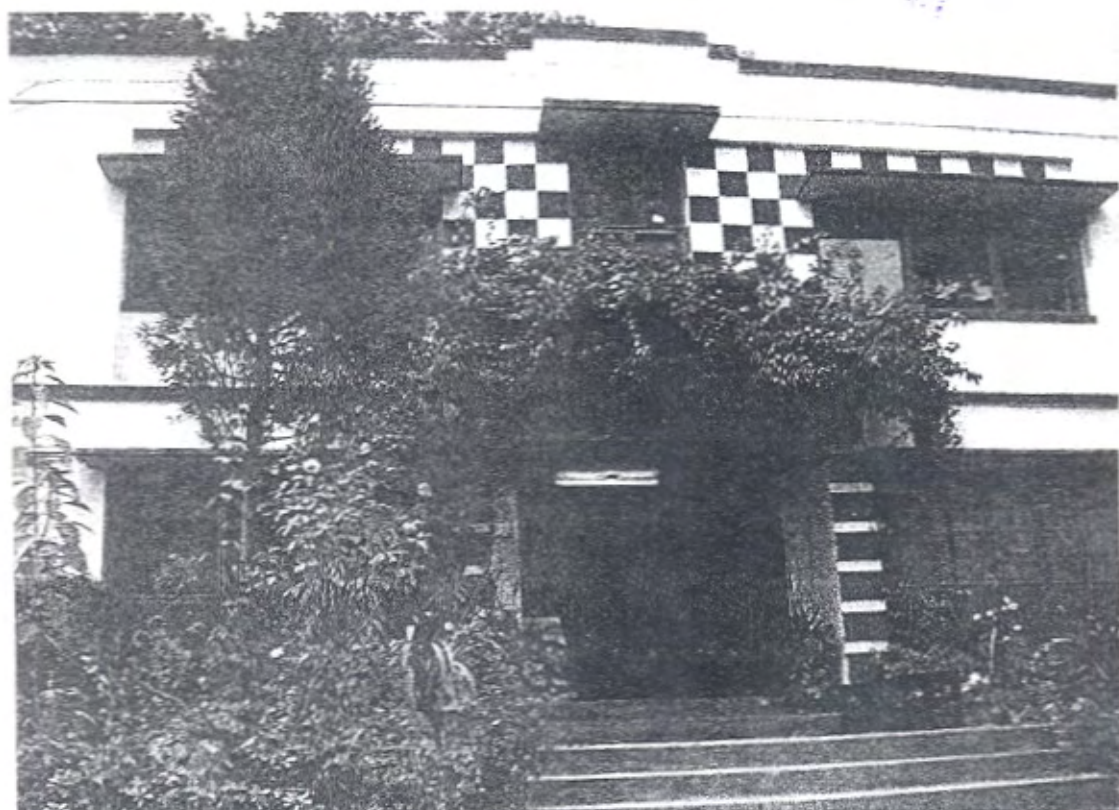


INTESTINAL PARASITIC INFECTIONS IN LEPROSY
PATIENTS AND NON- LEPROSY PEOPLE OF
ANANDABAN LEPROSY HOSPITAL,
TIKABHAIRAV, LALITPUR,
NEPAL

NHRC Library

Accession No. 121

Call No.



A THESIS
SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER IN SCIENCE
IN ZOOLOGY (PARASITOLOGY)

BY
DIPAK GUPTA



TO
CENTRAL DEPARTMENT OF ZOOLOGY
INSTITUTE OF SCIENCE AND TECHNOLOGY
TRIBHUVAN UNIVERSITY, KIRTIPUR,
KATHMANDU, NEPAL,
2002.



LIBRARY
RECOMMENDATION

NHRC Library

Accession No. 121

Call No.

