migration from different parts of the country and ethnic groups. In the downtown of the combination of varieties of castes and ethnic groups are founded dwelling in the municipality. Among them, the Brahmins, Chhetries, Newars, Magars, Tamangs and Gurungs are majorethnic groups. Indigenous tribes such as Chepangs, Tharus, Darais and Kumals can be found in the fringes of the municipality.

Economy

The economy of Bhojad was traditionally based on agriculture. The agricultural land is gradually covered into the residential area in one hand and being used for industrial uses on the other. Basic industries of Bhojad are processing industries of small scale. A large number of poultry industries have been developed in this area. It is believed that it serves more than 60% of the total poultry demand of the country.

1.3 Introduction of Intestinal Parasites

Parasites are those organisms which receive their food and shelter from other organisms where they live and host are the organisms which harbors the parasites (Chatterjee, 1998).

The parasites are biologically and ecologically associated with host. The effect of parasites on host is not constant but also related with various factors. Parasites case little effect on host but sometimes it produces adverse effect on host and produces the parasitic diseases.

Intestinal parasites are those organisms which live in the intestine of host. Intestinal parasites range from virus, bacteria, and protozoa to helminthes. However the most prevalent and endemic types of intestinal parasites are protozoa and helminthes parasites.

1.3.1 Intestinal Protozoan Parasites

Protozoan parasites consists of a single cell like unit which is morphologically and functionally complete (Chatterjee 2001).They cause serious health problem for human. Some common intestinal protozoan parasites are: *Entamoeba histolytica, Giardia lamblia, Entamoeba coli, Isospora, Trichomonas homonis, Balantidium coli, Cyclospora, Cryptosporidium etc.*

1.3.1.1 *Entamoeba histolytica*

- **History**: Lambli (1859) first discovered the parasite. Losch (1875) proved its pathogenic nature.
- Geograpical distribution: World-wide. More common in the tropic and subtropics than in the temperate zone.
- **Habitat**: Trophozite of *E.histolytica* live in the mucous and sub mucous layers of the large intestine of man.
- **Morphology**: *Entamoeba histolytica* has three stages in its life cycle.

a) Trophozoite: It is most active and feeding stage. Not fixed in shape and size ranges from 18 to 40 µm, cytoplasm is differentiated into two portions i.e. outer agranular ectoplasm while inner into fluid and granular endoplasm.

b) Pre-cystic Stage: It is smaller size, varying from 10 to 20µm. It is round or slightly ovoid with a blunt pseudopodium projecting from the periphery. It is transitory stage.

c**) Cystic Stage**: It is round and surrounded by highly retractile membrane. Cystic wall size varies from 5 to 20µ. Initially the cyst is quadrinucleated but the mature cyst is quadrinucleated, which is infective stage.

- **Mode of infection:** Faeco-oral route transmission of *E. histolytica* from human to human is through ingestion of food or drinks contaminated with quadrinucleated cysts.
- **Pathogeniticity**: *E. histolytica* is the parasite causing diarrhea (loose motions), dysentry (blood mixed with loose motion's), hepatitis (infection of liver) and liver abscesses (pus in liver) etc.

1. Amoebic dysentery: The infection is confined to the intestine and is characterized by the passage of blood and mucus in the stool. The trophozoites of *E.histolytica* secrete a proteolytic enzyme of histolysin nature, causing dissolution and necrosis of mucosa and sub mucosa of the

large intestine. These areas of destruction are called ulcers and they bleed profusely pouring mucus, cell debris, blood corpuscles, bacteria and amoeba into the lumen of large intestine which is inflamed.

2. Chronic intestinal amoebiasiasis: The patient usually suffers from diarrhea, bowl's irregularity, flatulence, pseudo constipation, abdominal pain, headache, nausea, loss of appetite, nervousness and fatigue etc.

3. Amoebiasis: Sometimes, the trophozoites reach, through the blood circulation, other body parts to cause extra intestinal amoebiasis as amoebic liver, lung, brain and spleen (Stanley, 2003)). Amoebiasis is two types.

a) Invasive Amoebiasis: When clinical symptoms result, the disease is referred to as invasive amoebiasis. Possibly only about 10% of infection result in invasive amoebiasis (Smyth 1996).

b) Non-invasive Amoebiasis: A high percentage of individual infection with *Entamoeba* shows no symptoms of diseases. This condition is referred as non-invasive amoebiasis and sometimes also called luminal amoebiasia.

Amoebiasis is second leading cause of death from parasitic disease world wide (stanleg 2003). In developing world, amoebiansis causes some 450 million. Infections per annum, about 50 million incident and 1, 00,000 death (symth, 1996).

1.3.1.2 *Giadia lamblia*

- **History:** First seen by leeuwenhook (1681) while examine his own stool.
- **Geographical distribution**: It is cosmopolitan in distribution, mostly fount in tropical and sub-tropical region.
- **Habitat:** It is mostly confined in small intestine particularly the duodenum and upper part of jejunum occasionally invading the bile duet gall bladder.
- **Morphology**: Exists in two phases' trophozoite and cyst.

a) Trophozoite: It is a 'tear drop' shaped with convex dorsal surface and concave ventral one (smyth 1996) trophozoite is rounded anteriorly with two sucking disc which make contact with the intestinal cells of the host. It is bilaterally symmetrical and all the organs of the body are paired. Thus, there are two axostyle, two nucleus and four pairs of flagella. It measures 14microns×7 microns in size (Dev, 1982). It is feeding phase trohozoites are in capable for tissue invading. They remain on epithelium of small intestine and prefer bile duct.

b) Cyst: The fully formed cyst is oval in shape and measures 12mm long by 7mm board. It is infective phase.

- **Mode of infection:** Cysts are released in faces with a think resistant wall. Transmission is through the faeco-oval route on reaching the suitable host, cyst Latches out into two trophozoites which then multiply in enormous number and localize in duodenum.
- **Pathogenicity:** The disease caused by *Giardia lamblia* is known as giardiasis. Giardiasis is also known as flagellate diarrhea. When trophozoite multiplies enormously, they may reduce the absorptive area of the intestinal mucosa. The main functional effect includes malabsorption of fats, vitamin-A, xylose and folic acid (Dev, 1982). *Giardia lamblia* has world wide in distribution with an incidence of 1-30%. In USA, it is now considered to be the most common intestinal parasite of man and the leading cause of diarrhea due to protozoan infection in human (smyth 1996). It is the most frequently reported intestinal parasites in Britain (Knight and Wright, 1978). Toxic produced by the parasites can cause allergic manifestation, fever, anemia as well as enteritities and sometime chronic cholecytopathy.

1.3.1.3 Cryptosporidium parvum

- **Geographical distribution:** It is worldwide in distribution. Infection rates are predicted to be highest in
- **Habitat:** These parasites inhabit the intestinal tract. It is found attached to surface epithelial cells of villi or crypts of the small intestine but less frequently in the stomach, appendix, colon and rectum.
- **Morphology:** Morphologically, the cryptosporidium shows six distinct forms during its life cycle. These are sporozoite, trophozoite, merozoite, microgamont, macrogamont and oocyst.

a**) Sporozoite:** It is slender, crescent-shaped and measures 1.5 to 1.45µm in diameter. The anterior end is pointed but the posterior end which contain a prominent nucleus, is rounded.

b)Trophozoite: It is intracellular transitional form of the parasite. The banana shaped sporozoite becomes intracellular differntation into an oval or spherical trophozoite with a prominent nucleus, undifferentiated cytoplasm, a well developed feeder organelle. The trophozoite measures 2-2.5µm in diameter. Each trophozoite consists of a large nucleus with or without a conspicuous nucleolus. Apical complex is not present. It provides schizonts or gamonts.

c) Merozoite or schizonts: The schizonts are crescent shaped and measures 1 to 5µm in diameter showing rounded anterior and posterior end. There are two morphological types of schizonts but they are morphologically indistinhuishable. Type I-schizont contain six or eight nuclei. As the schizont mature, each merozooite can potentially invade another host cell where it can develop into another type I-schizont or type II schizont that ultimately produces four merozoites.

d) Microgamont: Microgamonts are the male sexual form. These are wedge shaped, 0.2 to 0.7µm in length and are covered by a double layered membrane. Each microgamont contain a large compact nucleus and a polaring. A single microgamont gives rise to 1 to 4 microgametocytes.

- **Macrogamete:** Macrogamete are the female sexual forms. These are spherical, measure 3 to 5 µmare covered by a double layer membrane. Each macrogamete consists of a single large nucleus and endoplasmic reticulum. The old macrogametes contain dense polysaccharide granules.
- **Oocyst:** It is the infective form of parasite. It is colorless, spherical to oval and measures 4.5 to 6 µm in diameter. The cyst is surrounded by a 50 µm thin cyst wall. The latter consist of an electro lucent middle zone surrounded by two electron dense layers. Each oocyst contains up to four slender bow-shaped sporozoites. There are two types of oocyst, thin walled and thick walled. Thin walled oocyst can reinfect to the host but thick walled oocyst excretes out and infect to new host. Micropile polar granules, which are always, present in coccidian oocyst, are characteristically absent in cryptosporidium oocyst.
- **Mode of infection**: The parasite is transmitted by the faeco-oral spread of the oocyst stage. Zoonotic infection has also been reported. Many such reports implicate cattle or other livestock serving as a source of human infection. Water for drinking or swimming can serve as a vehicle fro transmission of oocyst stage. Recent studies indicate that Cryptosporodium oocysts are present in 65-97% of surface water in the US (Blanch, 1996).Persons to person transmission has been established between household and family member, sexual partners, children in day care centers, health care workers. Fomites and contaminated arthropods with faeces may serve as good transmitter.
- **Pathogenicity:** The small bowel is the common site of infection, although organisms have also been recovered in all the region of gut as well as biliary and respiratory epithelium (GIT manifestation of AIDS). The created oocysts are immediately infective without further maturation outside the host and remain infective for weeks to months.

The illness is characterized by profuse watery diarrhea with abdominal cramp. It can also cause vomiting, weight loss, loss of appetite and low-grade fever. The diarrhea faecal particles are foul smell. Fluid loss in immunocompromised patients is 17 liters per day (Soove *et al.,* 1984).

1.3.2 Intestinal Helminthes Parasites

The helminthes parasites are multicellular, bilaterally symmetrical, triploblastic metazoan. The helminthes are classified into three phylum platyhelminthes, nemathhelminthes and acathocephala. They are endoparasites of intestine and blood of human body and cause different diseases.

Helminthes differ from protozoa in their inability to multiply within the body of host. In case of helminthes except *H.nana* as they cannot multiply within the human body so that single infection generally does not lead to disease condition. World Health Organization (WHO) estimated that more then one billion people are chronically infected with intestinal helminthes (WHO, 1998). Many parasitic helminthes require one or more intermediate host. The relative importance of the major groups of helminthes may be roughly judged by Stoll's (1947) estimate that explains among 2200 million people, 72 million cestode, 148 million trematode and over 2000 million nematode are present (Crag and Faust).

1.3.2.1 Hymenolepsis nana

- **History:** This parasite was discovered by Bilharz in 1951 in the small intestine of a native boy in Cairo Grassi and Rovelli (1887, 1892) first worked on the life cycle and demonstrated that no intermediate host was required (Craig and Faust, 1943).
- **Geographical distribution:**-Cosmopolitan in distribution but is more common in the warmer than colder climate.

- **Habitat:** The adult worm inhabits n the small intestine of man particularly three quarters of the ileum. It is also found in rodents, especially in mice and rates.
- **Morphology:** *Hymenolepsis nana* is also known as dwarf tapeworm, as entire worm measures 4 to 45mm in length by 0.5 to 0.9 mm in breadth may have as many as 200 segments. It is attached to the intestinal wall by a small rhomboidal scolex with four hemispherical suckers and a short rostellum armed with 20-30 spines in one ring. The segments are wider than long. A single genital pore is situated laterally toward the anterior border on the same side of each segment. Each proglottid contains three dorsally located testes, vas-deference, cirral pouch, ovary, uterus and vagina with an enlarged seminal receptacle.

Eggs are oval or spherical in shape with two distinct membranes. The outer membrane is thin and colorless and inner embryophore encloses an oncosphere with three pairs of lancet-shaped hooklet.

- **Mode of infection:** Generally first infection occurs through ingestion of food and drink contaminated with eggs of *H. nana* liberated along with the faeces of an infected man or rodent. Infection generally more common in children than in adult through faceo-oral route.
- **Pathogenicity:** Catarrhal enteritis may be produced by very heavy infection as many as 7000 worms were once reported (Belding). Light infection usually produces no symptoms but heavy infection may give rise to a severe toxemia. If many worms are present, children may have asthma, abdominal pain with or without diarrhea, headache, epileptiform convulsion, nervous disturbance, restlessness and insomnia.

1.3.2.2 Enterobius vermicularis

- **Geographical distribution:** It is cosmopolitan in distribution, but less common in warm climates. This disease is more common in temperate and cold region.
- **Habitat:** It is especially common in children and women. The adult worms live in the caecum, vermiform appendix, colon and small intestine, with their heads attached to the mucosa.
- **Habit:** These parasites are nocturnal in habit. At night, when the host is in bed, the worm comes out through anus and crawl on the perianal and perineal skin to lay its sticky eggs.
- **Morphology:** The worms are slender and cream colored. Males measure 2 to 5 mm in length and 0.1 to 0.2 mm in diameter, while females 8to 13 mm length and 0.3 to 0.5 mm diameter respectively. Anterior end is provided with three small lips and a pair of cephalic expansions. Posterior end or tail of female is straight, long and pointed while that of male is blunt, curved with bursa-like expansions and a single spicule. The gubernaculums is absent. There is no buccal cavity but double bulb esophagus is a characteristic feature of this nematode. Male has a single testis (monarchic), while the female has two ovaries (didelphic). Uteri are very much coiled and filled with eggs.

Eggs are colorless, asymmetrical being Plano-convex measuring 60µm× 30µm and surrounded by transparent shell containing coiled tadpole like larva and float in saturated salt solution.

- **Mode of infection:** The ova from the perianal region are transferred to night clothes and bedding, dust and air. The hand of the patient particularly beneath the fingernails becomes contaminated with the ova through scratching the perianal region or handling the clothing and bed lines. Thus infective ova may be easily transferred to the same or another host either by hand to mouth or indirectly through food or drink. Likewise infection may be transmitted through inhalation of ova from bed

clothing or dust of rooms. Infection of less intensity may be produced by reinfection in which the larvae after hatching in the perianal regions enter the anus and migrate to the caecum.

- **Pathogenecity:** The disease caused by the parasite is known as oxyuriasis or pinworm infection, Enterobiasis. Irritation of perianal and perineal regions with exeoriation eczema and pyogenic infection from scratching occurs during hatching of eggs and migration of larvae. In females vaginitis may take place due to invasion of worm from perianal region. Internally parasites may cause mild, acute or chronic catarrhal inflammation of the worms. The early symptoms of this parasite are inflammation of colon mucosa with abdominal pain and irregular bowel habit, loss of appetite, appendicitis. Migration of gravid female cause intense irritation and itching towards perianal and perinea region. Insomnia, restlessness, nervousness, even sexual disorder to hysteria, vaginitis and salphangitis is also evident.

1.3.2.3Trichuris trichiura

- **Geographical distribution:** It is cosmopolitan in distribution, although most abundant in warm, moist regions. The whipworm infection is more or less co-extensive with ascariasis.
- **Habitat:** The adult worm lives in the large intestine of man particularly the caecum, also in the vermiform appendix. But it has also been reported in monkeys, lemurs, sheep, cattle etc.
- **Morphology:** They are also called whipworm, a term derived from the whip-like form of the body. The anterior three-fifth body is very thin and hair like and the posterior two-fifth is thick and stout resembling the handle of a whip. A spear like projection at its anterior extremity enables the worm to penetrate and anchor itself to the intestinal mucosa. The male is distinguished from the female by its coiled caudal extremit Male

measures about 3-4 cm in length with ventrally curved tail while female measures 4 to 5 cm in length. Eggs are brown in color (bile stained), has a double shell, outer one is bile stained. The size of ova is about 50µm in length by 25µm in breadth, bassel shaped with a mucus plug at each pole, floats in saturated solution of common salt.

- **Mode of infection:** No intermediate host is required; worm passes its life cycle in one host. Man is infected when the embryonated eggs are swallowed with food or water. The digestive juices dissolve the eggshell and the larva emergent through one of the poles of eggs near caecum, which is the site of localization.
- **Pathogenicity:** The pathogenic effects are due to tonic or mechanical action. In light infection, at the site of attachment of worm a small focus of tissue damage and at times petechial haemorrhages, eroded mucosa is reported where as in heavy infection, Trichuris dysentery, rectal prolaps, anemia, slight leukocytosis, eosinophilia, dysentery with blood tinged mucous, acute appendicitis constitute an important public health problem (Belding). Poor growth, clubbing of the fingers, Trichuris dysentery and loss of appetite, rectal prolepses are an another important health problem (Stephenson et al., 2000).It is common human parasite, is reported to infect up to 800 million people throughout the tropical and the temperate area (Smyth).

1.3.2.4 Ancylostoma duodenale

- **Geographical distribution:** It is widely distributed in all tropical and subtropical countries extending from parallel 36º north to parallel 30º south. They occur in all countries where humidity and temperature are favorable for the development of the larva in the soil.
- **Habitat:** The adult worms live in the small intestine of man, particularly in the jejunum, less often in the duodenum and rarely in ileum.

- **Habit:** It can flourish under primitive condition where people walk barefoot, modern sanitary conditions don't exit and human faeces are deposited on the ground. It is an endoparasite which enjoy with host's blood, lymph and tissue fluid.
- **Morphology:** *Ancylostoma duodenale* is small, grayish white and cylindrical in shape with separate sexes. The male worm generally measures about 8-11mm in length and 0.4 to 0.5 mm in diameter while female measures about 10-13mm in length and 0.6 mm in diameter. When the worm is passed fleshing it looks like reddish brown color because of digested blood in its intestinal tract.

The anterior end of both sexes is slightly bent dorsally and has a buccal and armed with 6-cutting plates or teeth, 4 hooks like on the ventral surface while 2-knob like (lancets like) on the dorsal surface. Buccal capsule helps in the attachment with intestinal wall of the host through pumping mechanism.

The posterior end of female worm tapers bluntly in a short post-anal tail, while that of the male is expanded and umbrella-like. The expanded structure is called copulatory bursa, which surrounds the cloaca. The copulatory bursa has two lateral lobes with six muscular rays in each and a small median dorsal lobe with one median dorsal ray.

Eggs are oval or elliptical in shape, measuring 65µm in length by 40µm in breadth, colorless with a thin transparent hyaline shell membrane and contain segmented ovum. Eggs can float in saturated solution of common salt.

- **Mode of infection:** Filariform larva is infective stage always in search of host climbing on elevated portion of soil. Infection occurs when man walks bare foot on the faecally contaminated soil or works there with his bare hands the filariform larva, (the infective form) makes its passage by penetrating directly through the skin with which they come in contact.

The common sites of their entry are thin skin between the toes, dorsum of feet and inner side of the soles. The larva can penetrate from hair follicle at any pat of the skin, which is sufficiently thin.

- **Pathogenecity:** During penetration, larva produces allergic reaction known as ground itch. During the migration of larva inside body can develop secondary infection. Petechial hemorrhage due to migration of larva from capillaries into alveoli and bronchioles. Trapped larva may develop into adult worm and can produce lobular collapse, consolidation. Cumulative damage in mucosa from movement and lytic action of adult female worm as well as deposited eggs and larva. When the parasite establish in the intestine, they cause gastrointestinal disorder like abdominal pain, irregular bowel habit, anorexia, emaciation, malnutrition and nausea. Other symptoms are jejunal ulcer, pernicious anemia due to continuous bleeding and consumption of blood by parasite. This anemia and vitamin B12 deficiency not only retards growth, geophagy and protruded belly can also be developed (Belding, 1956).

1.3.2.5Ascaris lumbricoides

- **History:** This worm was observed and reported as a parasite of man by many ancient people (Craig and Faust, 1943). It has undoubtedly been one of men most faithful and constant companion from time immemorial (Chandler, 1961).
- Geographical Distribution:-It is cosmopolitan and most common of all helminthes. It flourishes is warm moist climates or in moist temperate regions where personal hygiene and environmental conditions combine to favor embryo nation of the eggs in polluted soil.
- **Habitat:** The adult worm lives in the small intestine of human beings.
- **Morphology:** It is elongated, cylindrical nematode, tapering bluntly at the anterior end and somewhat more attenuated at the posterior end.

Lateral lines can easily be seen. The head is provided with conspicuous lips. Sexes are separated. The size of male is 15-25 cm in length with a maximum diameter of 3-4 mm and female is 25-40 cm in length with diameter of 5mm.

- **Mode of infection:** Faecal-oral route infection occurs by the ingestion of food or water contaminated with embryonated eggs of parasite.
- **Pathogencity:** It is an important parasite of human, if often occurs in high levels in population living under conditions of poor hygiene (Smyth, 1996). It has been estimated that there are about 1000 million cases of ascariasis worldwide, with average prevalence in the range of 32-60 percent (Crompton *et al.,* 1989). In some surveys of children between the ages of 6 and 12 years, the infection rate was as high as 90 %. The infection results in malnutrition and relation of growth in children but other symptoms associated with both the larval (Tissue) and adult (intestinal) stages include pneumonitis, asthma, diarrhea, nausea, abdominal pain and anorexia.

1.3.2.6 Strongyloides stercoralis

- **History:** Normand (1876) first found *Strongyloides stercoralis* in the faces of French colonial troops.
- **Geographical Distribution:** It is world wide in distribution. It is adapted to warm climate but it has reported sporadically in temperate regions (Craig and Faust, 1943).
- **Habitat:** Adult *Strongyloides ster*coralis are largely localized in the duodeno-jejunal region.
- **Morphology:** In the parasitic phase, the females are readily discovered but not the male. The parasitic female measures 2.5 mm in length and 40-

50 µm in diameter. Males are shorter and broader than females. Eggs are thin shelled, transparent and oval and measures 50µm ×30µm.

- **Mode of infection:** Infection occurs by the entry of filariform larvae, which penetrate directly through skin coming in contact with soil. It can undergo ‘auto infection’ this infection has been repoted to last more than 30 years in untreated human. Also, infection with these parasites can be transmitted via breast milk (Stephenson *et al*., 2000).
- **Pathogenicity**: *Strongyloides stercoralis* is the fourth most important intestinal nematode infection, but its impact is much less widely appreciated than those of *Ascaris, Trichuris* or Hookworm infections. *Strongyloides stercoralis* is symptomatic in around 50 % of cases, with diarrhea, abdominal pain, nausea and vomiting being the common gastrointestinal symptoms (Milder *et al*., 1981, Nonaka *et al*., 1998).

CHAPTER-TWO
OBJECTIVE

2.1 General Objectives

The general objective of the study is to find the status of the intestinal parasites in the people living in BHOJAD-11, Chitwan.