It is our pleasure to certify that **Mr. Dipak Gupta** has completed his dissertation work entitled "*Intestinal Parasitic Infections in Leprosy Patients & Non-leprosy People of Anandaban Leprosy Hospital, Tikabhairav, Lalitapur*" as a partial fulfillment of M. Sc. degree in Zoology (Parasitology) under our guidance and supervision. It is his original work and brings out useful results and findings in the concerned field. To our knowledge his work has not been submitted to any other degree.

We strongly recommend this dissertation for approval for the Master's degree in Zoology.

Co-Supervisor

Dr. Murdo Macdonald

Head, Mycobacterial

Research Laboratories

Anandaban Leprosy Hospital

Lalitpur.

Date :- 9/3/03

Supervisor

Dr. Ranjana Gupta

Associate Professor

Central Department of Zoology,

T.U. Kirtipur, Kathmadu.

Date :- 6.3.2003



Central Department
T. U.

LETTER OF APPROVAL

On the recommendation of Supervisor **Dr. Ranjana Gupta** and Co-supervisor **Dr. Murdo Macdonald**, this dissertation of Mr. Dipak Gupta is approved for examination and is submitted to the Tribhuvan University in partial fulfillment of the requirement for Master's Degree of Science in Zoology.

Prof. Dr. Tej Kumar Shrestha
Head, The Central Department of Zoology,
T.U. Kirtipur, Kathmandu, Nepal.
Date :- 3rd July 2003.

Head

Central Dept. of Zoology
T. U. Kirtipur.



NHRC Library

Accession No. 121

Call No.

ACCEPTANCE CERTIFICATE

This dissertation work presented by **Mr. Dipak Gupta** entitled "*Intestinal Parasitic Infections in Leprosy Patients & Non-leprosy People of Anandaban Leprosy Hospital, Tikabhairav, Lalitpur*" has been accepted in the partial fulfillment of the requirements for the degree of Master of Science in Zoology (Parasitology).

Expert committee:

Head of Department
Prof. Dr. Tej Kumar Shrestha

External Examiner

Dr. Mahesh Shal

Supervisor (Internal Examiner)
Asso. Prof. Dr. Ranjana Gupta,

Co-Supervisor
Dr. Murdo Macdonald
Head, Mycobacterial Research Laboratories

Date:- 03rd July 2003

ACKNOWLEDGEMENT

I would like to express my honorable and deep respect to supervisor Dr. Ranjana Gupta, Associate Professor, Central Department of Zoology, T.U. Kirtipur, and Co-Supervisor Dr. Murdo Macdonald, Head of Mycobacterial Research Laboratories, Anandaban Leprosy Hospital, Lalitpur, for their noble guidance and well supervision, I could complete the present work.

I am grateful to Prof. Dr. T. K. Shrestha, Head of the Department and former Head Prof. S. B. Karki for providing facilities required for this assignment. I express my thanks to my respected teachers and staff of Central Dept. of Zoology, TU.

It is pleasure to acknowledge Mycobacterial Research Laboratories, Anandaban Leprosy Hospital for providing equipments and other facilities. I would like to acknowledge my gratitude to all the staff of Anandaban Leprosy Hospital (ALH) especially my sincere thanks are offered to Mr. Kapil Neupane, who helped me during my work.

I am thankful to Dr. H. N. Gupta, Medical Officer, T.U. Health Center Kirtipur for providing me lab facilities.

My special thanks to Dr. Kamal Gyawali, Former Member Secretary, Nepal Health Research Council for financial support and approval letter of the dissertation. I am thankful to Er. Binod Kumar Upadhyay, Director, Cottage & Small Industries Training Center, Tripureshwor for providing me computer facilities.

I am thankful to my brother Bimal Gupta, Hari Shankar Shah and all my friends for their encouragement in the present study.

I would like to express my gratitude to my honorable parents for their kind hearted support and inspiration in my whole academic carrier.

Dipak Gupta
T.U. Examination Roll. No:-0259
T.U. Registration No:- 35068-94
Batch:- 056-58

ABSTRACT

A hospital based study on intestinal parasites was carried out in leprosy patients and non-leprosy people of Anandaban Leprosy Hospital (ALH) to determine the intestinal parasitic infections. Surveillance study was conducted through prepared questionnaire of 280 leprosy patients and non-leprosy people (i.e. attendants of the leprosy patients and general patients visiting ALH & Leprosy Clinic, Patan Hospital) from August 2001 to June 2002. The total 280 stool samples of different age-groups and sex of leprosy patients & non-leprosy people were collected and examined by faecal smear preparation method and flotation method.

Out of 280 stool samples examined (150 samples of leprosy patients and 130 samples of non-leprosy people), the overall prevalence of intestinal (protozoan and helminthes) parasites was 47.5%. The prevalence of Hookworm was 26.78%, *A. lumbricoides* 23%, *E. histolytica* 12.5%, *Taenia* sps. 11%, *Giardia* sps. 2.5%, *H. nana* 2.5%, *T. trichiura* 4% & *E. coli* 1%. Out of 280 stool samples examined the intestinal parasitic infections was observed higher in leprosy patients (57%) than in non-leprosy people (36%). However, statistically the significant difference was found in infection rate between leprosy patients & non-leprosy people ($\chi^2=4.798$, $P>0.05$). In leprosy patients, males were found to be more infected (59%) with intestinal parasites than that of females (54%). Similarly in non-leprosy people, females were more infected (46%) than males (33%). Altogether the parasitic load was found higher in females (51%) when compared to that of males (46%). But statistically the difference was found to be not significant ($\chi^2=0.187$, $P < 0.05$).

Regarding the distribution of parasitic infection in different age groups viz., 0-10, 10-20, 20-30, 30-40, 40-50, 50-60, and 60 years above, the infection rate was 40%(2), 44%(7), 35%(17), 43%(23), 46% (30), 53%(23) and 63%(31) respectively. The highest positivity of intestinal parasite was encountered in the age-group 60 years above (i.e. 63%).

The surveillance study of 280 persons belonging to two groups, leprosy patients & non-leprosy people of Anandaban Leprosy Hospital revealed that 36% of them were literate. Regarding the personal hygiene and sanitary conditions of these two groups, 52% of non-leprosy people and only 28% of leprosy patients were using safe toilet. Similarly, 36% non-leprosy people and 9% leprosy patients were aware of the intestinal parasites.

The high prevalence of intestinal parasites is an indication of unhygienic condition of the area, which is due to human behavior, walking barefoot, poor sanitary conditions, illiteracy & lack of awareness. The contributing factors are responsible for transmitting geo-helminths (soil-nematodes), faeco-orally transmitted parasites and water born-parasites. Health education is advised to play a vital role in the control of intestinal parasitic infections.

CONTENTS

ABBREVIATION	i
LIST OF TABLES	ii
LIST OF GRAPH FIGURES	iii
LIST OF PHOTOGRAPHS	iv
LIST OF MAP	iv
I INTRODUCTION	1-4
II AIMS AND OBJECTIVES	5
III LITERATURE REVIEW	6-15
❖ Landmarks of Review of Literature of intestinal parasites	6
❖ Landmarks of Human Intestinal Parasites of Nepal	13
IV METHODOLOGY	16-19
❖ Study Area	16
❖ Leprosy Services	16
❖ General Medical Services	16
❖ Stool Sample Collection	17
❖ Questionnaire Study	17
❖ Examination of Stool Samples	18
❖ Microscopical Examination of the Stool	18
(a) Smear Preparation	18
(b) Concentration Method	19

V RESULTS

NHRC Library
Accession No. 121
Call No.