2.2 Specific Objectives

- To determine the prevalence rate of intestinal parasites in the people of different age and sex-groups.
- To determine the prevalence rate of intestinal parasites (helminthes and protozoan) infection ethnic wise, feeding habit wise and rate of concurrent infection (i.e. single double and multiple species infections) of the persons.
- To asses the knowledge, attitudes and practices in study population in relation to transmission of intestinal parasites.
- To obtained possibility of conducting awareness and deworming programs.
- To develop the recommendation for further planning regarding the control of intestinal parasites.

CHAPTER : THREE
LITERATURE REVIEW

3.1 History of Parasitology

Up to the middle of the seventeenth century knowledge of parasitology was limited to recognition of the existence of a few common external parasites such as lice, fleas and internal parasites like tapeworms, ascaris, pinworms and guineaworms. However, they were considered as natural products of human bodies.

Even Rudolphi and Bremse also supported this idea (Chandler and Read, 1961).

In Linnaeus's time, people thought that internal parasites were originated from accidentally swallowed free-living organisms (Chandler and Read, 1961.

During the later half of seventeenth century Francesco Redi, grandfather of parasitology stated that maggots developed from eggs of flies. At the same time, Leeuwenhoek perfected microscopes and discovered Giardia in his stool and other protozoan in rain water, saliva etc(Chandler and Read, 1961).

Rudolphi(Linnaeus of parasitology) classified all the parasites known up to his time. In 1773, Muller discovered cercaria larvae but as protozoan.

In 1782, Dubini discovered human hookworm. Similarly, Leoss (1898) made the discovery of penetration of the skin by hookworm larvae.

Lamble, in 1859, first discovered the parasite *Entamoeba histolytica.*

In 1865, Leuckart first worked the life cycle of *Enterobius vermicularis.*

In1875, Loch proved the pathogenic nature of *Enterobius vermicularis.*

In 1876, Normand first reported *Strongyloides stercoralis*. Schoudinn, in 1903 differentiated pathogenic and non-pathogenic types of amoebae.

In 1916, Stewart experimentally proved tissue migration of *Ascaris* where as Ranson 1920, Stewart 1921 and Vokogawa 1923, conclusively demonstrated that only one host is required for *Ascaris.*

From the middle of twentieth century, the works on parasites regarding different aspects, i.e. distribution, life-cycle, pathogenesis, treatments and controls become fast and went wide spread. For this especially World War I and II were responsible that accelerated interest in parasitology especially the therapeutic aspects (Parajuli, 2003).

3.2 Literature Review in Global Context

- Bhaduri (1959) collected stools from 197 normal adult males 6-60 years of age were studied and eggs of hookworm or *Ascaris* were counted. The helminthic infection rate was 65.4%, hookworm 83.9% and *Ascaris* 10.4%. The average no. of hookworm eggs found were 784.5 sss/cc of stool, the minimum being 100 and the maximum 3400. The average no. of *Ascaris* eggs/cc of stool was 2492.8, the minimum being 300 and maximum 16200.
- Cosgrove (1960) recorded the prevalence of intestinal parasites in hospital inpatients and outpatients by examining 2500 consecutive fecal specimens submitted to the laboratory over 2 years period (1955-57).Zinc sulphate centrifugal flotation and iron haemaloxyline stained smears were used. Intestinal parasites were found in about 29% of specimens. Approximately 50% of the positive specimens contained more than 1 species of parasite, *G. lamblia* was the most common protozoan. *Entamoeba histolytica* was present about 4%. The most common helminthes were *T.trichuria* and hookworm.
- Roman and Gonzlez (1969) studied the intestinal parasitism in children in different villages of the province of Granada and disposed by coprological examinations and with adhesive tape. Two thousand two hundred and ninety three samples were analyzed.1151 of feces and 1142 with adhesive tape. Sampling was carried out in 40 schools in 6 villages. Twelve single or associated species were detected. The most common

parasite was *E. vermicularis* (64.53%), followed by *T.trichuria* (11.12%), and *H.nana* (4.17%) of the protozoan. The most frequent were *E.coli* (21.19%) and *G.Lambli* (20.24%), followed by *E.nana* (8.34%). Three important foci of helminthes were located: La Mala with 82.35% *E.vermicularis*, Torrenueva with 24.04%*T.trichuira* and La Mamola with 12.24% *Hymenolepsis.nana*. La Char was the village, which gave the highest percentage of intestinal protozoan (60.12%).

- Roberts (1970) investigated that the intestinal parasites were fairly common in African patients. *Taenia* was rare in Kariba and not uncommon in Charter, which was cattle-owning area. Hookworm was much more common in the Abercorn district of Zambia. *S.mansoni* was more common in Kariba (7.1% of all stools) *G.lamblia* was more common in Kariba.These figures indicated that there were a considerable difference in distribution of intestinal parasites over the country due to possible variation of climate, altitude and rainfall.
- Chong-Hwan *et al*., (1971) studied prevalence of intestinal parasites in Korea. A survey of intestinal parasitic infection among Korean people had been carried out during July 1961 to Dec.1970. A total of 2250 stool samples were collected from all the provinces and Seoul city in Korea, out of 2250 sample examined 1803(i.e.80.1%) were positive for intestinal parasites. Among them 46% for *A.lumbricoides* 6.8% for hookworm, 1.6% for *E. vermicularis*, 0.79% for *H.nana* 0.3% for *Taenia spp* was recorded .among protozoan parasite, 6.4% of *E.histolytica* and 5.1% *G.lamblia* were also recorded. In context of sexual distribution, female showed higher prevalence than male.
- Kyung *et al*., (1972) worked on prevalence of intestinal parasites in Roka soldier during the period from April 1970 to dec.1971.stool samples were collected from Army troops, 1755 from recruits during basic training and 245 stool specimens from student of (Republic of Korea Army) Roko

Nursing school of Taegu area. Overall Prevalence rate for intestinal parasites found to be 88% specific prevalence was recorded 28.1% *A.lumbricoides* 79.3% of *T.trichiura*, and 14.2% of hookworm. The incidence of *E.vermicularis*, out of 822 samples was 19.8% from anal swab and *E.histolytica* was recorded in 42% among 541 samples.

- Waugh (1973) recognized the threadworm infestation as cause of anal discomfort and pruritusani. They are usually spread by autoinfection and fecal contamination. Contamination via the fingers, lips and genitals in sexual play was also possible means of infection in these homosexual cases.
- Fujii *et al*., (1974) investigated helminthes infections of humans in 2 areas, Kumanogawa and Hongu, along the upper Kumano River of Wakayam prefecture. General infection rates in 2 areas were 31.1% and 22.6% respectively. *Trichuris* was the most common species in both areas 17.5% and 15.9% on average, respectively. The infection rate of *Ascaris* was as low as 3.6% or 3.5% in each area. Hookworms were found only on low incidences as 0.5% or 0.4% respectively. *A.duodenale* exceeded *N.americanus* (in ratio of 4:1). Mewtagonimus yokagawai was fairly prevalent in Kumanogawas 16.7% on average and 20.1%-28.2% among adults over 31 years of age, in Hongu area the rates were only 5.2% on average and 5.8%-10.2% even among adults. Helminthic infections still remain quite prevalent in these areas.
- Culting JW (1975) carried a survey of intestinal parasitism in a Yaviza community on the pan American Highway route in eastern panama. A total of 202 stool samples were examined 90% of samples were found to be positive for any one intestinal parasite. Specific prevalence found was 80% of *T.trichiura*, 62%of *A.lumbricoides*, 41%of hookworm, 7% *S.stercoralis*, 0.5%of *H.diminuta*, 165 of *E.histolytica*, and 5%of *G.lamblia*.

- Arora *et al*., (1976) studied on prevalence of intestinal parasites in rural community in Jammu Kashmir. A total of 436 stool samples were collected from healthy person and analyzed. Specific prevalence was recovered as 16.5% *Giardia* (i.e. maximum prevalence) followed by 8.3% of *E.histolytica*,6% of *A.lumbricoides*,4.6%of hookworm,2.8% of *E.vermicularis*,1.8% of *H.nana*,0.5%of *T.trichiura* from this study.
- Lynch *et al*., (1978) worked on prevalence of hookworm and other helminthes in British Gorkha recruits reported 89% of healthy appearing individuals were infected with hookworm, 49 % with roundworm and 36 % with whipworm.
- Chiu *et al*., (1979) studied on prevalence of intestinal parasitic infections among in habitants of Tanran village, Nantov Country, Taiwan out of 417 stool samples collected maximum prevalence rate was shown by *A.lumbricoides* i.e. 81.5%,followed by 73.6% of *T.trichiura*, 30.9% hookworm, 4.5%of *G.lamblia*, 3.1%of *E.histolytica*, 0.75of *S.stercoralis*, 0.2% of *T.solium* and 0.2% of *T.saginata*.
- Massound *et al.*, (1980) worked on prevalence of intestinal helminthes in Khuzestan, southern Iran. Examination of a stool of 16361 stool samples from people in 105 villages and 14 small towns revealed high prevalence of Roundworms, Hookworm, *T.trichiura* and *H.nana*. Hookworm was twice prevalent in rural area than in urban areas.
- Ejezie (1981) surveyed 5,595 primary school children in Lagos State showed that most of the children were over loaded with parasitic infections, which included malaria (37.7%), Schistosomiasis (13.4%), ascariasis (74.2%), trichuiriasis (75.8%), hookworm (29%) and tugiasis (49.5%). Multiple infections were observed with about 16.2% harboring all the causative organisms of the parasitic diseases enumerated above. The high prevalence of parasitic infestations was among children is an

index of the community's low level of health and also of inadequate health education.

- Datta *et al*., (1981) worked on prevalence of intestinal parasites in urban area of Alwar, Rajasthan. Stool specimens collected from 489 individuals, were examined for intestinal parasites during 1978-1979. 50.10% of the samples were positive for one or more intestinal parasites. *E.histolytica* and *E.coli* affected 46.49% of examined population. 3.3% of *G.lamblia,* 7.8% of *A.lumbricoides* and 0.4% of Hookworm were detected. 43.79% of sanitary latrine users 52.98% of unsanitary latrine users were detected. 43.79% of sanitary latrine users 52.98% of unsanitary latrine users were found to be infected as a proof of the importance of sanitary use of latrine.
- Ralna *et al*., (1984) worked on prevalence of intestinal parasitic infection in some urban localities of Solon district of Himanchal Pradesh. Out of 156 stool samples examined 54.5% were positive for one or more intestinal parasitic infection. Specific prevalence recovered was 12.8% of *G.lamblia,* 5.8% of Hookworm, 3.8% of *E.histolytica,* 4.5% of *A.lumbricoides*, 1.9% of *H.nana* and 0.6% of *T.trichiura*.
- Lall R (1985) worked on intestinal parasitic infection in a section of population of Port Blair, Andaman and Nicobar islands. A total of 1109 stool samples were collected from OPD patients attending G.B. Pant Hospital. Out of 1109 samples 668 (60.2%) were found to be positive for one or more parasites, 63% of single, 3.8% of multiple infection were detected. Specific prevalence was recovered as 18.6% of *A.lumbricoides,* 5.4% of *T.trichiura,* 4.3% of *E.histolytica,* 3.4% of Hookworm, 3% of *G.intestinalis,* 1.2% of *S.stercoralis*, 0.7% of *E.vermicularis.*
- Bossi *et al.,* (1986) studied about intestinal parasites, carried out on 630 individuals coming back from tropical-subtropical areas after business or pleasure. Journey Evidence has been collected that 26.7% of individuals

investigated were parasitic overall 0.16% *E. histolytica*, 0.16% *E.histolytica minuta*, 10.48% *E.coli*, 2.14 *E.nana*, 0.325 *I.butchlii*, 0.16% *D.fragilis*, 10% *G.intestinalis*, 0.95% *C.mesnili*, 2.22% *T.homonis*, 0.32% *E.intestinalis*, 0.63% *S.mansoni*, 0.64% *A.lumbricoides*, 2.22% *T.trichuira*, 0.32% *S.stercoralis*, 0.32% *Ancyloxtomatidae*, protozoa parallel prevail over helminthes, menoparasitosis over poliparasitosis.

- Fagbernro-Beyioku and Oyerinde (1987) examined microscopically the stool samples from 1659 children, aged 15 years and below in metropolitan Lagas and showed 71.9% and 68.3% infection with *T.trichuira* and *A.lumbricoides*, respectively. While the infection rate with hookworm was 22.5%. Infection with more than one parasite was also very common.
- Mishra *et al*., (1987) worked on a pattern of intestinal parasitic infestation in Diarrhoel subjecys in rural community.The overall isolation of intestinal parasites from from the stool samples was 79.9%.The most common parasite isolated from the Diarrhoeal stool was *Ascaris.lumbricoides* i.e. 55.6% of followed by 23.5% of *E.histolytica*, 19.2%of *G.lamblia* and 3.4% of Hookworm
- Diaz *et al*., (1988), studied the prevalence of three intestinal parasites (*G.lamblia, E.coli* and *E.nana*) in the humans of the province of Granada, Spain, according with the age and sex of the hosts and the seasons on which the samples were taken. The total parasitation rate was 9.5% and the greater parasitation belonged to *G.lamblia* (4.9%). Statistically significative differences with regarding the age and sex have not been found. The distribution according to the season only show significative differences for *E.nana*.
- Mcmillan (1989) studied the prevalence of intestinal parasites in homosexual men attending a sexually transmitted diseases clinic in Glasgow(Scotland,U.k0 was undertaken. Of 118 men examined over 8, 4

were infected with *E.histolytica*, cysts of *I.butchlii* were found in the stool of 1 man. Two patients had giardiasis and 11 had enterrobiasis. The importance of an awareness of these conditions was discussed.

- Holland *et al.,* (1989) in Nigeria conducted an epidemiological survey of intestinal helminthiasis on 766 primary school children aged 15-16 years.
- Goncalves *et al*., (1990) carried out parasitological examination on 485 inhabitants of four villages of Brazil. Approximately 99.6% of the inhabitants were infected with at least some species of intestinal parasites.
- Mao (1991) up to date,30 species of protozoa 12 species of cestodes,26 species of trematodes,23 species of nematodes,2 species of gordius and 1 acanthocephalan species had been reported as parasites. Of man in main land China.
- Ferrira *et al*., (1991) performed brine flotation and gravity sedimentation coproscopical examinations in stool samples from 69 of the 149 laualapiti Indians of the Xingu Park, Mto Grosso State, Brazil, Intestinal parasites were present in 89.9% of the population examined. High rate of prevalence were found for some parasite species. *Ancylostomitidae,* 82.6%, *E.vermicularis*, 26.1%, *A.lumbricoides* 20.3% and *E.coli,* 68.1%, helminthes prevalence in children age one year or less was comparatively low (33.3%).
- Koksal *et al*.,(1991) obtained 140 stool samples from froth classes (10 years of age) of the primary school students and examined for intestinal parasites. Out of 140 students 65% were found to be positive for intestinal parasites.
- Coskum *et al*., (1991) obtained 531 stool samples from primary schools. The age range was between 7 and 16years.49% was female and 51% male. The parasites incidences were 36.9%. The predominant parasites

were *A.lumbricoides* (12%), *G.intestinalis* (9%), *H.nana* (7.1%), *E.histolytica* (6%) and *T.trichiura* (2.6%).

- Alo *et al.,* (1993) determined the prevalence of intestinal helminthiasis among students of Nigeria. Of the 200 students between ages 10-12 years old examined, 86 (43%) were found infected. The most commonly found worm were hookworm, *A.lumbricoides, T.trichuira* with mean egg per gram of 4800, 2600 and 1250, respectively. Infection was independence of both sexes and parental occupations but decreased significantly with host age and progressive increase in body weight.
- Andersome, Timothy *et al.,* (1993) counted the faecal eggs scored to investigate the distribution and abundance of intestinal helminthes in the population of a rural village. Prevalance of the major helminthes were 41% with *A.lumbricoides,* 60% with *T.trichiura* and 50% with *N.americanus*. Age/prevalence and age/intensity profiles were typical for both *A.lumbricoides* and *T.trichiura* with the highest worm burdens in the 5-10 years old children. Analysis of association between parasites within hosts revealed strong correlation between *A.lumbricoides* and *T.trichiur*a showed highly significant aggregation within households.
- Alo *et al.* (1993) determined the prevalence of intestinal helminthiasis among students of Government secondary school, Gairei, Song Local Government Area of Adamawa State, Nigeria, between January and July 1991. Out of 200 students between ages 10-32 years old examined, 86 (43.0%) were infected.
- Kappus *et al*., (1994) examined 216275 stool specimens by the state diagnostic laboratories in 1987 and found 20% positives percentage were highest for protozoan. The most commonly identified helminthes were nematodes, hookworm (1.5%), *T.trichiura* (1.2%) and *A.lumbricoides* (0.8%).

- Xu *et al*., (1995) sampled randomly in 2848 different study sites, with about 500 people from each sites and covered total population of 1477742. By examinations of the stool using KatoKatz thick smear and larval culture techniques, overall prevalence of *A.lumbricoides*, *T.trichuir*a and hookworm infection were found, 47%, 18.8%, 17.2%, respectively. Higher prevalence of ascariasis and trichiuriasis were found in the age group of 5-9, 10-14, and 15-19 years and among adults for hookworm students, farmers and fishermen were the occupational groups with high infection rates.
- Kightinge *et al*., (1995) conducted an epidemiological study of intestinal nematodes with 1,292 children, upto 11 years age, living in the Ranomafana rain forest of Southeast Madagascar. Faecal examinations revealed prevalence of 78% for *A.lumbricoides*, 38% for *T.trichuira*, 16% for hookworm and 0.4% for *S.mansoni*. The distribution was over dispersed for all 3 nematodes. The age profiles showed a rapid acquisition of *A.lumbricoides* during infancy, increasing to 100% prevalence by age 10.
- Saito *et al*., (1996) served for intestinal parasites by using thin smear and floating method for faecal examination in residents in Caazapa Department,Paraguay.Out of the 608 samples of residents in Boqueron, a community of Caazapa Department,343(56.5%) were found positive. The parasites prevailing most severly was *N.americanus* (27.0%) followed by *E.coli* (19.8%), *G.lamblia* (12.7%), *A.lumbricoides* (4.8%) and other. The infection rate with *G.lamblia* and *A.lumbricoides* were conversely more frequent in children than in adults.
- Machando *et al*., (1998) examined a total of 900 stool samples from 300 children aging from four months to seven years, randomly selected in ten nursery schools from September 1994 to December 1995 both by the Baermann Movaes and Lutz methods in the city of Uberlandia, state of Minas Gerais, Brazil. Thirty nine Children (13%) were found to be

infected by *S.stercoralis* 64.1% were boys and 35.9% were girls followed by *G.lamblia* (78.3%), *A.lumbricoides* (4%), *H.nana* (6.7%), Hookworm (6%), *E.vermicularis* (4%),*Hymenolepsis diminuta* (4%) and *T.trichiura* (0.7%) from 265 (88.4%) infected children, (64.5%) were monoinfected, (27.2%) were infected by two parasites and 8.3% had ample specific parasitic burden.

- Ludwig *et al*., (1999) worked on correlation between sanitation condition and intestinal parasitosis in the population of Asiss, state of Sao Paulo. A total of 18366 stool samples were collected from six sanitary centers of Assis during 1990 to 1992. The general prevalence of endoparasites was 25.3%.The most frequently found endoparasites were*G.lamblia 3*.7%, *A.lumbricoides* 5.5%, *T.trichiura* 2.07% and *H.nan*a 1.97%. In Marialues, a low income neighborhood, the prevalence was 17%, 13.1%, and 4.2% respectively. The age group 3-12 years showed.
- Mocpherson *et al.,* (1999) carried out a cross-sectional point prevalence study of intestinal protozoan and helminthes in school children aged 6-12 years of age in three schools in St. George's Parish, Gronada. A total of 315 samples were collected and examined. The specific prevalence was 36% of *G.lamblia,* 12 % of *E.histolytica,* 0.41 % Hookwotm, 1.3 % of *E.vermicularis*, 5.3 % of *T.trichiura* and 1.4 % of *A.lumbricoides.* Protozoan was found to be common than helminthes, due to easy availability of wide spectrum of antihelminthics than antiprotozoal.
- Osman (1999) studied on coccidian parasites as a cause of watery diarrhea among protein energy malnourished and other immune-compromised Egyptian children. Cyclospora oocyst was detected only among two cases (1.29%) of PEM group. The duration of diarrhea was more prolong in cryptosporidium and cyclospora co-infection as compared to *G.lamblia and E.histolytica* cases among Pem and immune-compromised cases.

- Toma A. (1999) carried out questionnaire survey and studied prevalence of intestinal helminthes infections in Barru, Sulawesi, Indonesia. A total of 654 faecal samples were collected and examined. *T.trichiura* was most common followed by Hookworm and *A.lumbricoides*. In both 4-14 and over 15 years age group. The prevalence of Hookworm infection was significantly higher in males than in females of older age. The inhabitant with higher education background had significantly lower infection rates of *A.lumbricoides* and *T.trichiura*. The prevalence of *Ascaris* and *Trichuris* infection was significantly different between the inhabitant owing latrine and without it.
- Habbari (2000) worked on the association between the geohelminthic infection and raw wastewater reuse for agricultural purposes in Beni-Mellal, Morocco. In a randomly selected sample of 1343 children, 740 of them were from five communities using raw waste water for agricultural and 603 were from control communities that don't practice wastewater irrigation. Ascariasis prevalence was found to be approximately five times higher among children in wastewater impacted regions compare to control regions contact with wastewater irrigated land and public water supply were found to be associated with higher infection rates. Trichiuriasis rates did not show a statically significant difference between the wastewater impacted and control regions.
- Di Gliulla (2000) studied *C.cayetanensis* as an emergent agent of diarrhea and was first time observed in respiratory sample of 60 years Argentina patient who lived in a brick make house with potable water and works as builders of sewers. In February 1998, he was admitted to hospital due to loss of weight, cough, dysphonia and radiological picture of pulmonary fibrosis. Bacilloscopic study of sputum stain with Ziehl-Nelson technique showed large (8-10microm) spherical cyclospora oocysts.

- Lee *et al* ., (2000) examines stool and cello-tape and swab carried out in august 1997 on handicapped people at an institution located in Chowongun, Kangwon-do, Korea. A total of 112 stool samples (78 males and 34 females) revealed 3 cases of *T.trichirura* infection and 1 case of *E.vermicularis* infection. The overall prevalence rate was 35.7%.More than two different kinds of parasites were found in 42% of the positive stool samples, (17 cases). The infection rate for protozoan cysts are as follows: *E.coli* (25%), *E.histolytica* (1.8%), *Endolimax.nana* (21.4), *I.butschlii* (1.8% and *G.lamblia* (0.9%). In cello-tape anal swab examinations (165 samples), the prevalence rate of *E.vermicularis* was 20.6%.
- Zhang *et al*., (2000) investigated the prevalence and intensity of geohelminthes infection caused by Hookworm, *Ascaris* and *Trichuris* in two rural Yunnan villages. In Liuku, a village Lisu indigenous people in Lushui country, there was an overall geohelminth prevalence of 72 %. (48%, 43%, and 16% for Hookworm infection, Ascariasis and Trichiuriasis respectively). The prevalence of ascariasis was greatest among pre-school and school aged children. Where as prevalence of was greatest among the teenagers and prevalence of Hookworm increased until the age of 10-15 and then remained high throughout adult-hood. In Linger, a village of Han Chinese, located in Puer country there was an overall geohelminthe prevalence of 77%, (33%, 60% and 36% for hookworm infection, ascariasis and trichiuriasis respectively). The difference in prevalence for hookworm and ascariasis were statically significant.
- Chukitat *et al.,* (2000) studied on *H.nana* infection in Thai children. Stool examination was performed on 2,803 children from orphanages and primary school. *H.nana* infection was found only children from orphanages with a prevalence of 13.12%. Male had statically significant higher prevalence of infections than females.

- Janakiram *et al*., (20001) investigated on the prevalence of intestinal parasitic infection among patients attending Adichumchanagiri Hospital and research center. G.Nagar, Monday, Karnataka. Total of 4133 stool samples were collected from OPD patients suffering from diarrhea and other gastrointestinal Disturbance during August 1994 to July 1999.Out of 4133 stool samples examined 599 (14.49%) were positive for either protozoan (7.79%) or helminthes (6.7%) parasite. Majority of them, 97.98% was detected with single type pathogen and rest 2.02% with more than one pathogen.
- Toma *et al*., (2001) studied on storngyloides infection conducted by fecal examination and subsequent treatment of the population on a model Island (Kume Island) in Okinawa, Japan for 5 years from 1993 to 1997. More than 1200 persons accounting for 17% to 20% of the person and subjected, received fecal examinations each year. The positive rate in 1993 was found to be 9.7%.
- Sofia *et al.*, (2001) worked on intestinal parasitic infections in the University Campus of Aligarh. Fecal samples of 3695 persons complaining for diarrhea, dysentery, abdominal pain and other bowl disturbances were examined. Out of total samples, 2152 samples (58.24%) were found to be positive for *E.histolytica, A.lumbricoides, G.lamblia*. Among them, *E.histolytica* showed highest prevalence rate (37.55%) followed by *G.lamblia* (14.95%), while *A.lumbricoides* showed the least infections rate (5.71%).
- Smith *et al.*, (2001) conducted a cross sectional survey between January and March 1998 in four rural community in Honduras, Central America. He examined the prevalence and intensity of the *A.lumbricoides* and *T.trichiura* infections among 240 fecal specimens of 62 households. The overall prevalence of *A.lumbricoides* and *T.trichiura* was 45% and 38%

respectively. The most intense infections of *A.lumbricoides* and *T.trichiura* were found in children aged 2-12 years old.

- Uchoa *et al*., (2001) conducted a parasitological survey of children from five-community day-care centers from Nieterio City, Rio de Janerio, Brazil in 1999. Of 218 stool samples of children surveyed, 120 (55%) had positive samples for intestinal parasites. The most prevalence protozoan parasites were *G.lamblia* (38.3%) followed by *E.coli* (26.6%), *H.nana* (0.8%) and *E.vermicularis* (0.8%). Monoparasitism was found in 57.5% of positive cases.
- Fernandez *et al.,* (2002) carried out a comparative study of the intestinal parasites prevalent among children living in rural and urban setting in and around Chennai. A total of 324 stool samples were collected and examined. Out of 125 specimens tested from the rural location, the overall prevalence of intestinal parasite was 91%. *A.lumbricoides* was the most common helminthes parasitic detected 52.8% followed by *T.trichiura* 45.6%, *A.duodenale* 37.6% where as *G.lamblia* (16%) was the most common protozoan parasite detected followed by *E.histolytica* 4.0%.In contrast under urban setting out of the 199 stool samples tested the positive rate was 33%. *G.lamblia* was the most common parasite detected 22.6% followed by *E.histolytica* 10.6%. Other intestinal parasites, such as *T.trichiura* 2.01%, *H.nana* 1.01%, 0.5% of *E.vermicularis* and *A.lumbricoides* 0.5% were found to have much lower prevalence in comparison to the rural area.
- Xia *et al.*, (2002) across sectional study was performed to assess the prevalence and soil transmitted nematode infection in school children Mafia Island. Hookworm infection was widespread (72.5%) where as *T.trichiura* was less prevents (39.7%) and *A.lumbricoides* was present at a low prevalence (4.2%), mainly in urban area. In a sub sample of the study population both *Nectar.americanus* and *Ancyclostoma duodenale*

were found although *N.americanus* was more present. This survey was followed by a parasitological evaluation of Mebendazole treatment using a single (500mg) dose. A high efficiency of Mebendazole against hookworm infection was found in Mafia Island when compared with that observed in Pamba Island, possibly indicating that hookworm may be developing mebendazole resistance on Pamba Island as a result of intense exposure to the drug there.

- Hiroshi *et al.*, (2002) studied on the prevalence and intensity of *A.lumbricoides* in 492 children from five rural villages in the northern area of Pakistan. The overall prevalence of *A.lumbricoides* was 91%. The most intense of *A.lumbricoides* infections were found in children aged 5-8 years.
- Bong-Jin *et al.*, (2003) carried out a small state survey to investigate the status of intestinal protozoa and helminthes infection of inhabitants in Roxus city, Mindoro, Philippines. A total of 301 stool samples were collected. The overall positive rate was 64.5% and that of male and female were 56.6% and 72.5% respectively. The highest infected helminthes was *A.lumbricoides* (51.2%) followed by *T.trichiura.* Cultural and behavioral risk factors of *A.lumbricoides* among children in rural communites in the Northern area of Pakistan. Prevalence and intensity of *A.lumbricoides* in 492 children from five rural villages in northern area of Pakistan was examined. The overall prevalence of *A.lumbricoides* was 91% with geometric mean egg count intensities of 3985 eggs per g. The most intense *A. lumbricoides* infections were found in children aged 5-8 years. Univariate analysis associated *A.lumbricoides* intensity with age ($p=0.004$), location of household ($p<0.01$), defecation practice. ($p=0.02$), soil eating habit ($p<0.01$), hand washing after defection ($p<0.01$). Multivariate analysis identified the children's age 5-8 ($p<0.01$). The result indicated that there were certain clear risk factor in *A.lumbricoides*

transmission and its intensity was influenced by age related behavioral and environmental factor that contribute to exposure.

- Mirdha *et al.,* (2002) studied on *H.nana a* common cause of pediatric diarrhea in urban slum dwellers in India. The prevalence of intestinal parasitic infection was studied for a period of 5 years (April 1996-April 2001). Among urban slum dwellers, parasitological investigation were performed on 939 fecal specimens collected on a household bases. The total prevalence of pathogenic parasite was 33.6%. The most common intestinal parasites were recovered on following prevalence rate *H.nana* 9.9%, *A.lumbricoide* 3.5%, *G.lamblia*, 3.4% and *E.histolytica* 3.7%.
- Crame *et al.,* (2002) carried out a study on intestinal parasites among Wayampi Indians from French Guiana. A total of 138 Wayampi from an isolated Amerindian population from upper Oyopock with traditional social and cultural specification below the age of 15 years were collected and examined. The reveled was 92% of overall prevalence. The most common parasites were 50% of hookworm, 17% of *E.histolytica,* 16% of *S.stercoralis* and 13% of *H.nana* was frequent in children.
- Alakpa *et al.,* (2002) conducted a cross sectional laboratory based study in Lagos Metropolis state in South Western Nigeria during March 1999 to April 2000. In total1109 stool samples were collected during the period of study. 11 (0.99%) were confirmed to be positive to *cyclospora cayetanesis* oocysts. Other parasites were also detected including cryptosporidium, *Entamoeba, Ascaris, Trichuris, Strongyloides sp*.and hook - worm.
- Bong-Jin *et al.,* (2003) carried out a small state survey to investigate the status of intestinal protozoa and helminthes infection of inhabitants in Roxus city, Mindoro, Philippines. A total of 301 stool samples were collected. The overall positive rate was 64.5% and that of male and female were 56.6% and 72.5% respectively. The highest infected

helminthes was *A.lumbricoides* (51.2%) followed by *T.trichiura* (27.6%) hookworm (8.0%), *E.vermicularis*(0.3%). The protozoan infection status revealed that *E.coli* was the most frequent (15.0%). *Iodoamoeba. buetschlii* and *E.histolytica* were found but few. The multiple infections more than two parasites was 29.6% and double infection with *A.lumbricoides* and *T.trichiura* was common. The intestinal helminthes infections were highly prevalent in this area.

- Buchy (2003) worked on intestinal parasites in the Mahajanga region West coast of Madhgascar. A total of 401 stool and 112 sera samples were collected from OPD patients of Mahajanga Hospital during November 1996 to January 1997. The examination of stool specimens revealed 67.6% prevalence. The frequency of protozoa was higher 47.7% than helminthes 12.4%. The specific prevalence was *H.nana* 2.5% and *Taenia saginat*a and *Taenia solium* 0.5%. Out of 112 sera examined 50% of sera contained antibodies (anti *A.lumbricoides* and anti *S.stercoralis*).
- Miller *et al.,* (2003) examined the prevalence of intestinal protozoan and helminthes infections and their associations with clinical signs and symptoms in children in Trujillo, Venezuela. The point prevalence of protozoan infection was 21% for *G.lamblia* , 1.0% for *E.histolytica*, 4% for *E.coli*, 16% for *Blastocystis.hominis* and 89% for *cryptosporidium.* Prevalance of helminthes infection was 11% fo*r Ascaris*, 11% for *T.trichiura*, 0.0% for *S.stercoralis* and 2% for *H.nana.*
- Albonico *et al.,* (2003) evaluated the efficacy of and resistance to the mebendazole (500mg) and levamisole (40 or 80mg), alone or in combination for the treatment of *A.lumbricoides, T.trichiura,* hookworm infection on Pemba Island. A randomized placebo controlled trial was carried out in 914 children enrolled from the first and fifth grades of primary school. Stool samples collected at baseline and 21 days after treatment were examined by the Kato-Kato technique to asses the

prevalence and intensity of helminthes infection. Finding efficacy of mebendazole treatment of hookworm infestation gave significantly lower cure (7.6%) and egg reduction rate 82.4%). Combined treatment with mebendazole and levamisole has a significantly higher efficiency against hookworm infection cure rate 26.1, egg reduction rate 88.7%) than either drug given alone. The overall efficacy of mebendazole against hookworm infections after periodic chemotherapy is reduced.

- Teller *et al.*, (2003) worked out a study of protective effect of Anti Giardia antibodies in mother milk on the acquisition of *Giardia* infection in their children during the first 2 years of life. Among 24 children acquiring infection within the first 6 months, 23 were born to mother lacking antibodies. These children also developed more severe diarrhea .Hence children born to non-immune mothers are at significantly higher risk of acquiring *Giardia* infection and developing Giardiasis with more severe symptoms compared with children of immune mother.
- Chukiet *et al*., (2003) studied the prevalence intestinal parasitic infection by stool examination in institutionalized and non-institutionalized Thai people with mental handicaps. It was found that prevalence of infection was much higher in institutionalized (57.6%) than in non-institutionalized people (7.5%). The common parasites found in institutionalized people were *T.trichiura* (29.7%), *E.coli* (23.7%), *G.lamblia* (3.0%), H.*nana* (7.8%) and *E.histolytica disper* (7.1%).
- Ozbilgin *et al*., (2003) was designed a study to compare the treatment efficacy of single dose of ornidazole with 5 days treatment of ornidazole and metronidazole in children with Giardiasis. 175 children between 2-5 years old, whose stool samples were found to be positive for *G.lamblia* by either salinlugol formalin ethyl acetate, were enrolled in the study. OF these children, 105 are treated with a single dose of ornidazole 35 with 30mg/kg. 35 with25mg/kg and 35 with 20mg/kg per day metronidazole

for 7days in 3 doses. All cases were examined on the 7^{th}, 10^{th} days after treatment by the same methods. *Giardia lamblia* was eradicated in 34 of 35 (97%), 33 of 35 (94%) patients treated with 30, 25 and 20mg/kg single dose of ornidazole respectively. Eradication was achieved in all 35 patients treated with 25mg/kg per day ornidazole for 5 days and in 31 of 35 (89%) patients treated with metronidazple. Single dose ornidazole treatment could be considered as proper and effective alternative methods for the treatment of Giardiasis in children.

- Belzario *et al.*, (2003) determined the efficiency of single dose of albendazole, ivermeetin and diethyl carbamazine against common intestinal helminthes caused by *Ascaris* and *Trichiuris* spp. In a randomized placebo controlled trial, infected children were randomly assigned to treatment with albendazole+placebo, ivermectin+placebo, albendazole+ivermeetin, or alendazole+diethyl carbamazine. The kato-katz method was used for qualitative and quantities parasitological diagnosis. The test was used to determine the significance of care rates. Albendazole, ivermeetin and the drug combination give significantly higher care and egg reduction rates for ascariasis and trichiuriasis than diethyl carbamazine and other treatment. The infection rates were lower. 180 and 360 days after treatment.
- Anyaeze *et al.*, (2003) conducted a prospective study of the stool samples 129 rural patients with symptoms of upper abdominal pain, tenderness and indigestion was carried out from 2 February 1998 to 31December1998 and followed up to June 1999. The age range was 11-85 years, female and male ratio 2, 4:1:102 specimens were positive helminthes among parasites, *A.duodenale* (62%), *T.trichiura* (9.3%), *A.lumbricoides* (7.76%), *S.stercoralis* (2.3%) were recovered. The female and male ratio for hookworm was 3:1. Treatment with appropriate ant helminthes agents were given serially at each visit according to the result

of fecal examination. After 6 months treatment strategy appeared to be almost effective approach in the management of these patients.

- Verle *et al.,* (2004) conducted the prevalence of intestinal parasitic infections in northern vietnam. The surveyed revealed that eggs or cysts of at least one parasite species were detected in 88% of stool samples (n=2522). Prevalence of nematodes was high among all ethnic groups, hookworm (52%), *Trichuris trichiura* (50%), and *Ascaris lumbricoides* (45%). *Ascaris* infection appeared to be lower in households owning a latrine, was highest among children and decreased with age. Prevalence of hookworm rose during childhood, remained high until old age, was highest among adult women, but was not linked to anemia. Eggs of *Chlonorchis* spp. were found in 126 (5%) individuals. Chlonorchiasis increased with age and was highest among adult men. *Taenia eggs* were found in three individuals (0.1%). *Giardia lamblia* was found in all districts and among all groups and the prevalence of infection was estimated at 3%.
- Amin Omar M. (2004) reported that one-third of the 5,792 fecal specimens from 2,896 patients in 48 states testes positive for intestinal parasites. Multiple infections with 2-4 parasitic species constituted 10% of 916 infected cases. *Blastocystis homonis* infected 662 patients (23% or 72% of the 916 cases).Its prevalence appears to be increasing in recent years. Eighteen other species of intestinal were identified.
- Farook, M. Umarul *et al.,* (2004) carried out the study oon the intestinal helmintic infection among tribal population of Kottor and Achankovi areas in Kerala (India). Out of 258 stool samples examined, 60 showed ova of one or more intestinal helminthes, showing the overall prevalence of 23.3% with the confidence interval of 18.5-28.45. Among the tribal population of two areas studied, Achankovil area showed an increased overall prevalence rate (26.15%) as compared to Kottor area (22.27%).

The difference in prevalence rates of the two areas found to be statistically (p-value 0.01). Hookworm infection was found to be predominant (58.82%) in Achankovil and the remaining (41.1%) was due to only roundworm. Where as in Kottoor area roundworm infection predominated (74.41%) followed by hookworm (18.6%) and other types (6.97%).

- Rim *et al.,* (2004) conducted the prevalence of intestinal parasitic infections on a national scale among primary school children in Laos. A total of 29,846 stool specimens were collected from primary school children from may 2000 to June 2002 and examined. The cumulative egg positive rate for intestinal helminthes was 61.9%. By species, the rate for *Ascaris lumbricoides* was 14.9%, hookworm 19.1%, *Trichuris trichiura* 25.8%, *Opsthorchis viverrini* 10.9%, *Taenia* spp. 0.6% and *Hymenolepsis nana* spp. 0.2%. The northern mountainous regions such as Phongsaly, Huaphan or Saysomboune provine showed a higher prevalence (over 70%) of soil-transmitted helminthes. The regions along the Mekong River such as Khammuane, Scravane or Sarannakhet province showed a higher prevalence (over 20%) of fish-borne parasites on the otherhand, *Schistoma mansoni* eggs were detected in 1.7% of schoolchildren only in Champssak Province a previously endemic area. The highest prevalence was nnoted in Phongsaly Province (96.0%) and the lowest in Bolikhamxay provine (27.5%).
- Hailemariam *et al*., (2004) investigated the intestinal parasitic infection in HIV/AIDS and HIV seronegative individuals in a teaching hospital, Ethiopia. Out of 78 HIV/AIDS patients, 52.6% (41/78) and out of 26 HIV-negative individuals, 42.3% (11/16) were infected with one or more types of intestinal protozoan parasites and or helminthes parasites. The parasites detected among HIV/AIDS patients, included *Ascaris lumbricoides* (30.8%), *Blastocystis* spp. (14.1%), *Entamoeba histolytica*

(10.3%), *Trichuris trichiura* (6.4%), *Strongyloides stercoralis* (5.1%), *Giardia lamblia* (3.8%), *Schistosoma mansoni* (2.5%), hookworm species (2.5%) and *Taenia* spp. (1.3%) multiple infection were more common among HIV/AIDS patients. *Blastocystis* spp. were found to be significantly higher in HIV/AIDS patients than in control (p,0.05).The magnitude of intestinal parasitic infection was high between in HIV/AIDS patients.

- Wang *et al*., (2004) observed the changing pattern in intestinal parasitic infections among south-east Asian laborers in Taiwan. one fecal specimen was obtained from each of 1,569 laborers. The prevalence of intestinal parasitic infections was 8.2%, females (11.7%) had a significantly higher prevalence than males (6.9%), although there was no significant difference between Fillipines (7.7%), Thais (8.3%) and Indonesian (12.5%). *Blastocystis homonis* (3.4%) has the highest prevalence among the nine species of parasites detected. That significantly higher prevalence of *B.homonis* in the entry examination indicating an increasing trend in incoming southeast Asian laborers. In addition, the prevalence of soil-transmitted helminth infections has has become extremely low. Female laborers had a significantly higher positive rate. Although *Opisthorchis viverrinil/lonrchis sinesis* remains prevalent among Thai, the positive rate was also significantly reduced.
- Saksiris ampant *et al.*, (2004) carried out the survey on intestinal parasitic infections among children in the orphanage in Pathum Thani province. The total of 106 pre-school orphans (60 males and 46 females), aged 10-82 months, were examined for the study. There were 86 individuals (81.1%), 45 males and 41 females, infected with at least one parasite. Interestingly, most of the parasites identified were protozoa. *Blastocystis homonis* was found at the highest prevalence (45.2%). The infection caused by *Giardia lamblia* was 37.7% and *Entamoeba histolytica* was

3.7%. Other non-pathogenic protozoa were *Trichomonas homonis* (39.6%), *Entamoeba coli* (18.8%) and *Endolimaxx nana* (3.7%). The only one case of helminth parasite detected was *Strongyloides stercoralis* (0.9%).

- Tchuente *et al.,* (2004) carried out polyparasitism with *Schistosoma haematobium* and soil-transmitted helminth infections among school-children in Loum, Camerroon. For that 1454 fecal samples wew observed. Observation revealed that the prevalence of *S.haematobium* was 62.5%. Their were 47.7% and 619 eggs per gram of faeces for *Trichuris trichura*, 65.5% and 3636 per gram of feces of *A.lumbricoides* and 1.4% and (0.1 EPG for hookworm. Most children (90.3%) were infected with at least one of these four parasites, the largest population (34.3%) carrying two species, 27.4% carried three and 1.1% carried concurrently all four species of parasites. The average number of species harboured increased with as, did the prevalence of *S.haematobium* and *T.trichiura* but not that of *A.lumbricoides.* Mean abundance of infection varied significantly between age classes among school and between the sexes, with female showing heavier mean EPGs for *A.lumbricoides* and *T.trichiura*. A highly significant association was detected between *A.lumbricoides* and *T.trichiura* that was not context dependent.
- Ozumba *et al.,* (2005) observed helminthiasis in pregnancy in Enugu, Nigeria. A total of 161 stool samples were collected from the women and examined. The prevalence of helminthic infection was 11.8% with only Ascaris lumbricoides (8.7%) and T.trichiura (3.1%) being detected. The intensity of infection was generally high with a geometric mean intensity of 50.1% eggs per gram of feces. About 11.8% of cases were multiple infection.
- Zali *et al.,* (2005) investigated the prevalence of intestinal parasitinc pathogens among HIV+ve individuals in Iran. For that stool samples were

collected from 206 HIV-positive individuals. The overall prevalence of intestinal parasites was 18.4%. Most specifically, the following parasites were identified. *Giardia lamblia* (7.3%), *Blastocystis homonis* (4.4%), *E.coli* (3.9%) and *Cryptosporodium parvum* (1.5%). Other parasites observed included *Strongyloides stercoralis* and *Hymenolepsis nana* in two cases and *Dicrocolium dentriticum* in one of the 38 patients who tested positive for intestinal parasites, 15 (39.2%) had diarrhea than those without ($p<0.001$).

- Park *et al.,* (2005) observed the status of intestinal parasitic infections among children in But Dambang, Cambodio. A total of 623 fecal specimens were collected from Kindergarten and School children. The overall prevalence rate of intestinal parasites was 25.7% (boys 26.2% and girls 25.1%) and the infection rates of intestinal helminthes by species were as follows: *Echinostoma* spp. 4.8%, hookworm 3.4%, *Hymenolepsis nana* 1.3%, and *Rhabditis* spp. 1.3%. The infection rates of intestinal protozoan were: *E. coli* 4.8%, *G.lamblia* 2.9%, *I.butschlii* 1.4% *E.polecki* 1.1% and *E.histolytica* 0.8%. There were no egg positive cases of *A.lumbricoides* or *T.trichiura*.
- Aimpun *et al.,* (2005) surveyed for intestinal parasites in Belize, Central America 82% of a total population was found to have one or more intestinal parasites. The most common infection was hookworm (55%) followed by *Ascaris lumbricoides* (30%) *Entamoeba coli* (21%), *Trichiuris trichuria* (19%), *Giardia lamblia* (12%), *Idoamoeba butchilli* (9%) and *Entamoeba histolytica dispar* (6%). Other parasites were found *Entamoeba heartmani, Strongyloides stercoralis, Endolimax nana, Isospora belli* and *Chilomastix mesnili*. Children were more often infected than adults and more females had hookworm infections. Sixty percent of 111 household surved had drift floors, 43% were with out

toilets, 35% of the houses were overcrowed and 10% obtained drinking water from streams.