20-33

❖ Questionnaire Survey

20

(A) Result based on Questionnaire

1. Literacy response among Leprosy Patients & Non-leprosy people 20
2. Sanitary Condition among Leprosy & Non-leprosy people 21
3. Knowledge of Parasites 22
4. Knowledge of Mode of Transmission of Parasites 23
5. Food habit in Leprosy Patients and Non-leprosy People 23
6. Occupation of Interviewed Leprosy Patients and Non-leprosy People 24
7. Water Supply among Leprosy Patients and Non-leprosy people 25
8. Treatment Method of Intestinal Parasitic Infection in
Leprosy Patients and Non-leprosy People 26

(B) Laboratory Diagnosed Stool Test

General Prevalence of Intestinal Protozoon & Helminth Parasites 27

1. Group-wise Prevalence 27
2. Sex-wise Prevalence 28
3. Sex-wise Prevalence of Intestinal Parasites in Leprosy
Patients & Non-leprosy people 29
4. Age-group wise Prevalence of Intestinal Parasites among
Leprosy Patients & Non-leprosy People 30
5. Infection Rate of Specific Intestinal Parasites 31
6. Group-wise Prevalence of Specific Intestinal Parasites 32
7. Single or Concurrent Infection of Intestinal Parasites in Leprosy
Patients & Non-leprosy People 33

VI DISCUSSION AND CONCLUSION 34-40

VII RECOMMENDATION 41

VIII REFERENCES 42-47

IX ANNEXES 48-50

- ❖ Questionnaire Paper 48
- ❖ Consent-form 49
- ❖ Approval Letter from Nepal Health Research Council 50

ABBREVIATION

ALH	=	Anandaban Leprosy Hospital
CMI	=	Cell Mediated Immunity
TT	=	Tuberculoid
BT	=	Borderline Tuberculoid
BB	=	Mid borderline
BL	=	Borderline Lepromatous
LL	=	Lepromatous Leprosy
PB	=	Paucibacillary
MB	=	Multibacillary
WHO	=	World Health Organization
MRL	=	Mycobacterial Research Laboratories
TLMI	=	The Leprosy Mission International

LIST OF TABLES

1. Percentage of literate/ illiterate people in the interviewed leprosy patients & non-leprosy people.
2. Sanitary condition regarding use of toilet among leprosy patients & non-leprosy people.
3. Knowledge of intestinal parasites in leprosy patients and non-leprosy people.
4. Knowledge of mode of transmission of intestinal parasites in leprosy patients & non-leprosy people.
5. Food Habit in leprosy patients & non-leprosy people.
6. Occupation of interviewed leprosy patients & non-leprosy people.
7. Water supply among leprosy patients & non-leprosy people.
8. Treatment method of parasitic infections in leprosy patients & non-leprosy people.
9. Group-wise prevalence of intestinal parasites in leprosy patients & non-leprosy people.
10. Sex-wise prevalence of intestinal parasites.
11. Sex-wise prevalence of intestinal parasites in leprosy patients & non-leprosy people.
12. Distribution of intestinal parasites in different age-groups in leprosy patients and non-leprosy people.
13. Prevalence of specific intestinal parasites.
14. Positivity of different types of intestinal parasites in leprosy patients & non-leprosy people.
15. Single or concurrent infection of intestinal parasites in leprosy patients & non-leprosy people.

LIST OF GRAPH FIGURES

1. Representation of Literate / illiterate response among leprosy patients & non-leprosy people.
2. Representation of Toilet user in leprosy patients & non-leprosy people.
3. Representation of Knowledge of intestinal parasites among leprosy patients & non-leprosy people.
4. Representation of Food habit in leprosy patients & non-leprosy people.
5. Representation of Occupation of interviewed leprosy patients & non-leprosy people.
6. Representation of Water Supply in leprosy patients & non-leprosy people
7. Representation of Treatment method of intestinal parasites in leprosy patients & non-leprosy people.
8. Representation of Group-wise prevalence of intestinal parasites.
9. Representation of Sex-wise prevalence of intestinal parasites.
10. Representation of Sex-wise prevalence of intestinal parasites in leprosy patients & non-leprosy people.
11. Representation of Prevalence of intestinal parasites of different age-groups in leprosy patients & non-leprosy people.
12. Representation of Prevalence of Specific intestinal parasites.
13. Representation of Positivity of different types of intestinal parasites in leprosy patients & non-leprosy people.
14. Representation of Single or concurrent infection of intestinal parasites in leprosy patients & non-leprosy people.