- Zakai *et al.,* (2005) carried out the intestinal parasitic infections among primary school children in Jeddah, Saudi Arabia. A total of 1000 questionnaires were distributed to P.S.children, filled by the child's guardian and stool samples were collected from those who agreed to participate in the study. 231 stool smples were collected. Of the 231 stool samples only 22 (9.5%) sample had parasites. *Giardia lamblia* was the most reported parasite. Double infection was seen in only 3 samples. The low prevalence of intestinal parasites among the study group reflects the outstanding health and hygienic care in primary school visited.
- Chaudhary *et al.,* (2005) observed the epidemiological factors affecting prevalence of intestinal parasites in children of Muzaffarabad district. The prevalence of gastero-intestinal parasites in 15 years old children in Muzaffarabad city was 29.26%. Protozoal infection was higher than helminthic infection. Prevalance of *Giardia lamblia* (11.8%) was higher than *Entamoeba histolytica* (5.9%), *Ascaris lumbricoides* (3.8%0 was the most prevalent helminthic followed by hookworm (2.4%). Prevalance of other helminthes namely *Enterobius vermicularis*, *Trichuris trichura*, *Hymenolepsis nana* and *Taenia saginata* ranged from 1.0 to 1.7%. Mixed infection was seen only in 3.1% children. Rural children had higher prevalence of parasites than in city but the difference was statistically non-significant. After 2 years of age, the prevalence of parasites continued to decrease as the age of children increased. Family size, and income did not have statistically significant effect on the prevalence of gastrointestinal parasites in children.
- Culha *et al.,* (2006) carried out the prevalence of parasites in four different special daytime nursing homes and day-centers in Antakya. In the study the prevalence of intestinal parasites in 109 students (68 boys,

41 girls) n the 1-6 age group. One or more parasites were detected in 18 (20.93%) out of 86 concentrated fecal samples. Eight (7.40%) *Enterobius vermicularis* were detected in 109 cellophane tape specimens. The prevalence of parasites in concentrated specimens included 4 (19.04%) *Giardia intestinalis*, 12 (57.14%) *Blastocystis homonis*, 4 (19.04%) *Entamoeba coli* and 1 (4.76%) *Hymenolepsis nana*.

- Yzar *et al.*, (2006) surved on distribution of intestinal parasites among patients who presented out the Department of parasitiology of the Ericiyes University Medical School. For that a total of 34,883 stool samples were examined. Intestinal parasites have been found in 9,704 (27.8%) of the specimens. The parasites that were found and their prevalence are 11000 *Blastocystis homonis*, 6,723 (19.3%), *Entamoeba coli*, 1,007 (2.9%) *Giardia intestinalis*, 892 (2.6%) *Entamoeba histolytica/E.disper*, 798 (2.3%), *Endolimax nana*, 486 (1.4%), *E.hartmanni*, 252 (0.7%), *E. vermicularis*, 242 (0.7%), *Idoamoeba sutchilli*, 109 (0.3%), *Taenia saginata* 92 (0.3%), *Chilomastix mesnili*, 67 (0.2%), *Ascaris lumbricoides*, 55 (0.2%) and *Hymenolepsis nana*, 40 (0.1%)
- EI-Shazly *et al.*, (2006) carried out the reflection of control programs of parasitic disease upon gastro intestinal helminthiasis in Dakahlia Governorate, Egypt. During study period, one thousand individuals were randomely selected from each area. Different methods of stool examination of all participant revealed that the incidence in Mansoura cvity was in a decending order *Heterophyes heterophyes* 6.4%, *Enterobius vermicularis* 3.9%, *Hymenolepsis nana* 2.2%. *Schistosoma mansoni* 0.5%, *Trichostrongylus stercoralis* and *Fasciola* spp. were recorded as 0.2% of each. In Gogar, the parasitic infection was *H. hetephyes* 4.5%, *Enterobius vermicularis* 4.1%, *H.nana* 3.3%, *S.mansoni* 1.6%, *S.stercoralis* 0.5%, *Fasciola* spp. 0.4%, *T.saginata*, *A.lumbricoides*,

H.diminuta, A.duodenele and *T.trichiura* were recorded as 0.1% of each. So the infection rates of *H.heterophyes, E.vermicularis, H.nana, S.mansoni* etc.

- Guilherme *et al.,* (2006) investigated the intestinal parasites and commonsals of settled populations in three land settlements (Vials Rurasis) of Parana State, Brazil. This work carried out from February/2001 to Februray/2003, aimed to verify the occurrence of intestinal parasites and to promote sanitary educational measures for the population of three settlements. *Enterobius vermicularis,* hookworms *Entamoeba coli* and *Giardia lamblia,* were the most common parasites diagnosed. Treatment and cure control of the infected population, sanitary educational activities and training of multiplier team were performed.
- Hung *et al.,* (2006) observed the intestinal helminth infection in an ethnic minority commune in Southern Vietnam. Before intervention, 28.6% of children excreted eggs of at least one parasite, hookworm being the most common (23%), followed by *Trichuris trichurs* (1.9%), *Hymenolepsis nana* (1.9%), *Enterobius vermicularis* (0.9%), *Ascaris lumbricoides* (0.5%) and multiple kinds of helminthes (0.5%), *Strongyloides stercoralis* was never detected. Poor sanitation and personal hygine and walking barefoot were considered the main risk factors for intestinal helminth infections.
- Singh. H.Lokhendro *et al.,* (2006) surved on the helminthic infection of the primary school going children in Manipur. For that a total of 1010 stool samples were collected between the age group of 5 to 10 years from September 1998 to October 2000. A total of 248 (24.5%) were positive for various helminthes. Among the positive cases, 110 (26.3% were from the Urban area and 138 (23.4%) from the rural area. Of the 552 males and 458 female tested. 136 (24.6%) males and 112 (24.5%) female respectively were positive for various helminthes. Among the parasites, *Ascaris lumbricoides* was the commonest (19.6%) followed by *Trichuris*

trichiura (2.18%), *Hymenolepsis nana* (0.99%0, tapeworm (0.19%), Hookworm (0.09%), *Enterobius vermicularis* (0.09%). Mixed infection of *Ascaris lumbricoides* with *T.trichiura* (1.08%) with *Enterobius vermicularis* (0.09%) and *T.trichiura* with *S.stercoralis* (0.09%) were also encountered.

- Deepmala *et al*., (2006) surved on the prevalence of intestinal parasitic infections in human population of Darshangn region of Bihar. During study out of 2553 stool samples examined 920 (36.03%) were found to be positive for protozoan parasites. 1162 (15.52%) for helminth and 471 (18.45%) for mixed infection. *Giardia intestinalis* among protozoan parasites and *Ascaris lumbricoides* among helminthes were found the commonest intestinal parasites showing the prevalence rate of 30.78% and 35.6% respectively. In overall infection males and even those of 21-30 years age group showed higher prevalence rate (55.55%) than female (44.45%).
- Chandrasena *et al.,* (2007) investigated the parasites and the growth state of internally displaced children in Srilanka. It was found that there was a high prevalence of growth retardation (wasting, stunting and underweight being 41%, 28% and 69.9% respectively) and intestinal parasitic infections (40.2%) among the study population. Provision of adequate food, purified drinking water, sanitation and broad-specturum anthelmintics is recommended.
- Tong Chong-Jin *et al.,* (2007) carried out the investigation on the infection of intestinal parasitic diseases in Western region of Hainan Province. During study, a total of 2045 people were under fecal examination and the overall infection rate of intestinal helminthiasis was 59.32%. 7 parasites had been detected during this survey. The infection rate of *Trichiuris,* hookworm, *Ascaris* and *Enterobius* were 40.64%, 20.73%, 20.12% and 40.49% (190/494), respectively. The mixed

infection more than two species was serious. There was a significant difference in the infection rate with different survey site, sex, occupation, ethnic and age groups ($p<0.005$). The infection rate was higher in age groups of 5-9 years and 10-14 years than other age groups. The overall infection rate of human intestinal parasite was dropped slightly in western regions of Haiman province compared with 10 years ago, but infection rate of human intestinal parasites was still high, especially for *Trichuris.*

- All-Harthi *et al.,* (2007) surved on enteroparasitic occurrence in stool from residents in southwestern region of Saudi Arabia before and during Umrah season. Study of the prevalence of human gastrointestinal parasitic infections among patients living in Makkab Al-Mukkarmah city before and during Umrah season. Eighty were collected before the Umrah season began and 103 were collected during the Umrah season, age, sex and address were also recorded. The result suggests a higher prevalence of intestinal parasitic infections (70.5%) among patients under study. *Entamoeba histolytica/E.disper* and *Giardia lamblia* were found to be the most common intestinal parasites among patients before and during Umrah. The infection rate was higher in the under 30 age group (74.8%) and in persons living away from the Holy Majdid (77.7%). The prevalence of intestinal parasitosis during Umrah (73.8%) was higher than that before Umrah (66.3%).
- Woerdemann *et al.,* (2007) carried out the study on prevalence and risk factors of intestinal parasites in Cuban children. For that a total of 1320 Cuban children aged 4-14 were tested by stool examination for intestinal parasitic infection and evaluated by parental questionnaire for a number of common environmental sanitary, socio-economic and behavioural risk factors. Prevalance of intestinal parasitic infection were 58% in Fomento and 45% in Sanjuany Martinzz, for helminth infections, these were 18% and 24% for protozoa infection 50% and 29% respectively.

- Rayan *et al.,* (2007) investigated on the prevalence and clinical features of *Dientamoeba fraglis* infections in patients suspected to have intestinal parasitic infection. A total of 168 patients were examined for *D.fragilis trophozoites* were detected in 15 samples (8.9%) examined using trichrome staining and in 50 samples (29.8%) by culture method. Other enteric parasites were common in the study population as 48.8% of patients (82/168) found habouring intestinal parasites. *Blastocystis homonis* was the most common, identified in 33.3% (56/68) of the samples. *Giardia lamblia* was detected in 17.9% (30/168) and *Entamoeba histolytica/E.disper* in 11.9% (20/168). Diarrhea and abdominal pain were significantly more frequent in patients with dientamoebiasis compared to non-pathogenic cases ($p<0.05$). Diarrhea was 38.5% of patients infected with *D.fragilis* compared to 50% of patients infected with *G.lamblia,* while abdominal pain was encountered with *D.fraglis* in 41% compared to 33.3% with *G.lamblia*. These differences were insignificantly ($p>0.05$).
- Ei Shazly *et al.,* (2007) studied on intestinal parasites in Dakahlia governorate, with different techniques in diagnosis. Protozoa-During study a total of 3180 patients were examined. The intestinal helminthes in a desending order of abundance were *S.mansoni* (5.3%), *Fasciola* spp. (4.8%), *H.heterophyes* (4.2%), *Hymenolepsis nana* (3.9%). *Trichostrongylus* spp. (2.6%), *A.lumbricoides* (1.8%). *Strongyloides stercoralis* (1.5%), *H.diminuta* (1.4%), *Taenia saginata* (1.1%), *E.vermicularis* (1.1%), *T.trichiura* (0.7%) and lastly *A.duodenale* (0.1%). The intestinal protozoa in a descending order of abundance were *Blastocystis homonis* (22.4%), *G.lamblia* (19.6%), *E.histolytica/E.disper* (19%), *Idoamoeba butschilli* (16%), *Cryptosporidium parvaum* (14.3%), *E.coli* (9.7%), *Isospora homonis* (7.7%), *Endolimax nana* (6.9%), *E.hartmani* (5.9%), *D.fragilis* (5.1%), *Chilomastix mesnili* (5.1%),

Trichomonas homonis (4.2%), Microsporidia spores (3.2%), *Enteromonas homonis* (1.9%) and *Embadadomonas intestinalis* (1.3%).

- Kassem *et al.*, (2007) observed the intestinal parasitic infection among children and neonatus admitted Ibn-sina hospitaly Sirt, Libya. A total of 350 stool samples from 196 males and 154 female children and neonatus admitted in Ibn-Sina hospital, Sirt, were examined from June 2001 to May 2002 to determine the prevalence of intestinal parasites. Intestinal parasitic infection were identified in 196 (56%) of children and neonates. No intestinal helminthic parasites were detected. But 13 intestinal protozoan parasures were detected. The most prevalent protozoan was *Entamoeba histolytica/E.dispar* (36.57%) *Blastocystis hominis* (12.57%), *G.lamblia* (10.29%), *Isospora belli* (3.43%) and *Blantidium coli* (0.86%). The latter was detected in non-libyan children. The result showed a significant difference exits between the pathogenic and non pathogenic protozoan parasites ($p<0.05$). High prevalence of *E.histolytica* and *G.lamblia* in both sexes. The socio-economic status of children showed that high prevalence in children from medium socio-economic status.
- Steinmann *et al.*, (2008) carried out helminth infections and risk facor analysis among residents in Eryuan country, Yunnan Province, China_3220 individuals, aged 5-88 years, from 35 randomly selected villages in Eryuan country, Yunnan province. The prevalence of *Ascaris lumbricoides, Taenia* spp., *Trichurus trichura* and hookworm was 15.4%, 3.5%, 1.7% and 0.3% respectively. The seroprevalance of *Trichinella* spp. was 58.8% and that of cysticercosis 18.5%. The egg positivity rate of *S.japonnicum* in the 13 known endemic villages was 2.7%, and the corresponding seroprevalance was 49.5%. *A.lumbricoides* and *Taenia* spp. Infections were more prevalent at altitude above 2150m when compared to lower settings (or=1.51, 95% CI=1.24-1.84 and OR=5.32,

95% CI=3.42-8.28, respectively). The opposite was found for *T.trichiura* (OR=0.31, 95% CI=0.14-0.70).

- Suriptiastuti *et al.,* (2008) conducted the study on some epidemiological aspects of intestinal parasites in women workers before going abroad. Study was conducted in Jakarta 903 women workers. Of the women workers studied, 640 subjects (70.87%) were found to be infected with intestinal parasites either helminthes, protozoan or combination. Out of those infected, 451 (70.47%) subjects were infected with intestinal helminthes, namely *Ascaris lumbricoides,* (38.13%), *Trichiurs trichiura* (28.31%), a combination of *Necator americanus* and *Ancyclostoma duodenale* (13.59%) and *Enterobius vermicularis* (4.84%). In addition 319 (49.84%) subjects were infected with intestinal protozoa namely *Giardia lamblia* (22.03%), *Enatamoeba histolytica* (14.53%), *Blastocystis homonis* (6.56%) and *Entamoeba coli* (6.72%). The youngest age to be affected was 14 years old (14.19% of the subjects studied). Majority (72.09%) of the study subjects received junior high school level of education.
- Nayebzadeh *et al.*, (2008) carried out the survey in the prevalence of *Enterobius* family population between infected and non-infected groups. 5.7% prevalence as compared with other cities shows that the infection rate of the oxyuriasis is low in nursery school in Khorrambad.
- Oninla et al., (2008) instigated the intestinal helminthises among rural and urban school children in south-western Nigeria. Overall, 366 rural and 383 urban school children. More investigated and 30.0% of the rural and 24.3% of the urban.:$p<0.001$) were found to be harboring at least one species of parasite. The mean intensities of infection, in terms of excreted egg/g faeces of those infected, were 2371.4 for *Ascaris*, 1070.6 for hookworm and 500 for *Trichuris*. Although the mean intensities of *Ascaris* infection were significantly lower among the infected rural

children than among the infected urban (2025.7v, 2791.4, p=0.014), the corresponding difference in the hookworm infections did not reach statiscal significance (1458v.666.7; p=0.063), a significant difference between the rural and urban *Ascaris* infections (3.1877v.3.3340; P=0.00) but not between the rural and urban hookworm infections (2.9667v.2.8027; P=0.453).

- Almerie *et al.,* (2008) prevalence risk factors for giardiasis among primary school children in Damascus, Syria. A cross-sectional study was carried out on school children from 23 primary school's in Damascus, between March and June 2006. Data were collected from 1469 children of both genders from urban and rural regions. Results showed that 206 (14.0%) of 1469 children were infected with *Giardia lamblia*, while 119 (8.1%) were found infected with other sorts of intestinal parasites. No correlation was found between giardiasis and age, gender, residence in urban and rural areas, availability of piped water or sewage system. In contrast, both mother's (p=0.003) and father's (p=0.0018) levels of education and the number of siblings in home (p=0.014) were found predictors of giardiasis.
- Wani *et al.,* (2008) carried out the survey on the prevalence of intestinal parasites and associated risk factors among school children in Srinagar city, Kashmir, India. Stool samples were collected from 514 students enrolled in 4 middle schools. Of the 514 students surveyed, 46.7% had one or more parasites**.** Prevalance of *Ascaris lumbri*coides was highest (28.4%) followed by *Giardia lamblia* (7.2%), *Trichurus trichura* (4.9%) and *Taenia saginata* (3.7%). Conditions most frequently associated with infection included the water source, defecation site, personal hygiene and the extent of maternal education.
- Uneke *et al.,* (2008) surveyed on potential for geohelminth parasite transmission by raw fruits and vegetables. Isolotation of geohelminth ova

from fruits and vegetables using a standard parasitological technique. Results of the 118 helminth ova isolated, 64(54.2%) were *Ascaris lumbricoides* (9.3%). *Trichurus trichura* and 43(36.4%) hookworm. Vegetables were more contaminated than fruits (71.2%, 95%, confidence interval 63.0-79.3% vs. 28.8%, 95% confidence interval 20.6-37.0%) Carrot (Daucus carota) was the most contaminated vegetables (31.0%, 95% confidence interval 21.1-40.9%) and the least contaminated was egg plant (Solanum macrocarpon) (60%, 95% confidence interval 0.9-11%).

3.3 Literature Review in National Context

- Sharma (1965) reported that worm infestation is very common in some parts of our country. He studied 976 stool samples and found 40% roundworm infestation in Bhaktapur area.
- Romana and Kasprazak (1966) examined that the total incidence of protozoan infection was 54%. Among of them, *E.coli* (24%), *Lamblia intestinalis* (21%), *E.nana* (18%), *D.fragilis*(16%), *E.heartmani*(5%), *E.histolytica*, *C.mesnili* and *E.homonis*(3%) in each were found and *I.butschlii* was 2% of the 202 persons of 1 to 18 years old.
- Sharma *et al.*, (1971) carried out a study on intestinal parasites among auxiliary health worker in Kathmandu. They examined 80 stool samples of which 10 did not show any infestations. The rest 70 i.e. 87.5% respondents were suffered from different types of protozoan and helminthic infection. The commonest infestation found was roundworm (*Ascaris lumbricoides).* Among them 61 i.e. 78.5% of them were suffered from vermicularis infection in nursery schools in Khorramabad, Iran-1220 cases from 30 nursery schools were tested. The prevalence rate of infection was 5.7% overall. There was a significant difference in respect of childrens age, parent's educational level and single infection and 7 i.e 7.5% suffered from multiple infection. Among them 41.25% of

roundworm, 27.5% hookworm, 10% *Trichiuris trichiura*, 5% of *E.histolytica* and 3.75% of *G.lamblia* were recorded.

- Gongol (1972) studied a case of roundworm infestation in gall bladder.
- Souba (1975) carried out a survey of the prevalence of intestinal parasites in Pokhara and found very high incidence. He observed that dirty finger nails might play an important role in the transmission of intestinal parasites.
- Lynch *et al.,* (1978) worked on prevalence of hookworm and other helminthes in British Gorkha recruits reported 89% of healthy appearing individuals were infected with hookworm, 49% with roundworm and 36% with whipworm.
- Acharya (1979) reported that the intestinal infestations like Giardiasis, amoebiasis, ascariasis, ancyclostomiasis, fascioliasis and taeniasis were common in Nepal.
- FPAN/TP (1979) studied the parasitic infection rate in Paanchkhal village community and found 89% parasitic infection rate in 4056 sample size.
- Nepal and Palfy (1980) reported about study of prevalence of intestinal parasites in the Mahanchal Panchayat. Out of 225 examined stool samples 95.3% were positive. The most common parasites were roundworm (63.5%) followed by hookworm (34.2%), *E.histolytica* (28.8%) and *G.lamblia* (28.4%).
- Khetan (1980) carried out the study of the incidence of parasitic infection on Narayani zone. Stool sample of 2073 patients were examined between the years 1977-1980. Out of total samples 1522 stool samples had worm infection, of which 458 sample had *Ascaris* 591 had hookworm, 203 had *Trichiuris*, 175 had *G.lamblia* and 83 had other infection.
- Integrated Family Planning and Parasite Control Project IFPPCP (1980) examined 11,699 samples from June 1979 to 1980. Out of these,

10,385(89%) cases showed positive results in Bhaktapur and Panchkhal area. The infection rate of the *Ascaris* (66.5%) was the highest followed by hookworm (38%), *T.trichiura* (20%). The infestation by other type of parasites was around 2%.

- Gurbacharya (1981) observed that the infestation by soil transmitted helminth in Bhaktapur and Panchkhal area were higher then any other type of parasite.
- Bol and Roder (1981), reported soil-transmitted nematodes in Lalitpur district. They observed *A.lumbricoides, N.americanus, A.duodenale, T.trichuira* and *S.stercoralis* as the soil-transmitted nematodes.
- IFPPCP (1981) examined 5,532 stool samples in Pachkhal area in which 4148 (70%) were positive. The hookworm infection was highest followed by *T.trichiura* and Ascaris. In Bhaktapur, 586 stools were examined in 525 (89%) were found positive.
- IFPPCP (1982) examined 4696 stool samples in Panchkhal area in which 3475 (74%) stool were positive. The infection rate of *Ascaris* was 37% followed by hookworm (47%), *T.trichiura* 254 stool samples were positive.
- Estevez *et al.,* (1983) studied intestinal parasites in remote western village of Nepal and reported 83.3% of individuals positive for hookworms, 52.8% for roundworms and 55% for whipworm infection.
- Estevez et al., (1983) examined 40 stool samples in a remote area of western Nepal and 36 (90%) of which were positive. The infection rate of hookworm was 83.3% followed by roundworm (52.8%) and whipworm (5.5%).
- Shrestha I.L 1983 conduct a survey study in Bhaktapur district showed 99% stools were positive for the eggs of soil transmitted helminthes. 94% eggs were of *Ascaris,* 42% eggs were 0f *Trichuris* and 11% eggs were of

hookworm. Similarly from the Panchkhal area 41% were positive among them 75% were of *Trichuris* 37% were of hookworm and 19% were of *Ascaris*.

- IFPPCP (1984) examined 416 stool samples of school children of Panchkhal. Out of which 112 (27%) cases were positive. The common intestinal helminthes were *Ascaris* 22 (20%), hookworm 53 (47%) and *Trichuris* 53 (47%). In Bhaktapur the project examined 412 stool, samples of which 295 (72%) were positive.
- Sugari *et al.,* (1985) conducted to find the helminthes infections in 737 Nepalese people living in Gandakki, Dhaulagiri, Lumbini and Sagarmatha Zone of Nepal and in 26 Japanes living in Kathmandu. The overall helminthes infection rate was found 36.8% including roundworm (50.3%), hookworm (44.1%), whipworm (47.6%), pinworm (1.2%) and *Taenia sp*. (0.1%).
- IFPPCP (1985) examined 25260 stool samples of students from 46 schools of Kathmandu valley out of which 22626 (86%) were found positive.
- Rai and Gurung (1986) collected 200 stool samples and examined by direct smear techniques over a period of 16 days. The incidence of roundworm was the highest (35%) followed by hookworm (14%). The overall infection rate was 69% and the result showed that the infection was more common in girls than the boys.
- IFPPCP (1986) examined 26018 stool samples of students from 116 schools, out of which 21610 (83%) were positive cases. *Ascaris* had the highest infection rate (69.68%) followed by *Trichuris* 6,838 (31.6%), *Giardia* 1663 (7.7%), hookworm 637 (2.9%), tapeworm 293 (1.3%) and others 90 (0.5%).
- Morel (1986) reported the incidence of human hookworm in the Eastern hills (Koshi) of Nepal. He examined 757 human fecal samples at

Pakhribas Agriculture and Veterinary investigation Laboratory in which 17% were proved positive for hookworm.

- Yadav S.N (1986) reported some helminth parasites from Kirtipur area.
- Sugari setsco *et al.,* (1986) conducted a survey of helminth infections in 737 Nepali citizens from Gandaki, Dhauligiri , Lumbini, Sagarmatha zone also they collected fecal samplees from 26 japanese citizen living in Kathmandu The infection rate was 86.8% including roundworms, hookworms, whipworm, pinworm and Taenia sps. The positive rate was the lowest in Bhairahawa and highest in Darbang. In Namche Bazar, roundworm infection rate was highest 70.3% and hookworm infection was lowest 0.25% there was co-relation ratio of roundworm and altitude, the rate being higher with the increase of altitude. On the other hand there was a reverse co-relation between the infection rate of hookworm and altitude. There was a co-relation between the hookworm infection rate and the age i.e. the rate being higher with age. In Japanese persons living in Kathmandu the positive rate of roundworm infection was 26.9% and that of whipworm was 11.55%.
- Gupta and Gupta (1988) collected 285 stool samples in Kirtipur. Among them 192 (67.36%) was found to be positive for intestinal parasite. Out of 192 positive stool samples, 49 (25.52%) cases were infected with protozoan parasite, 9.12% by *G.lamblia* and 9.47% by *E.histolytica*. Out of 192 stool samples, 155 (80.72%) were positive for helminth parasite. *A.lumbricoides* (40%), *T.trichiura* (25.26%), *A.duodenale* (4.56%) *H.nana* (2.46%) and *T.soliium* (0.55%).
- Geollman (1988) carried out an extensive disease survey in Paten Hospital General out patient Clinic from December 1986 through November 1987. A total of 79,404 people were seen during the period and the incidence of the related infections diseases were as follows:

Amoebic disease 1.7%, Giardiasis 2.7%, Ascariasis 3.5%, hookworm infection 0.85% and other parasites 0.7%.

- House *et al.,* (1990) studied about helminthes infections among Peace corps Volunteers Station in rural regions of Nepal indicated 14% were positive for hookworm, 3% for whipworm and 82% for roundworm.
- Glanottms Alan in 1990 carried out a comprehensive survey of intestinal parasite in TUTH during spring of 2990. Total 209 people were surveyed 187 from Kthmandu and 22 from Kunde village of Solukhumbu district. Study revealed the maximum prevalence of *A.lumbricoides* i.e. 12%, followed by 8.6% of *T.trichiura*, 8.6% of *G.lamblia*, 5.7% of *E.histolytica,* 3.3% of hookworm and 0.5% of *Strongylodes stercoralis*.
- Rai *et al.,* (1991) showed the prevalence of various intestinal parasites in Kathmandu Valley Nepal. The overall prevalence of parasites was 30.9%. There were no significant differences in the prevalence between two sexes. Intestinal parasites were more common among children (<15 years*). A.lumbricoides* was the common parasite followed by
- Hookworm, *E.vermicularis* and others. Among protozoan parasites *G.lamblia* was the most common followed by *E.histolytica.*
- Blangero *et al.,* (1993) studied the helminthes infection in Jiri, concluded that roundworm, whipworm and hookworm were endemic in Nepal and are the major health problem for the population.
- Gianotti (1993) surved in 1990, a total 137 cases from Kathmandu valley and 22 cases from Solukhumbu in children. He reported *Ascaris* 11.2%, *Trichuris* 9.8%, *Giardia* 5.9%, *E.histolytica* 5.3%, hookworm 3.3%, *H.nana* 0.5% and T.solium 0.5% in Kathmandu valley TUTH cases but in the cases of Solukhumbu *Ascaris* 22%, *G.lamblia* 31.8% and *E.histolytica* 9.1%.

- Sherchand *et al.,* (1994) studied the intestinal parasites in the Kathmandu valley and reported 28.1% of parasitic load among subjectively healthy children and 38.8% parasitic load among healthy adults, where as 62.7% total parasitic load among recovered among children with abdominal discomfort. *H.nana* was recorded most common tapeworms associated with patients having abdominal discomfort. Among protozoan parasites prevalence of *G.lamblia* was highest among the sick children. In healthy children the prevalence of mixed parasitic infection was 2.1% and 7% in healthy adults, while 13.3% prevalence was found in sick children and 11.5% in sick adults.
- Rai *et al.,* (1994) studied the status of soil transmitted helminthes infections in Nepal during 1985-1992. Average of 6537 fecal samples was examined each year. The annual rate of positivity for soil-transmitted helminthiasis ranged from 18-36%. *A.lumbricoides* had the most common prevalence than the hookworms and others.
- Sherchand *et al.,* (1995) studied the intestinal parasitic infections in rural areas of Southern Nepal, Dhanusha districts. Out of 604 children of aged 0-9 years examined (63.1%) were found positive for at least one intestinal parasite. Hookworm infections were found 11.6% positive followed by other common parasites. They were *A.lumbricoides, T.trichuira*, *Oxyuris vermicularis* and *G.lamblia*.
- Rai *et al*., (1996) examined fecal samples about one decade 1985-1995 in Tribhuvan University Teaching Hospital and Patan hospital are revealed the prevalence rate of intestinal parasites varying from 29.1% to 44.2%.
- Save the children fund U.K. made stool examination in October 1996 among the school children of Bhutanese refugees of age group 6-21 years. The result has following, Hookworm 84.21%, *Ascaris* 10.52%, *Taenia* 2.63% and *Trichiuris* 2.63%. Again same project worked in Goldhap of Jhapa from January to October 1999. Total 612 stool samples

were taken and examined among them 13.72% hookworm, 10.13% *Ascaris*, 0.81% *Taenia* and 0.49% *Trichiuris*.

- Chettri MK (1997) analyzed the parasitic infection Scenario of Nepal and concluded that 50% of people were infested by helminthes. Among them *Ascaris.lumbricoides* was found to be top in the list of helminth and *Giardia* in protozoan from 4,00,000 stool samples reported studied by different organization at different places and period (from 1979to 1995 i.e. 16 years.)
- Serchand *et al.,* (1997) studied the intestinal parasitic infection in rural areas of Dhanusha district. Out of 604 children aged group 0-9 years 63.1% were found positive for one or more intestinal parasites.
- Navisky *et al.,* (1998) examined fecal specimens from 192 pregnant women (age 15 to 40 years) and 129 infants (age 70-140) days for helminthes eggs by the Kato-katz method. These stool specimens were collected from Sarlahi district in Southern Nepal among pregnant women was found to be 78.8% hookworm, 52% *A.lumbricoides* and 79% *T.trichiura.*
- Rai *et al.,* (1999) *Ascaris* and its recent scenario in Nepal had suggested *Ascaris* as leading human parasite and also reported as major causes of public health problem. The study reported that over 75% people were infested by *A.lumbricoides* in rural areas, where as hospital based study in Kathmandu over a period of one decade also shown a static annual prevalence with mean of approximately 35%.
- Rajendra Bdr. Thapa (2000) collected 120 people (45 Bote and 75 Darai) were ntervied and the stool from 152 people (62 Bote and 90 Darai) were collected for diagnosis. The result showed *Ascaris* (21.7%), Hookworm (19.73%), *Taenia* (18.42%), *Diphyllobothrium* (13.15%), *Trichuris* (7.23%) and *Enterobius* (1.97%).

- Sharma *et al.,* (2005) studied the prevalence of intestinal parasitic infestation in school children in the northern part of Kathmandu valley. A total of 533 school children (269 girls and 264 boys aged 4 to 19 years) were included in this study. Fecal samples from children were examined. The overall prevalence of parasitosis was 66.6% (395/355) with no significant difference between boys and girls ($p>0.05$). Tibeto-Burman children had a non-significant higher prevalence compared with Indo-Aryan and Dalit children ($p>0.05$). Half (53.8%, 191/355) of the children had multiple parasitic infections. Altogether nine types of parasites were recovered. The recovery rate of helmintes was higher (76.9%) than protozoa (23.1%). *Trichuris trichiurs* was the most common helminthes detected followed by hookworm, *Ascaris lumbricoides* and others. *Entamoeba coli* was the most common protozoan parasite followed by *E.histolytica, Giardia lamblia* and others.
- Ghimire *et al.,* (2005) conducted a study to determine the prevalence of the intestinal parasites and to evaluate the types of intestinal parasites and haemoglobin concentration in the people of two areas of Nepal. The cross-sectional descriptive type of study was conducted from April 2005 to October 2005 in Kirtipur, Kathmandu and Gunjanagar VDC, Chitwan, Nepal. A total of 400 stools were processed by using standard formalin-ethyl acetate concentration method, direct light microscopy, modified acid fast stain, oculo-micrometer and bisporulation assay. The blood was collected from the 59 solitary parasite positive persons, one concomitantly infected person and 17 parasite non-infected persons and examined by colorimeter. The total prevalence of intestinal parasite was 42.0% in which the prevalence of males and females was 35.2% (58/165) and 46.8% (110/235) respectively with statistically significant ($p<0.05$, 95% CI). There was statically significant of low concentration of

haemoglobin in the helminth and protozoa infected males and females with different age groups ($p<0.05$, 95% CI).

- Ghimire *et al.,* (2006) conducted a study to highlight the intestinal parasites in the role of diarrhea in Human Immunodeficiency Virus infected patients who attended in Sukra Raj Tropical and Infectious Disease Hospital of Kathmandu, Nepal from May 1, 2003 to April 30, 2004. The total of 86 stool samples was collected from 86 HIV patients once and they were examined by direct smear methods and modified Kinyoun acid fast stain. Here, 18 females (78.3%) out of 23 HIV patients and 40 males (63.4%) out of 63 patients were found to be infected with intestinal parasites with the prevalence of 67.4%. Though in August and October 2003, 100% samples were positive, there was statistically no significant difference with months $\chi^2=18.83$, $p>0.05$). In this study, Cyclospora (19.8%), Cryptosporidium (14.0%), *Isospora* (3.5%), *Strongyloides* (10.5%), *Ascaris* (4.7%), *Giardia* (3.5%), *Hymenolepsis nana* (2.3%), *Trichuris trichiura* (2.3%), *Entamoeba histolytica* (2.3%), Hookworm (2.3%) and *Enterobius* (2.3%) were reported with statistically significant ($\Re^2=18.3$, $p<0.05$).The total prevalence of coccidian and non-coccidian parasites was 37.0% and 30.2% respectively with statistically significant ($\Re^2=15.51\%$, $p<0.05$). The prevalence was found 100% in drivers, 80% in farmers, 100% in housewives and 48.9% in sex workers. Among 48 diarrhoea patients, 36 (75.0%) showed infection. 17 (35.4%) was acute diarrhoea patients among which 11 (64.7%) was positive. Among 31 (64.6%) chronic diarrhoea, 25 (80.6%) was positive. They conclude that the control of intestinal parasite involves adequate treatment and proper health education, provision of adequate toilet facilities and pipe borne water.

CHAPTER- FOUR
MATERIALS AND METHOD

4.1 Sample Size

Total of 300 stool samples were collected and examined during study period. Out of 300 stool samples, 80 stool samples were collected from Pragati Tole, 120 samples were collected from Kumal Tole and remaining 100 stool samples from Lama Tole.

4.2 Survey Study

Questionnaire is the important tool during survey study. Most of the people are illiterate so, questionnaire was filled by the interviewer to get more information about the food habits, socio-economic condition, socio-cultural factors and other factors.

During survey study, target area was visited and different factors such as drinking water supply, living conditions, feeding habits, working styles, methods of cleaning the vegetables and fruits, places of defecations, the condition of surrounding, condition of domestic animals and all other factors were observed.

4.3 Materials

4.3.1 Equipments

1. Compound microscope
2. Hot air oven
3. Refrigerator
4. Sample vials

5. Gloves
6. Trays
7. Applicator sticks
8. Glass slides
9. Cover slips
10. Forceps
11. Stinger (Tape)
12. Marker, maxes
13. Ocular and stage micrometer

4.3.2 Chemicals

1. Normal saline (0.85%)
2. Lugol's iodine solution (1% wt by volume)
3. Potassium dichromate solution (2.5% wt by volume)
4. Soap
5. Formaline and alcohol

Normal Saline

It helps to observe characteristics movement of the parasites. It is used in unstained preparation. This solution was prepared by dissolving 8.5 gm. of sodium chloride in 1000 ml. of distilled water

2.5% Potassium Dichromate

This solution is useful for preservation of parasite, which is found in the stool. 2.5 gm. Of potassium dichromate was weighted accurately by the help of electric balance and dissolve in distilled water.

Iodine solution

It is used to study the internal characters for identification of the species of protozoan parasites. \it is also helps to identify the egg of helminth. Dissolving 10 gm Potassium iodide in 100 ml of distilled water and slowly adding 5 gm of iodine crystals in it prepared the solution used in the present study. The solution was filtered and kept in a stopper bottle of amber co lour.

4.4 Methods

The rate of parasitic infection was determined by examination of stool samples through binocular compound microscopes in parasitological laboratory in central Department of Zoology. The photographs of the larva and eggs of helminthes and trophozoites and cysts of protozoan

were taken by using microscopic photographic camera in CDZ, T.U. After complete examination of stool, drugs distribution programmed was performed for each individual from 13 to 25 May, 2007.

4.4.1 Sample Collection

First phase of stool collection, preservation and examination was held .In this time, respondent were interviewed individually and were provided sterile stool sample collecting vials with details instruction required for stool collection. Then samples were collected next morning.

Second phase of stool collection is preservation and examination.

4.4.2 Ensuring Good Condition of Sample

- To ensure the good condition of the stool sample the following precautions were applied
- The vials were cleaned with detergent and kept in antiseptic solution for hours and dried
- The labeled vials were distributed without any extraneous materials and preservatives in it.
- The vial never be overfilled and stool should not be mixed with urine. This suggestion should be given to each and everybody during distributing the vials.
- Stool from infants were collected by coating one end of a straw with Vaseline and gently inserting it about one inch into the rectum. On removal, cut the end of the straw into a container.
- Then after the physical appearance of stool sample was noted and 2.5% potassium dichromate solution was added in stool sample for preservation of the parasites present.

- Vials were arranged in such a way that it could be carried into the laboratory of college for further processing, slide preparation examination and identification.

4.5 Methods of Examination

Laboratory diagnosis of the intestinal parasites present in the stool is based on gross/macroscopic examination of stool

4.5.1 Macroscopic examination

Examination of stool was carried out by naked eye for studying physical appearance like colour of stool, odour of stool, solidity or consistency of stool, presence of gravid segment/adult worm and presence of mucus and blood.

4.5.2 Microscopic Examination

Microscopic examination of the stool is necessary to identify helminth eggs, larva, protozoan cysts and trophozoites. 400 stained and unstained stool smear were prepared to observe the various intestinal protozoan as well as helminth parasites. For accurate identification of the parasites, measurement of the size of the parasites was done with the help of an ocular micrometer that had been properly calibrated.

4.5.2.1 Unstained Smear Preparation of Stool

A portion of stool sample was picked up with a wooden applicator and emulsified with freshly prepared normal saline on a clean glass slide. A clear coverslip was placed over it and excess of fluid was removed with the help of cotton. The resulting smear should not be thick and its consistency should be such as to allow news print to be read through it. Unstained smear made chromatoid bodies more visible.

4.5.2.2 Stained Smear Preparation

Stained preparation was required fro identification and the study of internal nuclear characters for identification of the species. The iodine stained preparation was used for this purpose. It was prepared by adding a drop of iodine on saline emulsion and then covered by cover slip. Vaseline or Glycerin was kept there to prevent desiccation before the coverslip was kept there. The excess of fluid was removed with the help of filter paper. Both stained and unstained preparation was kept on the same glass slide one on each half (Chattarjee KD, 1967).

4.5.3 Method of observation

Both of the preparations that are stained and unstained were first examined under the low power (10x) objective and (4x) ocular. It was started from one corner of the coverslip, the whole slide was examined. It was carefully watched on shape, size and colour marking on the surface of the egg shell during the identification of eggs of helminth and cyst of protozoa. With the help of Standard books and references, the presence or absence of yolk granules, ovum or differentiated embryos, the existence of operculum, polar filament or knob in specific case of cestodes and in case of protozoa, cyst, remains of flagella, nucleus characters and portion of nucleolus were considered. Larval stages of hook worm (*Strongyloide stercoralis*) were also observed.

4.5.4 Identification

During microscopic examination of unstained and stained stool smear under 10x and 40x objectives, the identification of the cystic and trophozoite stage of protozoan and egg as well as larva stage of helminthes were done on the basis of medical laboratory manual and experts. For the identification of size, shape, shell contain, colour,

external feature and hooks were studied then systematic study of all characteristic of eggs were carried out to confirm their identification.

4.6 Data Collection

The primary data were collected by questionnaire method and by examining the collected stool samples from the interviewed individual. They were given dry, clean and leak proof vials for collecting the stool samples.

4.7 Data Analysis and Interpretation

Thus obtained data from stool examination as well as survey study were edited, coded, classified, in different category, tabulated and analyzed. Analysis of data was done on the basis of age, sex, literacy, profession, locality wise, social and cultural aspect of children of the study area.

Thus analyzed data was represented with table, bar, diagram, pie chart and drawing graphs of suitable data. The signifi.cant diference was calculated by ki2 test.

4.8 Limitation of Study

The present work does not include all the people of the total Bhozad area.Only three localities of Bhozad VDC were selected as study area.

Some of unknown parasites reported from this study were also neglected due to lack of identification.

Some of the respondents did not give correct and actual information. Hence, some of data was filled by interviewer herself by observing their surrounding.

The study was focused in the humans who do not have much more information about the knowledge of parasites and possible sources of infections.

CHAPTER-FIVE

RESULT

The study was carried out on the people of Bhozad area. The localities selected for the study purposes are Pragati tole, Kumal Tole and Lama Tole. Out of 300 stool samples, 80 stool samples were collected from Pragati Tole, 120 stool samples from Kumal Tole and remaining 100 stool samples from Lama Tole.

5.1 Result of Stool Examination

The overall intestinal parasitic prevalence was found to be higher in Lama tole (51%), then in Kumal tole (33.33%) and Pragati tole (17.5%), (shown in Table no.1). The overall prevalence of parasites was 35%. The prevalence was higher in female (36.12%) then in the male (33.79%) in the whole of the studied population.

Table No. 1: Showing males and female ratio in different localities

S. N.	Locality	Male			Female			Grand total		
		Total no samples examined	No of positive samples	Per (%)	Total no samples examined	No of positive samples	Per (%)	Total no of samples examined	No of positive samples	Per (%)
1	Pragati Tole	35	5	14.28	45	9	20	80	14	17.5
2	Kumal Tole	65	19	29.23	55	21	38.18	120	40	33.33
3	Lama Tole	45	25	55.55	55	26	47.27	100	51	51
4	Total	145	49	33.7	155	56	36.12	300	105	35

				9						

Out of 300 stool samples, 105 (35%) were found to be positive for intestinal parasites. Among the positive cases, prevalence percentage of intestinal parasites was found to be little higher in females (36.12%) than that of males (33.79%).

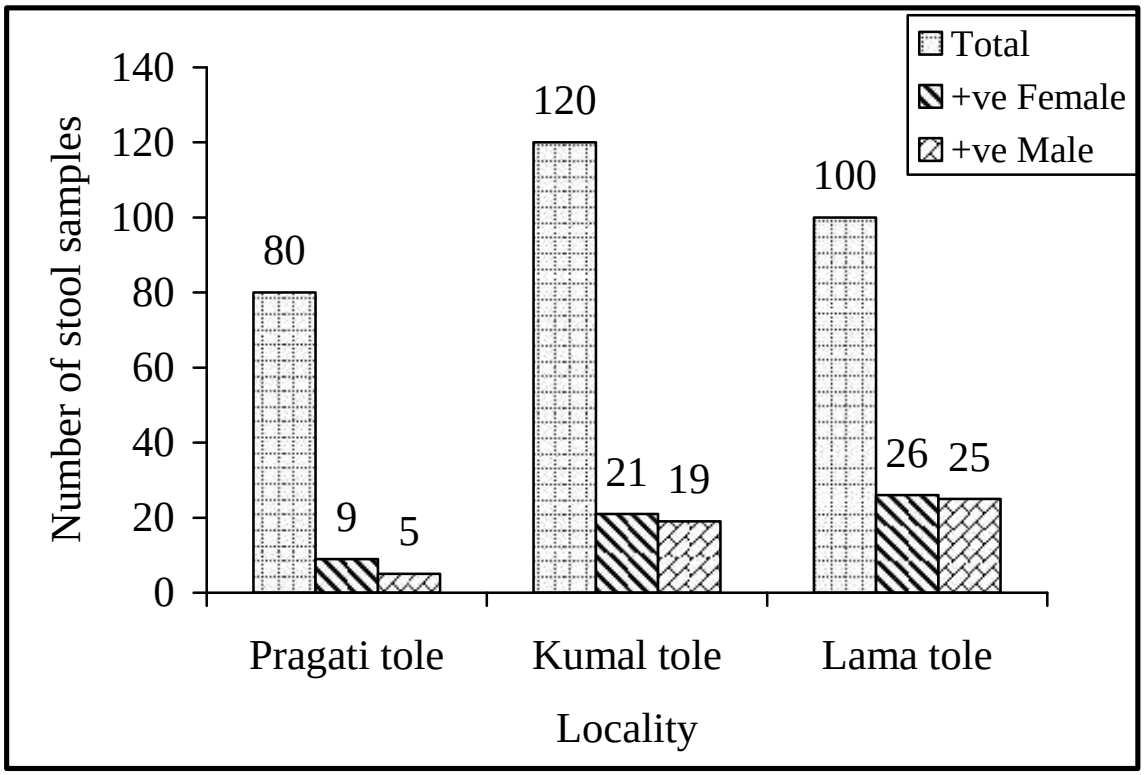


Fig. No. 1: Age and sex-wise prevalence of intestinal parasite

Table No.2 Age and sex-wise Prevalance of Intestinal parasites in Pragati Tole

Age Group (yrs)	Total No. of samples collected and examined			Male			Female		
	Total samples	+ve	Per (%)	Total samples	+ve	Per (%)	Total	+ve	Per (%)
0-5	4	0	0	2	0	0	2	0	0
5-10	8	1	12.5	6	0	0	2	1	50
10-15	10	1	10	4	1	25	6	0	0
15-20	9	3	33.33	3	2	66.66	6	1	16.66
20-25	12	3	25	5	0	0	7	3	42.85
25-30	10	1	10	6	0	0	4	1	25
30-35	8	1	12.5	3	1	33.33	5	0	0
35-40	5	1	20	3	1	33.33	2	0	0
40-45	3	0	0	1	0	0	2	0	0
45-50	2	1	50	0	0	0	2	1	50
55-60	2	1	50	0	0	0	2	1	50
60-65	1	0	0	0	0	0	1	0	0
65-70	2	0	0	1	0	0	1	0	0
Total	80	14	17.5	35	5	14.28	45	9	20

The largest percentage of prevalence of parasite was found in the age groups of 45-49 and 55 -59 years. In which 50% (1 out of 2) people were infected with at least one kind of intestinal parasite. The second largest group was among the age group 15-19 years in which 3 out of 9 (33.33%) were infected. The highest number of stool samples were collected from 20-24. No parasites were detected from the age group of 0-4, 40-44, 60-64 and 65-70. The prevalence rate was not equal in both sexes i.e. out of 35 samples male 5 (14.28%) and out of 45 female samples 9 (20%) was positive with parasites.