LIST OF PHOTOGRAPHS

NHRC Library
Accession No. 121
Call No.



1. Anandaban Leprosy Hospital.
2. Leprosy Patients of Anandaban Leprosy Hospital.
3. Consent-form being signed by Non-leprosy People.
4. Consent-form being signed by Leprosy Patients.
5. Interview with Leprosy Patients.
6. Interview with Non-leprosy People.
7. Cyst of *Entamoeba coli*.
8. Cyst of *Entamoeba histolytica*.
9. Cyst of *Giardia sps.*
10. Ovum of Hookworm.
11. Ovum of *Ascaris lumbricoides*.
12. Ovum of *Trichuris trichiura*.
13. Ovum of *Taenia sps.*
14. Ovum of *Hymenolepis nana*.

LIST OF MAP

1. Map of Central Region showing Anandaban Leprosy Hospital.

INTRODUCTION

Good health is an integral part of human well-being. Although the loss of good health is inherently unpredictable, human behavior at the individual and societal levels profoundly influences the incidence of disease.

The parasites that are actually or potentially pathogenic to humans, defined broadly to include sub-cellular, unicellular and multi-cellular organisms such as viruses, bacteria, fungi, protozoa, helminth & arthropods.

Nepal, like in most of third world countries is characterized by poverty, ignorance, illiteracy and diseases. No country is free from parasitic disease, so also it is very difficult to find parasite free man and animals.

Parasites are organisms that victimize other living organisms causing several dreadful and fatal diseases. Parasitic disease often lead to severe consequences with direct or indirect loss of national or global economy.

Parasitic diseases play a vital role in the human health of the country. Like other developing countries, people of Nepal are more susceptible to parasitic diseases due to unhygienic management practices, poor sanitation, low socio-economic condition and lack of knowledge about parasites. Hence, it has become difficult to eradicate parasitic diseases. The heavy infection of parasites effect on growth of the host bringing emaciation, weakness and death.

Parasitic infection contributes directly to malnutrition and malnutrition reduces the resistance or immunity to parasitic infections. The host resistance, malnourished population living in poor sanitary conditions are more susceptible to parasitic diseases than are healthy, well nourished population.

Leprosy (Hansen's disease), one of the oldest disease of mankind, is still afflicting millions of patients in many parts of the third world today mainly South-East Asia and Central Africa.

Leprosy remains one of the main public health problems in Nepal. At the end of the year 2001, Nepal still ranked amongst the top 6 countries in the world as far as prevalence and detection rate are concerned (Annual report, ALH, 2001).

It is a chronic infectious disease caused by bacteria, *Mycobacterium leprae*. The causative agent was discovered in 1873 by the bacteriologist, G. Armauer Hansen, in skin biopsies of Leprosy patient at Bergen in Norway. *Mycobacterium leprae* is the first identified microbial pathogen of man.

M. leprae has not yet been cultured in vitro (Thangaraj and Yawalkar, 1988). Early recognition of the organism as a *Mycobacterium* was based on its acid fastness, morphology associated with granulomatous lesions. *M. leprae* is an obligate intracellular bacillus multiplying in the skin and peripheral nerves. Leprosy is the most complex and the most chronic of all human bacterial diseases. Leprosy develops after many years of incubation period with *M. leprae*.

Ridley and Jopling divided leprosy, which is based on the immunological condition of the patients into following five types :-

(I) Tuberculoid leprosy (TT): It is found in patients with high degree of resistance where Cell Mediated Immunity (CMI) is intact. The skin lesions of Tuberculoid leprosy is usually single, may be reddish or brownish. This type is bacteriologically negative in routine. Slit-skin smear examination and lepromin test is highly positive (Thangaraj and Yawalkar, 1988).