Table No.3 Age and sex-wise prevalence of intestinal parasites in Kumal Tole

Age groups	Total no. of samples collected and examine			Male			Female		
	Total	+ve	+ve%	Total	+ve	+ve%	Total	+ve	+ve%
0-5	5	3	60	3	1	33.33	2	2	100
5-10	12	5	41.66	6	2	33.33	6	3	50
10-15	20	7	35	9	4	44.44	11	3	27.27
15-20	11	3	27.27	7	2	28.57	4	1	25
20-25	18	3	16.66	8	1	12.5	10	2	20
25-30	13	5	38.46	7	2	28.57	6	3	50
30-35	10	2	20	5	1	20	5	1	20
35-40	9	4	44.44	6	3	50	3	1	33.33
40-45	6	1	16.66	4	0	0	2	1	50
45-50	4	2	50	3	1	33.33	1	1	100
50-55	5	3	60	3	2	66.66	2	1	50
55-60	3	1	33.33	2	0	0	1	1	100
60-65	3	1	33.33	1	0	0	2	1	50
65-70	1	0	0	1	0	0	0	0	0
Total	120	40	33.33	65	19	29.23	55	21	38.18

Among 120 samples, 65 were from males and remaining 55 samples were from females. The youngest individual in male is 3 years of age while that of female is 4 years of age. The most aged person was 68 years in male and 67 years in female. There was not any sample examined from the age group of 60-65 years of male. The prevalence of parasites was slightly different in male and female among Kumal Tole. The 19 persons (29.23%) of the males and 21 individuals (38.18%) females were found to be positive with one or another type of intestinal parasites.

Table No.4: Age and sex-wise prevalence of parasites in Lama Tole

Age group	Total no. of samples collected and examine			Male			Female		
	Total	+ve	+ve%	Total	+ve	+ve%	Total	+ve	+ve%
0-5	3	1	33.33	1	0	O	2	1	50
5-10	5	2	40	2	1	50	3	1	33.33
10-15	10	5	50	3	2	66.66	7	3	42.85
15-20	15	8	53.33	7	3	42.85	8	5	62.5
20-25	14	7	50	7	3	42.85	7	4	57.14
25-30	14	7	50	5	4	80	9	3	33.33
30-35	7	3	42.85	3	2	66.66	4	1	25
35-40	6	4	66.66	5	4	80	1	0	0
40-45	7	4	57.14	4	2	50	3	2	66.66
45-50	5	3	60	2	1	50	3	2	66.66
50-55	5	3	60	1	1	100	4	2	50
55-60	4	2	50	2	1	50	2	1	50
60-65	3	1	33.33	12	1	50	1	0	0
65-70	2	1	50	1	0	0	1	1	100
Total	100	51	51	45	25	55.55	55	26	47.27

The largest percentage of prevalence of parasite was found in the age group 35-39 years in Lama Tole of Bhojad in which 66.66% (4 out of 6) people were infected with at least one kind of parasite and the second largest was among the age group 45-50 and 50-55 in which 3 out of 5 (60%) were infected . Only two stool samples were collected from the age group 65-75.

Among 100 samples, 45 were from males and remaining 55 samples from females. There was not any sample examined from the age group 65-70 of male similarly no samples were collected from the age group 50-54 and 65-70 years of female. The prevalence of parasites was slightly different in male and female in people of Lama tole. The 25 person

(55.55%) of the males and 26 females (47.27%) were found to be positive with one or another type of intestinal parasites.

Table No.5: Distribution of Specific Intestinal Parasites.

S.N.	Specific parasites	+ve population				Total	Percent
		Male	Percent	Female	Percent		
1	*Entamoeba histolytica*	13	8.96	15	10.34	28	9.33
2	*Giardia lamblia*	9	6.20	11	7.09	20	6.66
3	*Ascaris lmbricoides*	9	6.20	10	6.45	19	6.33
4	*Hymenolepsis nana*	7	4.82	7	4.51	14	4.66
5	*Ancyclostoma duodenale*	5	3.44	8	5.16	13	4.33
6	*Trichuirus trichura*	4	2.75	3	1.93	7	2.33
7	*Strongyloides stercoralis*	2	1.37	2	1.29	4	1.33
	Total	49		56		105	

Total male samples=145, Total female samples=155, Total Samples =300

In three different localities, out of 300 stool samples, 105 stool samples were positive with intestinal parasites. From the protozoan parasites, the most prevalent protozoan parasites was *Entamoeba histolytica* (9.33%) and from the helminth parasites the most common parasite was *Ascaris lumbricoides* (6.33%) and least commonest helminth parasites was *strongyloides stercoralis* (1.33%).

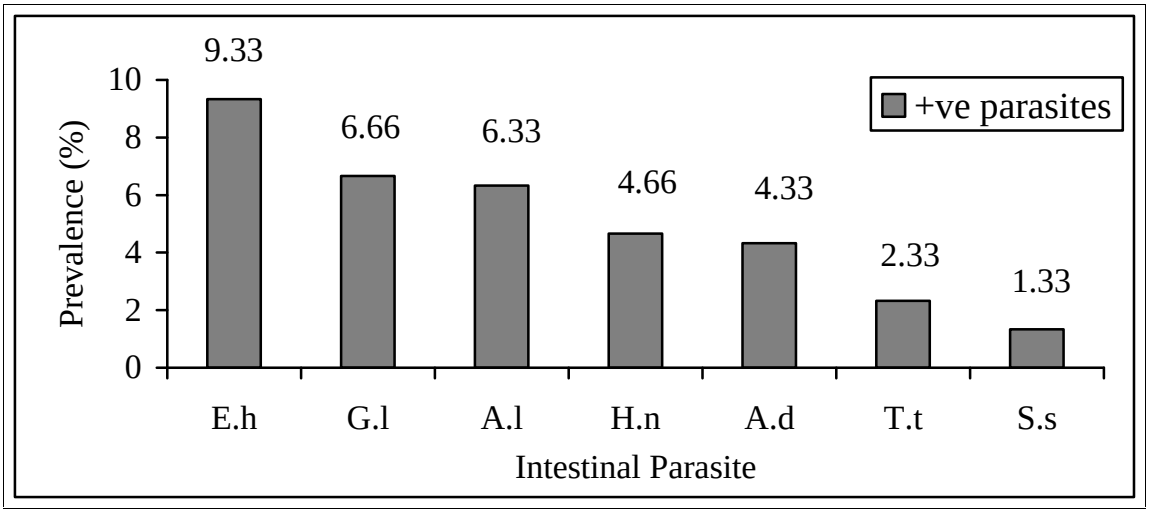


Fig. No. 2: Overall prevalence of intestinal parasites in different localities

Table No.6: Co-infection (Double or more than one infection) in different localities

S.N.	Types of parasites	Total
1.	*Ascaris lumbricoides* and *Entamoeba histolytica*	6
2.	*Entamoeba hhistolytica* and *Giardia lamblia*	1
3.	*Ascaris lumbricoides* and *Hymenolepsis nana*	0
4.	*Hymenolepsis nana* and *Trichuris trichiura*	0
5.	*Strongyloides stercoralis*	0
6.	*Entamoeba histolytica, Hymenolepsis nana, Ascaris lumbricoides* and *Giardia lamblia*	1
Total		8

In different communities, only one case of multi-infection was found, seven cases being double infection. There were six cases in double infection with *Ascaris lumbricoides* and *Entamoeba histolytica* and the multiple infections with *Entamoeba histolytica*, *Hymenolepsis nana, Ascaris lumbricoides* and *Giardia lamblia*

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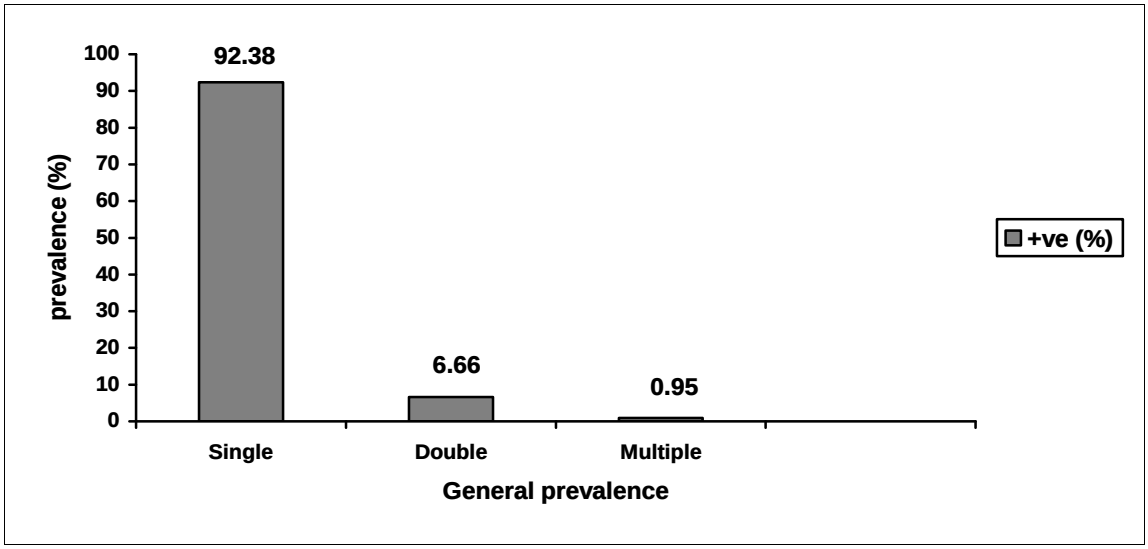

Fig. No.3: General Prevalence of Specific Parasities

Table No.7: Prevalance of specific helminth parasites

S.N.	Parasites	No. of infected male	No. of infected female	Total infected no.	% from total positive cases (57)	% from total samples examine
1	*Ascaris lumbricoides*	9	10	19	33.33	6.33
2	*Trichurus trichura*	4	3	7	12.28	2.33
3	*Hymenolepsis nana*	7	7	14	24.56	4.66
4	*Ancyclostoma duodenale*	5	8	13	22.80	4.33
5	*Strongyloides stercoralis*	2	2	4	7.01	1.33
	Total	27	30	57	100	19.0

Out of 57 samples infected with helminth parasites, the prevalence of specific helminth parasites were *Ascaris lumbricoides* (33.33%), *Trichurus trichura* (12.28%), *Hymenolepsis nana* (24.56%), *Ancyclostoma duodenale* (22.80%) and *Strongyloides stercoralis (7.01%).*

Table No.8: Prevalance of specific protozoan parasites

S.N.	Parasites	No. of infected male	No. of infected female	Total infected no.	% from total positive cases (48)	% from total samples examined (300)
1	*Entamoeba histolytica*	13	15	28	58.33	9.33
2	*Giardia Lamblia*	9	11	20	41.66	6.66
	Total	22	26	48	100	16

During survey, only two specific protozoan parasites were identified. They were *Entamoeba histolytica* (58.33%) and *Giardia lamblia* (41.66%)

Table No. 9: Positvity of different types of intestinal helminthes in different localities

Site	Obs. No.	Positive cases											
		Ascaris lumbricoides		*Trichiuris trichiura*		*Hymenolepsis nana*		*Ancyclostoma duodenale*		Strongyloides stercoralis		**Total**	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Pragati Tole	80	3	3.75	1	1.25	2	2.5	1	1.25	1	1.25	8	10.0
Kumal Tole	120	9	7.5	3	2.5	7	5.83	2	1.66	2	1.66	23	19.16
Lama Tole	100	7	7.0	3	3.0	5	5.0	10	10.0	1	1.0	26	26.0
Total	300	19	6.33	7	2.33	14	4.66	13	4.33	4	1.33	57	19.0

From the stool examination, we found that the prevalence of helminth parasites in three different localities found that the overall prevalence of helminth parasites were found least in Pragati Tole and highest prevalence was found in Lama Tole. Like wise among helminth parasites,

Ascaris lumbricoides (6.33%) were in highest prevalence where as *Strongyloides sercoralis* were fond in least (1.33%) prevalence.

Table No.10: Positivity of different specific protozoan parasites in different localities

Site	Obs. No.	Positive cases					
		Entamoeba histolytica		*Giardia lamblia*		Total	
		No.	%	No.	%	No.	%
Pragati Tole	80	3	3.75	3	3.75	6	7.5
Kumal Tole	120	9	7.5	8	6.66	17	14.16
Lama Tole	100	16	16.0	9	9.0	25	25.0
Total	300	28	9.33	20	6.66	48	16.0

On the basis of survey, it was found that more specific protozoan parasites were *Entamoeba histolytica* and *Giardia lamblia.* The overall prevalence of parasites revealed that *Entamoeba histolytica* was found more prevalent (9.33%) than *Giardia lamblia* (6.66%)

Table No.11: Sex-wise Intensity of infection

S.N.	Sex	Total sample collected	Total positive cases	Single		Double		Multiple	
				No.	%	No.	%	No.	%
1.	Male	145	49	44	89.79	4	8.16	1	2.04
2.	Female	155	56	53	94.64	3	5.35	0	0
	Total	300	105	97	92.38	7	6.66	1	0.95

The above table shows that out of 145 male samples, 44 (89.79%) showed single infection, 4 (8.16%) showed double infection and remaining 1 (2.04%) showed multiple infection. However out of 155 female, 53 (94.64%) shows single infection, 3 (5.35%) showed double infection and no multiple infections of parasites were recorded from female.

Table No.12: Locality wise intensity of infection

S.N.	Locality	Total no. of samples collected	Total no. of positive cases	Single infection		Double infection		Multiple infection	
				No.	%	No.	%	No.	%
1	Pragati Tole	80	14	12	85.7	2	14.3	0	0
2	Kumal Tole	120	40	37	92.5	3	7.5	0	0
3	Lama Tole	100	51	48	94.1	2	3.9	1	2.0
4	Total	300	105	97	92.38	7	6.66	1	0.95

During study period, 300 samples were collected from different localities. Out of 300 samples, 105 samples were positive for intestinal parasites. In which overall prevalence of single infection was 97 (92.38%), 7 (6.66%) showed double infection and remaining 1 (0.95%) shows multiple infection. Pragati Tole and kumal Tole do not show the multiple infection while Lama Tole shows 1 (2.0%) of multiple infection. The maximum single infection was found in Lama Tole while maximum double infection was found in Pragati Tole.

Table No. 13: Parasitic infection in different communities in relation to occupation

Table. No.13.1 Parasitic infection in Pragati tole.

Occupation	Total No. of samples examined	Total No. of positive samples	Per (%)
Student	27	3	11.11
Farmer	25	4	16
Teacher	5	2	40
Health person	2	0	0
Businessman	10	3	30
Driver and others	7	2	28.57
Children <5yrs	4	0	0
Total	80	14	17.5

When collected samples from Pragati Tole were examined according to their occupation. It was found that highest percentage of parasitic infection was found among teachers. Out of 5 teachers, 2(40%) were infected with at least one type of intestinal parasites. But none of the Health workers (among 2 only) were found to be infected with parasite.

Table. No.13.2: Parasitic infection in Kumal Tole

Occupation	Total No of samples examined	Total No. of positive samples	Per (%)
Student	43	8	18.6
Farmer	35	15	42.85
Teacher	16	5	31.25
Health person	1	1	100
Businessman	10	5	50
Driver and others	10	4	40
Children<5yrs	5	2	40
Total		40	33.33

Out of 120 samples were taken from Kumal tole for examination of intestinal parasites. Highest numbers of stool samples were collected from students. However, Highest percentage of parasitic infection was found among health worker, out of 1 (100%) infected with parasites. The prevalence rate was as shown in decreasing order Health worker> businessman>farmer>children <5yrs>driver and others>and students.

Table. No.13.3: Parasitic infection in Lama Tole

Occupation	Total No. of samples examined	Total No. of positive samples	Per (%)
Student	25	14	56
Farmer	47	21	44.68
Teacher	2	1	50
Health person	0	0	0
Businessman	8	6	50
Driver and others	15	8	53.33
Children<5yrs	3	1	33.33
Total	100	51	51

In Lama tole no stool samples were collected from health worker. Highest numbers of samples were collected from farmer however few numbers of samples were collected from children. Highest percentage of parasitic infection was found among students. Out of 25 students 14 (56%) were infected with at least one type of intestinal parasite. In the same way out of 47 samples of farmers, 21 (44.68%) were positive in parasite.

Fig. No. 4: Parasitic infection in different localities in relation to occupation

Table No.14 Prevalence of Parasites on Month wise in Summer Season of 2064 BS (in three different localities)

Month	No. of samples collected	No. of positive samples	Per (%)
Baishak	95	39	41.05
Jestha	81	26	32.09
Asad	59	17	28.81
Shrawan	37	15	40.54
Bhadra	28	8	28.57
Total	300	105	35

During samples collecting, 300 stool samples were collected in the five months of the summer season, Baishak, Jestha, Asad, Shrawan and Bhadra. Maximum numbers of samples were collected in the month of Baisak and least number of samples was collected during Bhadra. Highest percentages of parasites were found in the month of Baisak, however least percentage of parasites were found in the month of Bhadra.

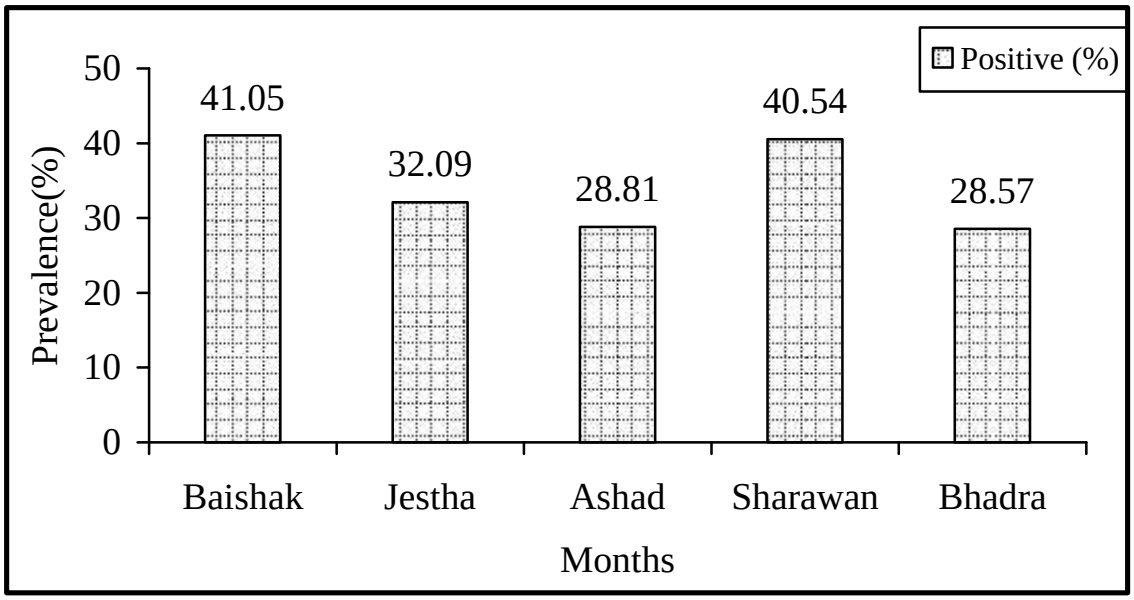

Fig. No. 5: Month- wise prevalence of parasite

Table No.15: Knowledge of Parasites in different Localities

S.N	Locality	Interviewed No.	Aware		Not aware	
1	Pragati Tole	80	57	71.25	23	28.75
2	Kumal Tole	120	39	32.5	81	67.5
3	Lama Tole	100	34	34	66	66
Total		300	130	43.33	170	56.66

Yes/No answer based question i.e. are you aware of intestinal parasitic worms? Most of the people in the Pragati Tole had enough ideas about the parasite and were aware of intestinal parasitic worms i.e. out of 80 samples, 57(71.25%) people were conscious about parasites. On the other hand remaining two localities most of the people do not have even a single idea about the parasites, their mode of transmission. Hence from the total of 300 interviewed people (from Pragati tole, Kumal tole and

Lama tole) only 43.33% were aware of parasitic worms and the rest (56.66%).

Table No.16: Prevalence of Intestinal Parasites on the basis of Sanitary Condition

S.N	Locality	Toilet user			Open Feld			Total		
		Total No. of samples examined	No. of positive samples	Per (%)	Total No. of sample examined	No. of positive samples	Per (%)	Total no of samples	No. of positive samples	Per (%)
1	Pragati Tole	76	11	14.47	4	3	75	80	14	17.5
2	Kumal Tole	37	18	48.64	83	22	26.50	120	40	33.33
3	Lama Tole	28	9	32.14	72	42	58.33	100	51	51
	Total	141	38	26.95	159	67	42.13	300	105	35

The analysis of questionnaire, showed that almost of people in Pragati tole used toilet for safe disposal of latrine (i.e. out of 80 people, 76 (95%) were used toilet. However others two localities like Kumal tole and Lama tole (situated near the jungle) most of people do not have toilet and like to defecate open field and bushes near jungle.