(II) Borderline tuberculoid leprosy (BT): Skin lesions are few, usually well demarcated. The no. of lesions are greater than in TT, up to 10 or 20 or more. Lesions are comparatively larger. It is paucibacillary and the bacterial index in skin lesion is nil or 1+. Lepromin test is weakly positive (Thangaraj & Yawalkar, 1988).

(III) Mid-borderline leprosy (BB): There is a characteristic lesion with 'punched out' appearance. Peripheral nerve damage is widespread and asymmetrical. Multibacillary, bacterial index in skin lesion is 2+ or 3+ and the lepromin test is negative (Thangaraj & Yawalkar, 1988).

(IV) Borderline lepromatous leprosy (BL): Skin lesions are many, roughly symmetrical, shiny macules, papules, nodules and plaques with sloping edge. Peripheral nerve damage is widespread and less asymmetrical. Multibacillary,

bacterial index in skin lesion is 4+ and the lepromin test is negative (Thangaraj & Yawalkar, 1988).

(V) Lepromatous Leprosy (LL): It is a generalized form of the disease and found in individuals where the host resistance is low (deficient CMI). Nodular skin lesions on face, ear lobes, hands, feet and less commonly on trunk. Many peripheral nerves are symmetrically affected. *M. leprae* is present in large number in skin lesions and in mucosa of nose. Hair is lost in all skin lesions, especially on the face, loss of eyelashes and eyebrows, a condition called madarosis.

Lepromatous leprosy is more bacilliform & infectious than other types. Slit-skin smear is always positive and lepromin test is negative due to deficient Cell Mediated Immunity (CMI).

Leprosy patients are said to be more infected with intestinal parasites than non-leprosy people because in lepromatous leprosy (LL) there is lack of cell mediated immunity against leprosy. Therefore in lepromatous leprosy, the body is unable to put up resistance against the disease.

The skin is very good protective coat. Healthy skin does not permit the entry of germs except through cuts or injuries (Thangaraj, 1988). Leprosy patients are more susceptible to different types of parasitic infections having abraded skin, nodular skin lesions on face, ear lobes, hands, feet and less commonly on trunk; compared to a non-leprosy people.

The most recent statistics on registered and new cases reported at country level, published by WHO in January 2002 showed totals of 597, 232 registered cases and 719,330 new cases detected during the year 2002. The global prevalence of registered leprosy cases is now slightly below 1 per 10,000 (March 2002, International Journal of Leprosy).

As in many other endemic countries, there is a wide variation in the prevalence of leprosy in different areas of Nepal. In 2001, the overall leprosy prevalence rate in Nepal was 6.4/10,000. The report recently published by His Majesty's Government of Nepal shows that 89,245 individuals have completed a course of treatment for leprosy. At the same time 15,056 individuals are under going treatment for the disease. The number of leprosy patients in the Central Development Region under treatment was 4181 cases (Annual Report - 2001, ALH).

Parasitic diseases contribute to the total morbidity in a community especially in the developing countries. In Nepal, health status is also dominated and badly affected by the parasitic diseases overshadowing due to the low socio-economic condition, food hygiene and sanitation of the people (Sherchand, 1997).

Like other developing countries, intestinal parasitic infections are major health problem in Nepal. Intestinal parasitic infection is very much prevalent in different areas of Nepal [Rai and Gurung (1986), Gupta (1988), Rai *et al.* (1991), Sherchand (1997), Navitsky *et al.* (1998), Rai (2000), Pradhan (2001) & Rai *et al.* (2001)].

The high prevalence of intestinal parasite is an indication of human behaviour walking bare foot, poor sanitary condition, illiteracy and lack of awareness and less immunity power due to illness.

It is also assumed that leprosy patients are badly affected by parasitic infection. Most of the people affected by leprosy are poverty stricken. Weakness in hands and feet reduces the ability to work. Deteriorating physical conditions leave him behind in the competitive world.

As no work has been done regarding the intestinal parasitic infection in leprosy patients of Nepal, an attempt has been undertaken to study the present topic entitled "Intestinal Parasitic Infections in Leprosy Patients and Non-leprosy People of Anandaban Leprosy Hospital, Lalitpur". This comparative study will help to find out the prevalence rate of intestinal parasitic infection in leprosy patients.

II

AIMS & OBJECTIVES

The study has been taken with following aims and objectives:

(a) General objective

To study the prevalence of intestinal parasitic infection among leprosy patients and non-leprosy people (i.e. attendants of leprosy patients and general patients visiting ALH and Leprosy Clinic, Patan Hospital) visiting Anandaban Leprosy Hospital.

(b) Specific objectives

- (i) to determine the prevalence of different intestinal parasites in the leprosy patients and non-leprosy people.
- (ii) to analyze the susceptibility of intestinal parasites with relation to various age-groups in leprosy patients and non-leprosy people.
- (iii) to determine the prevalence of intestinal parasite regarding the ethnic and socio-economic condition of the leprosy patients.
- (iv) to compare the health and educational status of leprosy patients and non-leprosy people through questionnaire.
- (v) to develop the recommendations for further planning regarding control of the intestinal parasites.

III

LITERATURE REVIEW

Landmarks of Review of literature of intestinal parasites

Up to the middle of the 17th century, the knowledge of parasitology was limited to the recognition of external parasites i.e. lice, fleas and some internal parasites as roundworm, tapeworm and pinworms. However, they were thought to be the natural products of human bodies.

In the later half of 17th century, father of parasitology Francesco Redi, stated that maggot developed from eggs of flies and also demonstrated that roundworm had separate male and female and produced eggs.

At the same period, Leeuwenhoek perfected microscopes and studied protozoan in rainwater, faeces and saliva and also discovered protozoan parasite *Giardia* in his own faeces.

In 1842, Dubini discovered human Hookworm. Similarly, Loss (1898) in Egypt made the discovery of penetration of the skin by hookworm larva. Later, in 1904 Loss demonstrated the mode of infection of hookworm by accidentally infecting himself with the larva of *Ancylostoma duodenale* in Cairo (Craig & Faust's, 1970).

From this time on discoveries in the life-cycle and mode of transmission of parasites came thick and fast.

Human Intestinal parasites have been studied by many workers in different areas of the world. Some recent studies on human intestinal parasites are given below

Fagbenro – Beyioku & Oyerinde (1987) examined 1659 stool samples of children aged 15 years and below in Metropolitan Lagos, Nigeria and showed 71.9% and 68.3% infection with *T. trichiura* and *A. lumbricoides* respectively. While the infection rate with hookworm was 22.5%. Those children whose households had toilet facilities had the lowest infection with all the intestinal parasites surveyed.

Miller *et al.* (1989) random stool specimens were collected from 101 children admitted to the trauma unit of the Red Cross War Memorial Children's Hospital of Cape Town, South Africa. Examination of the stools showed evidences of parasitic infection in 46 of the children, of whom 39 harbored *A. lumbricoides*, *T. trichiura* or both.

Goncalves *et al.* (1990) carried out parasitological examinations of 485 inhabitants in Sao-Lourenco Damata, Brazil. Approximately 99.6% of the inhabitants were infected with at least some species of intestinal parasites. A high prevalence of *S. mansoni* (82.1%), Hookworm (80.2%), *T. trichiura* (69.9%), *A. lumbricoides* (61.9%) and *E. coli* (36.1%) infection were demonstrated.

Ramesh *et al.* (1991) examined 970 stool samples belonging to lower socio-economic groups for parasites. A total of 121 samples showed positive result. However, the prevalence was higher in hospital employees residing in well senitized area. *G. lamblia* (69.5%), *E. histolytica* (15.7%), *H. nana* (12.4%), *A. duodenale* (10.7%), *A. lumbricoides* (8.3%) and *Taenia* *sps.* (0.8%) were the parasites seen. Mixed infections seen in 9 samples.