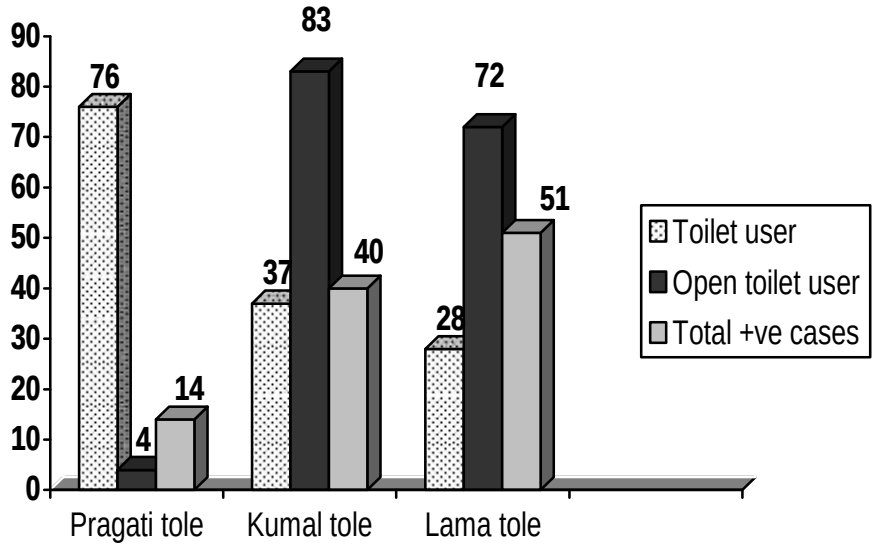

Fig. No.6: Sanitary condition in localities

Table No.17: Prevalence of Intestinal Parasites according to Nail cutting Habit

S.N.	Category	No. of respondents		Result obtained from stool examination	
		Number	Per (%)	No. of positive samples	Per (%)
1	Once a week	62	20.66	17	16.19
2	Once a month	74	24.66	31	29.52
3	Randomly	89	29.66	38	36.19
4	Never cutting (biting)	75	25	19	18.09
Total		300	150	105	52.5

The analytical study of the table shows that out of 300 respondents 20.66% cut their nails once a week. 24.66% cut their nail once a month and 29.66% cut their nails randomly while remaining 25% never cut their nails however most of them bite their nails to keep short. Respondents who cut their nail randomly are more (36.19%) affected. However those who cut their nails once a week show least (16.19%) affected.

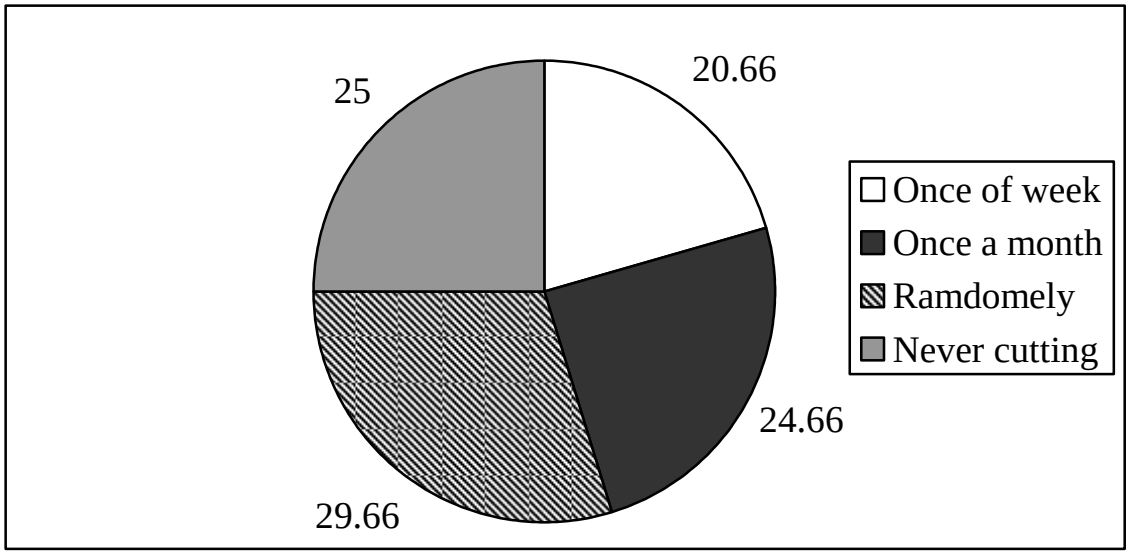

Fig. No. 7: People's view about cutting nails

Table No.18: Prevalence of Intestinal Parasites according to method of cleaning hands

S.N.	Category	No. of respondents		Result obtained from stool examination	
		Number	Per (%)	No. of positive samples	Per (%)
1	Water only	80	26.66	56	53.33
2	Water and Ashes	73	24.33	17	16.19
3	Water and Soap	34	11.33	6	5.71
4	Mud and water	51	17	10	9.552
5	All of above	62	20.66	16	15.23
	Total	300	150	105	52.5

From the above table, it is revealed that maximum prevalence was recorded from those respondents who used only water to clean hands for various purposes such as cooking, before meal, after meal, after defecation, after playing, after working in field etc. Similarly, least prevalence was recorded from those respondents who used water and soap for washing hands.

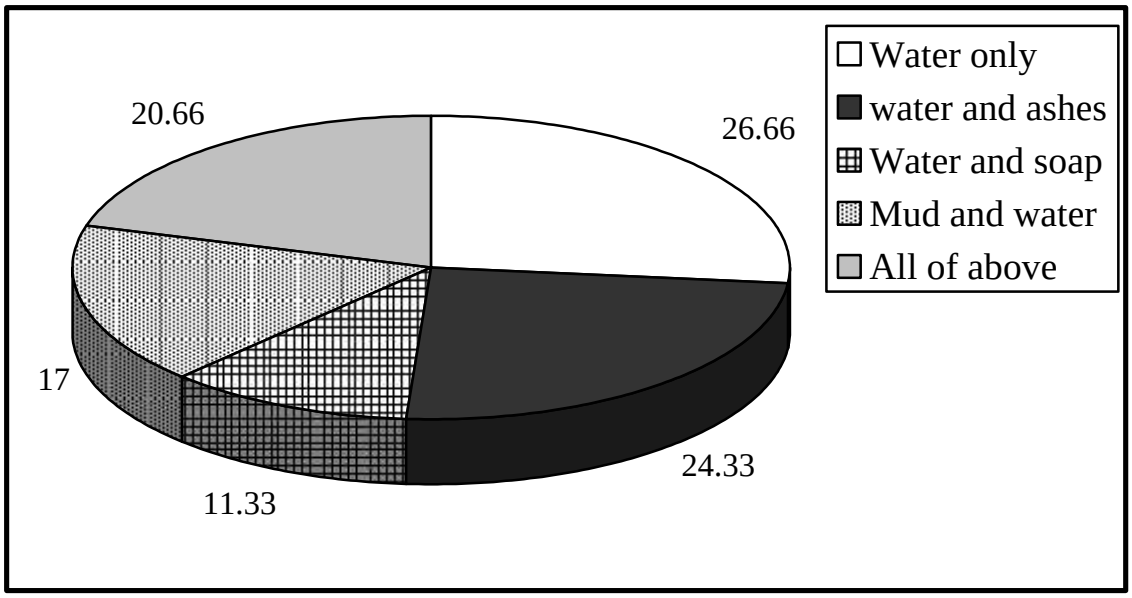

Fig. No. 8: Method of cleaning hands by respondents

Table No.19: Prevalence of intestinal parasites according to food type.

S. N.	Locality	Vegetarian		Non-vegetarian		Total		
		No. of respondents	No. of positive cases	No. of respondents	No. of positive cases	Total samples examined	Total no. of positive samples	Per (%)
1	Pragati tole	30	4	50	10	80	14	17.5
2	Kumal tole	41	13	79	27	120	40	33.33
3	Lama tole	29	9	71	42	100	51	51
	Total	100	26	200	79	300	105	35

On the basis of survey, in three different localities of Bhozad, Bharatpur, Most of the people were non-vegetarian and they mostly consume the meat of the mutton, buff, chicken, pork, chauri, badel and so on. Out of 100 vegetarian, 26 (26%) were infected. Likewise out of 200 non-vegetarian, 79 (39.5%) were infected with at least one kind of parasites

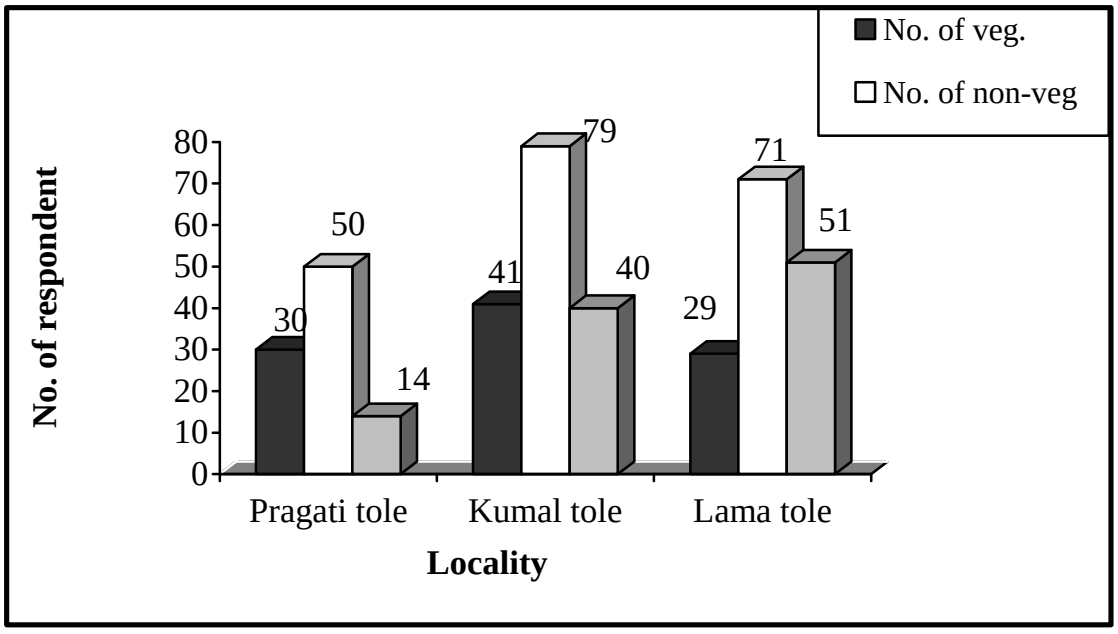

Fig.No. 9:- Vegetarian and Non-vegetarian in three localities.

Table No.20: Caste-wise prevalence of intestinal parasites

S.N.	Caste	Total no of sample examine	No. of positive samples	Per (%)
1	Brahman and chatteri	90	20	22.22
2	Lama and Gurung	71	25	35.21
3	Kumal and Newar	63	23	36.5
4	Damai and Rai	44	27	61.36
5	Other	32	10	31.25
	Total	300	105	35

When study was carried out for the analysis of intestinal parasites on the basis of their caste, showed that highest prevalence of parasites were found among Damai and Rai. Out of 44 samples, 27 (61.36%) were positive. The least prevalence was that of Brahman and Chettri people having 22.22% i.e. out of 90 samples, 20 samples were found to be positive for intestinal parasites.

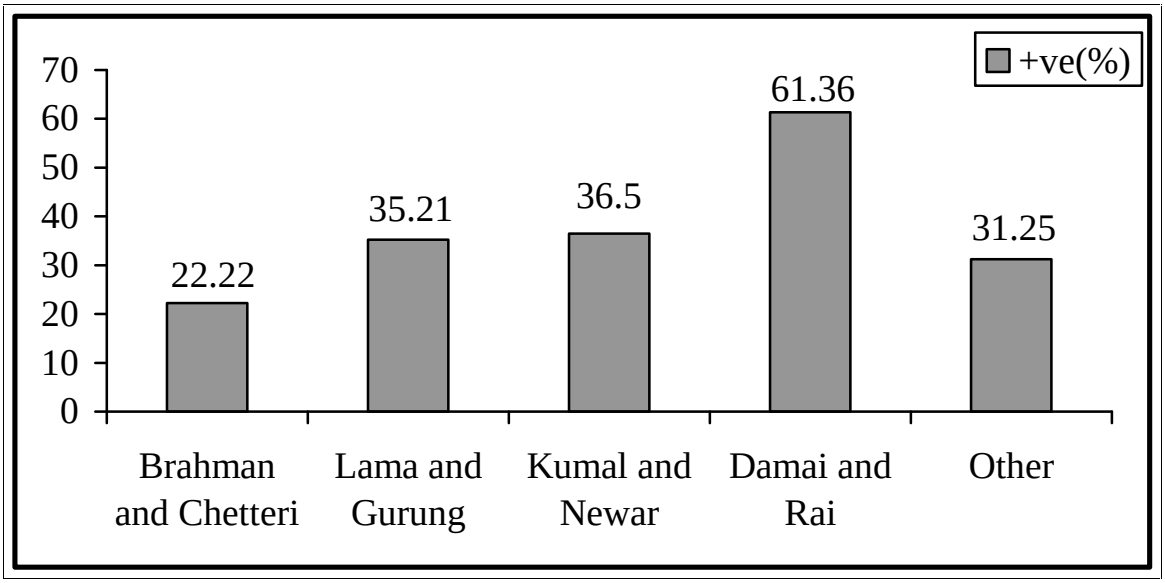

Fig. No.10:- Caste- wise prevalence of intestinal parasites

Table No.21: Prevalence of parasites in relation to literacy in different localities

S.N.	Locality	Total samples collected	Literate			Illiterate		
			Total	+ve	Per(%)	Total	+ve	Per(%)
1	Pragati Tole	80	30	4	13.33	50	10	20
2	Kumal Tole	120	41	13	31.70	79	27	34.17
3	Lama Tole	100	47	17	36.17	53	34	64.15
Total		300	118	34	28.81	182	71	39.01

Out of 300 people in different localities, 118 people were literate and 182 people were illiterate. Out of 118, 34 people (28.81%) and out of 182, 71 people (39.01%) people were infected with at least one type of intestinal parasites.

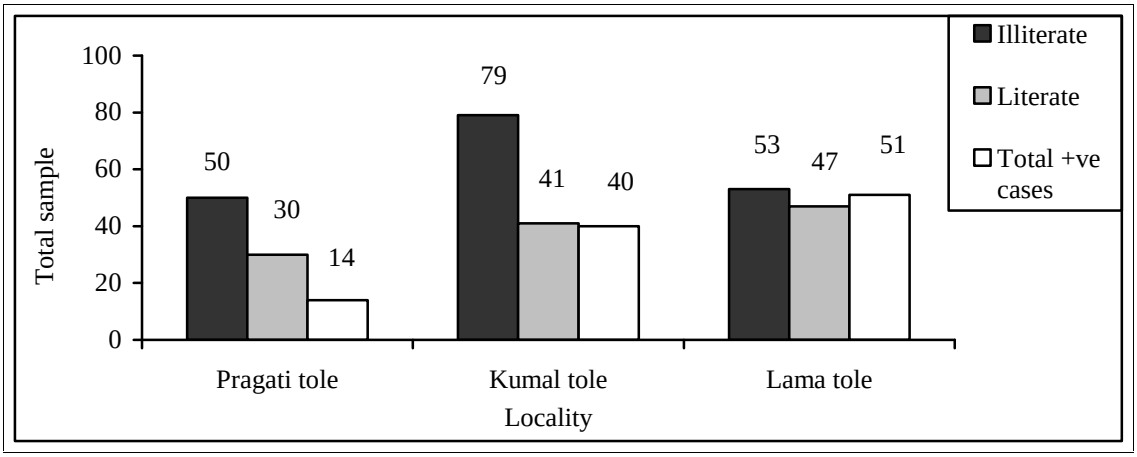

Fig. No.11:- Literacy condition in three localities

CHAPTER-SIX

DISCUSSION AND CONCLUSION

The gastro-intestinal parasites of human are cosmopolitan in distribution. These parasites are responsible for various parasitic diseases. These diseases are ranked among 20 most fatal infection in Tropical countries of Asia, Africa, and Latin America in 1977-1978 (Davis A, 1980). However parasites mostly cause serious health problem in developing countries as Nepal, Where illiteracy, ignorance, poverty are interlocked, owing to their uniquity and despite their high rate of infections in these countries, physicians and public health authorities show little interest in their control (WHO,1981). *Ascaris lumbricoides*, *Trichuris trichiura* and hookworms are the major helminthes parasites where as *Giardia lamblia and Entamoeba histolytica* are the major protozoan parasites (Warren and Mahimoud 1984, Walsh 1984).

Roundworm infects about 1×10^8 people and kill 20,000 people per year. Hookworm infect about 9×10^8 people and kill 60,000 people per year, Amoeba infect 4×10^8 people and kill 30,000 people per year, 2×10^8 people get infected by *Giardia* and 5×10^7 people from tapeworm and 50,000 died per year (WHO, 1984). Almost 4.8% of people died due to

cholera and diarrhea in Nepal (CBS-2002). Mortality due to intestinal parasites has always been an important public health problem in tropical region (Sherchand *et al.,* 1996). The importance of intestinal parasite thus can be judged by the great surveillance rate among the population of the world and amount of money spent for curative and preventive measures against these parasites.

The present study revealed that 35% of the people were infected by different kinds of intestinal parasites. This prevalence was lower than those reported in other studies as 87.5%, Sharma *et al*., 1971., Nepal *et al.,* 1980, 89%, IFPPCP, 1985, 67.4% Gupta et al., 1988, 81.9%, Shrestha, 2001, 76.4%, Rai *et al.,* 2001, 60%, Rai *et al.,* 2002, 76.6%, Chaudhari R, 2004, 66.9%, Karki *et al.,* 2004, 77.1%. Parajuli R, 2004, 67.4%, Ghimire *et al.,* 2006 in different areas .In presents study this positivity (35%) contain seven kinds of intestinal parasites. These are *Entamoeba histolytica* (58.33%), *Giardia lamblia* (41.66%), *Ascaris lumbricoides* (33.33%), *Trichuris trichiura* (12.28%), *Ancyclostoma duodenale* (22.80%), *Hymenolepsis nana* (24.56%) and *strongyloides stercoralis* (7.01%). These parasites were also reported by Parajuli, R.P. (2004) in Chitwan Chaudhary, B. (2004) in rural area of Kirtipur, Sherchand *et al.,* (1994) in rural areas of Southern Nepal, Gianotti (1993) in Solukhumbu. In such study, the prevalence rate of intestinal parasites infections in female was slightly higher than male. The result of this study was similar to various study conducted by parasitologists in different time, Rai *et al.,* (1991). Taisoon *et al.,* (1992) also brought same result. This might due to daily kitchen activities, usual contact with infected with infected soil, water, food and faeces, low immunity and low illiteracy.

Regarding the helminthes parasites, several previous studies have shown that hookworm was the most common helminthes infection in Nepal

(Esteven *et al.,* 1983, Navisky *et al.,* 1998). A few other studied reported that *Ascaris lumbricoides* is the most common intestinal helminthes parasite in Nepal (Suguri *et al.,* 1985, I.F.P.P.C.A. 1985, Geollman 1986, Gianotti 1993, Chhetri 1997, Rai *et al.,* 1997, Rai *et al.,* 1999, Rai *et al.,* 2001, Chaudhary (2004). The present study also provided the similar result that *Ascaris lumbricoides* was the most prevalent helminthes parasite (33.33%) followed by *H.nana* (24.56%). *A.duodenale* (22.80), *T.trichiura* (12.28%) and *S.stercoralis* (7.01%). This study coincides with Maharjan K.(2004) and Gupta *et al*., (1988) in Kirtipur, where the prevalence of *A.lumbricoides* was found to be most (40%) in Gupta *et al.,* (1988) and 24.04% in Maharjan K. (2004). However, this study does not coincide with some previous study conducted by various parasitologist in Nepal. The study conducted by

Al Maldani *et al.,* 1995 on female housekeepers in Abha district, Saudi Arabia, that had revealed that *Trichuris trichura* was most common parasite. Similar result obtained by Menon (1997) in school aged children in the city of Abidjan, Toma, A. (1999) in Indonesia.

In case of protozoan parasites, the prevalence of *E.histolytica* was the highest (58.33%) followed by *G.lamblia* (41.66%), which resembles with the finding of Sharma and Tuladhar (1971), Nepal and Palfy (1980), Geollman (1988) Sherchand *et al.,* (1997), Parajuli, R. (2004). According to Geollman's finding in Patan Hospital during 1986-1987, the prevalence rate of *E.histolytica* 2.7% and G.lamblia 2.1%. Nepal and Palfy (1980) also reported that *E.histolytica* (28.8%) was the most common protozoan parasite followed by *G.lamblia* (28.4%) in Nepal. Similarly Sharma and Tuladhar (1971), Parajuli, R. (2004) showed that *E.histolytica* was most common protozoan parasite followed by *G. lamblia* in Nepal. However, a few other studied revealed that *G. lamblia* is the most common protozoan parasite. Sherchand *et al.,* (1997) and

Chaudhary (2003) Maharjan K (2004). Reported 9.9% *G.intestinalis*, 7.2% *E.histolytica* while Chaudhary found 11.4% *G.intestinalis* 8.8% of *E.histolytica* and then Maharjan K. (2004) found 19.55% *G.lamblia* 7.69% *E.histolytica*. Likewise, the present study also different from the study carried by Sherchand *et al.,* (2005) according to whom cyclosporiasis was found to be 16% and 22% but pecked in June and decline there after. In recent years, the parasitic protozoan *C.cayetanesis* and *C. parvum* has emerged as an important human pathogen that cases enteric diseases with protracted diarrhea in both immuno-compromised and immuno-component host. The prevalence of helminthes infection (19%) was the highest than protozoan infection (16%) among intestinal parasites. According to WHO, infection by soil-transmitted helmlinth has been increasingly recognized as an important public health problem, particularly in developing countries. This finding also resembles with the result of Shrestha (2004) carried out in the urban area of Lalitpur district and Sukra Raj Tropical and Infections Diseases Hospital Teku, Kathmandu. In this study, helminth infection was also higher than protozoan.

Fujita *et al.,* (1993) carried out an epidemiological survey for parasitic infection. Parasites were detected in 270 faecal samples, 57.4% of these specimens showed single infection, 28.9% showed double, 9.6% triple, 4.1% quadrupal and 0.4% quintupal infection. Likewise, Parajuli R.P. (2004) reported 32.8%. Single infection, 21.9% double infection and 45.3% multiple infection from Malpur VDC of Chitwan district. But in the present study, there were 12.31% single infection, 6.66% double infection and 0.95% multiple infection. In single species infection, *Ascaris lumbricoides* and *E. histolytica* were found to be the most dominant helminth and protozoan parasites respectively. Where as the double infection was fond to be combination of *E. histolytica* and *G.*

lamblia. In multiple infections the most prevalent parasites were *E. histolytica*, *H. nana*, *A.lumbricoides* and *G. lamblia.* Prevalence were significantly related to economic status, education, housing conditions, drinking water and their personal hygiene which is supported by De Silva *et al.*, (1996). People with power in economic condition had more prevalence of intestinal parasites. This is because , people with low economic status spend less money for food and drinking that may lead to malnutrition with respective increase of parasitic infections which are supported by Loewenson *et al.*, (1986) and Culting(1986).

Among the different ethnic castes, Damai and Rai had the highest prevalence (61.36%) followed by other castes. Congested housing condition, lack of education and insufficient sanitary facilities may also help in transmission of parasites, which is supported by Sorensen *et al.*, (1996). But the study carried by Jha A. (2004) showed that there was great variation in the types of helminth parasitic infection in three ethnic group in which highest in Pode (66.1%) and lowest in Brahman (3.84%).

On the other hand, analysis of surveillance data shows that out of 80 people of Pragati Tole, 71.25% were aware of the parasitic worms. However in Kumal Tole and Lama Tole out of 120 and 100 people, only 32.5% and 34% were aware about parasitic worms. This results shows that people of both areas lacks proper knowledge of parasites. However, Altogether (43.33%) people were aware of parasitic worms. While analyzing the awareness about intestinal worms among Magars of Teendobate V.D.C., (2000) reported 26.22% awareness. Moreover, The World Health Organization noted that human behaviors may influence the prevalence and intensity of intestinal infection (1981). So the human behaviors such as open air defecation and cultural practices such as growing vegetables in faecally polluted gardens were all found to be contributing factors in transmission of parasites. Polluted water, infected

or raw meat, bare footed is also facilities for the transmission of parasites (Sherchand *et al.*, 1997).

Regarding Literacy Condition Surveillance study revealed that among 300 interviewed. 118 people were literate (39.33%) and 182 people (60.66%) people were illiterate. Out of 118, 34 (28.81%) people and out of 182, 71 (39.01) people were infected with at least one kind of parasites. This literacy has also play very important role in awareness of population regarding health and hygiene. Males were found to be more literate than female. Due to high illiteracy; most of the people do not have enough knowledge towards sanitation.

Regarding the sanitary condition of study area only (47%) people were found to be using pit toilet. While remaining (53%) people used open field for defecation, which is responsible for contamination of soil, water, air and vegetables. Which play vital role for the parasitic infestation. In fact, the infections are not only due to unhygienic condition and poor sanitation but most of the people in Bhojad area spending conservative life so they believe in Dhami and Jhskri due to which they finally victimized by different types of viral, bacterial, protozoan and helminthic infection. On the other hand, during study period, it was found that most of the people keep their domestic animals very close to their dwelling, sometimes inside their own room too. Majority of people keep different domestic animals like buffalo, cow, goat, dog, cat, ox, pigs, hens etc. As we know, these domestic animals serves as the primary or reservoir host of certain intestinal parasites and also are responsible for unhygienic conditions which accelerate the survival and breeding of various vectors. These vectors help for the transmission of parasites. Not only this, but also these factors i.e. domestic animals and vectors help to transmit the zoonotic diseases among people.

Regarding people's food habit prevalence of intestinal parasite is directly affected by feeding habit of people. In present study among 300 people, 200 were non-vegetarians and 100 were vegetarian. Among them 79 (39.5%) non-vegetarian and 26 (26%) vegetarian were found positive to intestinal parasites. This present study, showed that there was significant difference in prevalence of parasites in vegetarian and non-vegetarian (χ^2_{cal}=5.33,
$\chi^2_{cal}>\chi^2_{0.05}$ at 2 d.f). This study revealed higher prevalence rate in non-vegetarian than vegetarian. According to Chaudhry (2003), there was not significant difference in prevalence of parasites in vegetarian and non-vegetarian. Besides, Maharjan K.P (2004) showed that distribution of intestinal parasite is independent on food habit.

During surveillance study, it was found that majority of people 89 (26.66%) did not cut their nails regularly. However 20.66% cut their nails regularly i.e. once a week. Remaining respondents 74 (24.66%) cut once a month. Moreover, 75 (25%) never cut their nails but they bite their nails to keep short, this practice mostly helped in acceleration of transmission of parasites. This is because; long nails provide the settlement for the egg or larval stage of the parasites. So that highest prevalence of parasites (36.19%) was recorded from those respondents, who cut their nails randomly while least prevalence (16.19%) was from those respondents who cut their nails once a week.

Regarding the behaviors of washing hands, only 34 (11.33%) properly wash their hands with soap and water after every occasion such as defecation, working in field, playing in dust and before meal. While remaining 73 (24.33%) used water and ashes to wash their hands. However 80 (26.66%) used only water for washing hands. This practice also facilities for the transmission of parasites and parasitic diseases. From the survey and stool examination, it was revealed that maximum

prevalence i.e. (53.33%) was recorded from those respondents who used only water to clean hand where as least prevalence i.e. (5.71%) was recorded from those who used soap and water to wash their hands. According to Otsen *et al*., (2001) household without soap had a 2.6 times higher risk of being infected with parasites. Most of the people in Kumal Tole and Lama Tole, eat raw vegetables and fruits by rubbing on their clothes. Likewise, most of them also built their dwelling near the jungle.

Infection of intestinal parasites is not associated with occupation (χ^2_{cal}= 6.41). $\chi^2_{cal}<\chi^2_{tab}$, 0.05, 6 d.f). However, farmer, agricultural and businessman were highly infected with different types of intestinal parasites. This is due to usual outdoor activities like working in field and with livestock contact with infected soil, water and faeces and lack of knowledge about personal hygiene. This is because protozoan is generally water borne, soil borne and food borne diseases. Like wise students were also suffered from the intestinal parasites during their study period and working in field.

Public health problem especially in human infection caused by intestinal helminth parasites had been observed in various countries.

Bangs *et al.,* (1966) examined to determine the prevalence of intestinal parasites in an indigenous highland community in the Oksibil valley of Ivan, Jaya, Indonesia.

Prevalance of intestinal parasites increased with age up to 6-15 years, then decreased slightly into adulthood.

Likewise Sherchand *et al.,* (1997) showed that the parasitic infection was the highest (30.81%) in the age group 6-9 years.

However in the present study, the result is quite different i.e. highest prevalence (54.54%) was found in 45-50 years of age group. The high prevalence can be explained on the basis of the poor health and sanitation, lack of education, low nutritional value, most time spending in

field and low immune power. The minimum prevalence was observed in the age of 65-70 years.

Sharma (1965) examined the stool samples of patients from Bhaktapur. The result showed that 32% male, 44% female and 49% of children were infected giving an overall incidence of 40%.

The climatic environmental conditions and human customs favor the prevalence of a particular helminth. Craig and Faust (1970) reported that in warm and moist climates, infection with several intestinal parasites is encountered in a large proportion of individuals in the population of individuals in the population. In communities with high incidence of multiple infections the clinical and public health aspects are complex, requiring careful evaluation of the clinical picture and multiple methods of attacks to reduce the prevalence of the parasites in the individuals and the community.

Under the favorable circumstances, helminthes may develop in epidemic proportions or may provide a serious chronic public health problem for native populations. In communities with high incidence of multiple infections the clinical and public health aspects are complex, such as malnutrition, retardation in child growth, other symptoms associated with both larval and adult stage includes pneumonities, asthma, diarrhea, nausea, vomiting, abdominal pain and anorexia.

Likewise, there are different castes in community. Each cast has their typical traditions and cultures. Which may also be responsible for prevalence of intestinal parasites? Most of the castres like Gurung, Kumal, Newar, Tamang, Lama mainly consume the meat of buff. They prepare different varities of meat like Kachila, Chowela, Sekuwa, Chhengula etc with out proper cooking. Moreover, traditional activities like animals sacrifice and consumption of their meat without proper meat inspection is also responsible for the parasitic diseases. During survey,

people were given various information and ideas about the parasites, their mode of transmission, their hazardous effect and methods of their control and prevention. Like wise, most of the parents were suggested do not allow their children to play in dust and also suggested them to examine the stool in the interval of every six month.

So, timely control measures should be undertaken otherwise the situation might be out of control to such an extend that both man and animals may become suffered with zoonotic disease as well as other transmissible disease as well as other transmissible diseases which will be beyond our reach.

CHAPTER-SEVEN
RECOMMENDATIONS

The recommendations for effective control of intestinal parasites among people in Bhozad area.

1. There is a need for educating people about public health and sanitary condition of the community.
2. Defecating habits of people near water sources, backyard, pig shelter and open field should be avoided and human night soil should be managed properly.
3. Awareness programmers should be run so that they could know about parasitic infections or mode of transmission among the people of Bhozad because most of the people are illiterate and economically poor.
4. Public health education should be included in the school curriculum as compulsory.
5. The municipality should encourage the local health workers to make people aware.
6. Soil- pollution should be prevented by proper disposal of sewage and household products and disinfection of contaminated soil.
7. Well established sanitary toilet should be built up each and every home.
8. Consumption of unwashed fruits and vegetables and washing with contaminated water should be prevented.
9. There must be the provision for slaughter houses and process of the meat inspection with proper enforcement.
10. People should be taught about the effect of consumption of improperly cooked meat.

11. Avoiding walking barefoot and use gloves during working on farms to prevent soil transmitted helminthes.
12. Regular health checked up and stool checked should be done free of cost and medicine should be given with subsidized price.
13. Advertising, as to prevent the parasitic infections, should be introduced through hands-outs, billboards, leaflets, papers etc.
14. People should be provided the knowledge about use of filtered or boiled or chemically treated water for drinking purpose.
15. Health worker should be trained to make them familiar with newly emerging parasites.
16. Animal husbandry should be managed by lunching training programmed.
17. The research work on the prevalence of intestinal parasites and preventation should be encouraged.

ABSTRACT

Baseline household survey was carried out with prepared questionnaire to investigate the presence of intestinal parasites in people living in Bhojad area. For that, samples were collected from different localities. Altogether 300 stool samples of different age groups and sexes of people were collected. In the present study, out of 300 stool samples 105 (35%) were infected with at least one kind of intestinal parasites. Among the 80 stool samples of Pragati Tole collected, 17.5% of them among 120 stool samples from the Kumal Tole, (33.33%) and among 100 stool samples from the Lama Tole (51%).During examination it was found that people were found infected with seven (7) different kinds of intestinal parasites. *Entamoeba histolytica* was the most commonly found intestinal parasites (9.33%), followed by *Giardia lamblia (6.66*%), *Ascaris lumbricoides* (6.33%), *Hymenolepsis nana* (4.66%), *Ancyclostomata duodenale* (4.33%), *Trichurus trichura* (2.33%) and *Strongyloides stercoralis* (1.33%). The prevalence rate of intestinal parasitic infection in female was found to be slightly higher (36.12%) than male (33.79%) without statistical significance (χ^2= 0.178 χ^2cal <χ^2 0.05 at 1 df). Out of 105 positive stool samples 92.38% showed single infection 6.66%, double infection and 1% multiple infection. In single species infection *Entamoeba histolytica* and *Ascaris lumbricoides* were found to be most dominant helminthes and protozoan parasites respectively. In Bhojad area, the prevalence of intestinal parasites was found highest in the people who lack the knowledge about parasites and their effects. Likewise, the high prevalence rate was associated with open field defecation,

occupation, sanitary condition, used of contaminated water and poor personal prophylaxis.

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ANNEX-1

HYPOTHESIS TESTING

1. IN RELATION TO SEX AND POSITIVITY OF INTESTINAL PARASITES

Contingency Table of Sex and Positivity of Intestinal Parasites

S.N	Sex	No. of positive samples	No. of negative samples	Total
1	Male	49	96	145
2	Female	56	99	155
Total		105	195	300

Formulation of Hypothesis:

Null Hypothesis: Ho-Intestinal parasites positivity is independent on sex

Alternative Hypothesis: Hi-Intestinal parasites positivity dependent on sex.

Level of significance is taken as 5%

Degree of freedom (d.f)= (r-1) (c-1)

= (2-1) (2-1)

=1

Test statistic

Where $\chi^2 = \sum(O-E)^2/E$

Computation of Expected frequency

S.N.	Sex	Expected (positive)	Expected (negative)	Total
1	Male	50.76	94.25	145

2	Female	54.25	100.75	155

Computation of χ^2

S.N.	Observed frequency(O)	Expected frequency (E)	(O-E)	$(O-E)^2$	$(O-E)^2/E$
1	49	50.76	-1.76	3.09	0.06
2	56	54.25	1.75	3.06	0.056
3	96	94.25	1.75	3.06	0.032
4	99	100.75	-1.75	3.06	0.03
$\sum(O-E)^2/E=0.178$					

Calculated value of $\chi^2$for 1 d.f at 5% level of significance is (3.841). Since calculated value of χ^2 (0.178) is less then the tabulated value of χ^2 (3.841) for 1 d.f at 5% level significance. Hence null hypothesis is accepted i.e intestinal parasites is independent on sexes.

2. IN RELATION TO AGE AND POSITIVITY OF INTESTINAL PARASITES

Contigency Table of age group and positivity of parasites.

S.N.	Age Group(Years)	No. of positive samples	No. of negative samples	Total
1	0-5	4	8	12
2	5-10	8	17	25
3	10-15	13	27	40
4	15-20	14	21	35
5	20-25	13	31	44
6	25-30	13	24	37
7	30-35	6	19	25
8	35-40	9	11	20
9	40-45	5	11	16
10	45-50	6	5	11

11	50-55	7	7	14
12	55-60	4	5	9
13	60-65	2	5	7
14	65-70	1	4	5
Total		105	195	300

Formulation of Hypothesis

Null Hypothesis:- H0: Intestinal parasites positivity is independent on age.

Alternative Hypothesis:-Hi: Intestinal parasites positivity is dependent on age

Level of significance is taken as 5%

Degree of freedom (r-1) (c-1)

= (14-1-10)

= 3

Test statistic:-χ^2

Where $\chi^2=\sum(O-E)^2/E)$

Computation of Expected Frequency

S.N.	Age group	Expected frequency (positive)	Expected frequency (negative)	Total
1	0-5	4.2	7.8	12.0
2	5-10	8.75	16.25	25.0
3	10-15	14.0	26.0	40
4	15-20	12.25	22.75	35
5	20-25	15.4	28.6	44
6	25-30	12.95	24.05	37
7	30-35	8.75	16.25	25
8	35-40	7.0	13.0	20
9	40-45	5.6	10.4	16
10	45-50	3.85	7.15	11

11	50-55	4.9	9.1	14
12	55-60	3.15	5.85	9
13	60-65	2.45	4.55	7
14	65-70	1.75	3.25	5

Computation of χ^2

S.N.	Observed frequency(O)	Expected frequency(E)	(O-E)	$(O-E)^2$	$(O-E)^2/E$
1	4	4.2	-0.2	0.04	0.009
2	8	8.75	-0.75	0.56	0.06
3	13	14	-1	1	0.07
4	14	12.25	1.75	3.06	0.25
5	13	15.4	-2.4	5.76	0.37
6	13	12.95	0.05	0.0025	0.00019
7	6	8.75	-2.75	7.56	0.86
8	9	7	2	4	0.57
9	5	5.6	0.6	0.36	0.06
10	6	3.85	2.15	4.62	1.2
11	7	4.9	2.1	4.41	0.9
12	4	3.15	0.85	0.72	0.22
13	2	2.45	-0.45	0.2	0.08
14	1	1.75	-0.75	0.56	0.32
15	8	7.8	0.2	0.04	0.005
16	17	16.25	0.75	0.56	0.03
17	27	26	1	1	0.03
18	21	22.75	1.75	3.06	0.13
19	31	28.6	2.4	5.76	0.2
20	24	24.05	-0.05	0.0025	0.001
21	19	16.25	2.75	7.56	0.46
22	11	13	-2	4	0.3
23	11	10.4	0.6	0.36	0.03
24	5	7.15	-2.15	4.62	0.64
25	7	9.1	-2.1	4.41	0.48
26	5	5.85	-0.85	0.72	0.12
27	5	4.55	0.45	0.2	0.04
28	4	3.25	0.75	0.56	0.17
					$\sum(O-E)^2/E$ =

8.004

Here, calculated value of χ^2=8.004. Here degree of freedom=d.f= 3.

The tabulated value of χ^2 for 3 d.f at 5 % level of significance is 7.82. Since calculated value of χ^2(8.004) is greater than tabulated value of χ^2= 7.82. Hence it is significant and null hypothesis is rejected i.e is distribution of intestinal parasites dependent of age groups.

3. INRELATION TO LITERACY AND POSITIVITY OF INTESTINAL PARASITES.

Contingency Table of Literacy and Positivity of Intestinal parasites.

S.N.	Literacy	Positive Samples	Negative Samples	Total
1	Literate	34	84	118
2	Illiterate	71	111	182
	Total	105	195	300

Formulation of Hypothesis:

Null Hypothesis-Ho:-Intestinal parasites positivity is independent on literacy.

Alternative Hypothesis-Hi: Intestinal parasites positivity is dependent on literacy Level of significance is taken as 5%.

Degree of freedom (d.f) =(r-1) (c-1)

= (2-1) (2-1)

= 1

Computation of Expected frequency.

S.N.	Literacy	Expected frequency(positive)	Expected frequency(negative)	Total

1	Literate	41.3	76.7	118
2	Illiterate	63.7	118.3	182

Test statistic:-χ^2

Where $\chi^2 = \sum(O-E)^2/E$

S.N.	Observed frequency(O)	Expected frequency(E)	(O-E)	$(O-E)^2$	$(O-E)/^2E$
1	31	41.3	-7.3	53.23	1.29
2	71	63.7	7.3	53.29	0.83
3	84	76.7	7.3	53.29	0.69
4	111	118.3	-7.3	53.29	0.45
$\sum(O-E)^2/E=3.26$					

Calculated value ofχ^2=3.26. Here degree of freedom=1. The tabulated value of χ^2 for 1 d.f at 5% level of significance is 3.26 which is less than tabulated value of χ^2 (3.84), which is insignificant and null hypoyhesis is accepted i.e. distribution of parasites is independent on literacy.

4. IN RELATION TO OCCUPATION AND POSITIVITY OF INTESTINAL PARASITES

S.N.	Occupation	No. of positive samples	No. of negative samples	Total
1	Student	25	70	95
2	Farmer	40	67	107
3	Teacher	8	15	23
4	Health Person	1	2	3

5	Businessman	14	14	28
6	Driver and others	12	18	30
7	Children<5yrs	5	9	14
	Total	105	195	300

Formulation of Hypothesis

Null Hypothesis-Ho:-Intestinal parasites posivity is independent on occupation.

Alternative Hypothesis-H1:-Intestinal parasites positivity dependent on occupation.

Level of significance taken as 5%

Degree of freedom (d.f) =(r-1) (c-1)

= (7-1) (2-1)

=6

Computation of Expected frequency.

S.N.	Occupation	Expected frequency (positive)	Expected frequency (negative)	Total
1	Student	33.25	61.75	95
2	Farmer	37.45	69.55	107
3	Teacher	8.05	14.95	23
4	Health Person	1.05	1.95	3
5	Businessman	9.8	18.2	28
6	Driver and other	10.5	19.5	30
7	Children<5yrs	4.9	9.1	14

Computation of χ^2

S.N.	Observed frequency(O)	Expected frequency(E)	(O-E)	$(O-E)^2$	$(O-E)^2/E$
1	25	33.25	-8.25	68.06	2.04
2	40	37.45	2.55	6.5	0.17
3	8	8.05	0.05	0.0025	0.0003
4	1	1.05	0.05	0.0025	0.002
5	14	9.8	4.2	17.64	1.8
6	12	10.5	1.5	2.25	0.21
7	5	4.9	0.1	0.01	0.002
8	70	61.75	8.25	68.06	1.1
9	67	69.55	-2.55	6.5	0.09
10	15	14.95	0.05	0.0025	0.00016
11	2	1.95	0.05	0.0025	0.0012
12	14	18.2	-4.2	17.64	0.96
13	18	19.5	-1.5	2.25	0.038
14	9	9.1	-0.1	0.01	0.001
$\Sigma(O-E)^2/E)=6.41$					

Calculated value of $\chi^2=6.41$. Here degree of freedom=d.f=6

The tabulated value of χ^2 for 6 d.f. at 5% level of significance (12.59). Since calculated value of χ^2 is less then tabulated value. Hence it is highly insignificant and null hypothesis is accepted i.e. distribution of parasites is independent on occupation.

5. IN RELATION TO SANITARY CONDITION AND POSITIVITY OF INTESTINAL PARASITES.

Contigency table of sanitary condition and positivity of intestinal parasites.

S.N.	Sanitary condition	No. of positive samples	No. of negative samples	Total
1	Toilet user	38	103	141
2	Open field	67	92	159
	Total	105	195	300

Formulation of Hypothesis:-

Null Hypothesis:-Ho-Intestinal parasites positivity is independent on sanitary conditions.

Alternative Hypothesis:-Hi- Intestinal parasites positivity is dependent on sanitary condition

Level of significance taken as 5%

Degree of freedom (d.f) =(r-1) (c-1)

= (2-1) (2-1)

= 1

Test statistic: - χ^2

Where $\chi^2 = \Sigma(O-E)^2/E)$

S.N.	Observed frequency (O)	Expected frequency (E)	(O-E)	$(O-E)^2$	$(O-E)^2/E$
1	38	49.35	-11.35	128.82	2.61
2	67	55.65	11.35	128.82	2.31

3	103	91.65	11.35	128.82	1.4
4	92	103.35	-11.35	128.82	1.24
					Σ(O-E)²⁄E)=7.56

Calculated value of $\chi^2=7.56$

Degree of freedom=d.f=1

The tabulated value of χ^2 for 1 d.f at 5% level of significance is (3.84). Since, calculated value of χ^2 is (7.56) which is greater than tabulated value for 1 d.f at 5% of level of significance, it is significant and hence null hypothesis is rejected i.e distribution of intestinal parasites is dependent on sanitary condition.

7. IN RELATION TO FOOD HABIT AND POSIVITY OF INTESTINAL PARASITES.

Contigency table of food habit and posivity of parasites.

S.N.	Food Habit	Positive samples	Negative samples	Total
1	Vegetarian	26	74	100
2	Non-vegetarian	79	121	200
	Total	105	195	300

Formulation of Hypothesis:

Null Hypothesis-Ho: - Intestinal parasites positivity is independent on food habit.

Alternative Hypothesis- Hi: - Intestinal parasites positivity is dependent on food .

Level of significance is taken as 5%

Degree of freedom (d.f) = (r-1) (c-1)

= (2-1) (2-1)

=1

Test statistic: χ^2

Where $\chi^2 = \Sigma (O-E)^2/E)$

S.N.	Observed frequency(O)	Expected frequency(E)	O-E	$(O-E)^2$	$(O-E)^2/E)$
1	26	35	-9	81	2.31
2	79	70	9	81	1.15
3	74	65	9	81	1.24
4	121	130	-9	81	1.62
					$\Sigma(O-E)^2/E$ =5.32

Calculated value of $\chi^2 = 2.25$, here degree of freedom, d.f =1

The tabulated value of χ^2 for 1 d.f at 5% level of significance is 3.841.

Since, calculated value of χ^2 is 5.32 which is greater than tabulated value of χ^2 (3.841) for 1 d.f at 5% level of significance, it is significant and hence null hypothesis is rejected i.e distribution of parasites is dependent on food habit.

QUESTIONAIRRE

S.N……..
DATE:……

1.Name of the respondent:
Address: District:
Tole:
2.Age:

3.Sex:
a.Male( ) b.Female( )

4.Marital status:
a.Married( ) b.Unmarried( )

5.Education:
a.Literate( ) b.Illiterate( )

6.Occupation:
a.Student( ) b.Farmer( )
c.Teacher( ) d.Others( )

7.Sanitary condition:
a.Toilet user( ) b.Open field( )

8.Nail cutting habit:
a.Once a week( ) b.Once a month( )
c.Randomly( ) d.Never cutting( )

9.Method of cleaning hands:
a.Water only( ) b.Water and ashes( )
c.Water and soap( ) d.Mud( )

10.Food type:
a.Vegetarian( ) b.Non-vegetarian( )

11.Knowledge about parasites:
a.Well known( ) b.Little known( )
c.Completely unknown( )