Obiamiwe & Nmorsi (1991) examined faecal samples from 862 male & female donors of nine age-groups (1-90 years) in three geographical zones were screened by the examination of concentrates from formal ether concentration technique. The overall incidence of six parasites were *E. coli* (19.7%), *E. histolytica* (3.9%), *G. lamblia* (1.4%), Hookworm (29.%), *A. lumbricoides* (38.2%) and *T. trichiura* (7.3%). Protozoan and helminthes infections were higher in males than females.

Rawlins *et al.* (1991) examined and analyzed 2947 samples from Jamaicans, Ethiopia. Prevalence of organism were as follow: *T. trichiura* (12.3%), *A. lumbricoides* (9.5%), Hookworm (2.2%), *S. stercoralis* (0.3%), *G. lamblia* (6.3%) and *E. coli* (7.7%). *A. lumbricoides* and *T. trichiura* were reached prevalence of 15.3% and 20.5% respectively in 5-9 years old children while Hookworm peaked later at 15-19 years of age. Greatest variations were age related.

Asaolu *et al.* (1992) investigated the prevalence and intensity of soil-transmitted helminthes was undertaken in four villages in Oyo State, Nigeria. Diagnosis was based on examination of stool samples for the presence of helminthes ova in all

age classes. The prevalence of *A. lumbricoides* ranged from 61.5%-72.2% of *T. trichiura* from 65%-74% and of Hookworm 52.4% - 63% depending on the village concerned.

Hammouda *et al.* (1992) conducted the research to study the risk of intestinal parasitic infections among sewage workers in Egypt. One hundred sewage workers in Alexandria and another hundred as control group not exposed to sewage were selected for research. The results indicated that sewage workers were at a higher risk of developing intestinal parasitic infection especially Ascariasis & Amoebiasis. Nail examination revealed that sewage workers were at higher risk of infection by *E. vermicularis*.

Hasegawa *et al.* (1992) examined a total of 419 fecal samples by using direct smear floatation, formalin-ether concentrations the inhabitants of 6 villages of Likupang, Minahasa, Perinsula, North Sulawesi, Indonesia, in August 1991. Five nematode and seven protozoan parasites were detected. Soil-transmitted nematode infections were pre-dominant. Among the younger inhabitants aged less than 15, positive rate of *Ascaris*, *Trichuris* and Hookworm infection were almost same (i.e. 45.7% 45.3% and 45.7% respectively). Among the elder people aged 15 years or more, positive rate of Hookworm infection (89.4%) was much higher than *Ascaris* & *Trichuris* infections (i.e.19.3% and 26.1% respectively).

Wondimagegnehu *et al.* (1992) a study of intestinal parasites were done among the people who lived within the plantation zone of the Melka Sedi Agriculture Enterprise, Ethiopia in April 1987. Out of 633 population, 311 were examined at random of them 60.8% were positive for one or more intestinal parasites.

Ibrahim *et al.* (1993) conducted retrospective study among expatriate works in Al-Ain City, United Arab Emirates to determine the prevalence of parasitic infection. The study was based largely on expatriates arriving from India, Pakistan, Bangladesh, Iran, Philippines, Sri-Lanka and other Arab Countries. Stool specimens were examined in 60,268 screened individuals of which 14,010 (23.25%) were found to be positive with pathogenic intestinal parasitic disease. The most common were *Ancylostoma* sps. (6.7%), *A. lumbricoides* (6.6%), *T. trichiura* (6.2%) and *Giardia lamblia* (2.4%). The distribution of intestinal parasites among expatriates were different for all nationalities. The result showed

that *G. lamblia* was more prevalent among Iranians (54.7%) and Pakistanis (42.2%). *Ancylostoma* sps. was found to be more prevalent among Sri-Lankans (33.3%) and Indians (39.6%). *A. lumbricoides* was more prevalent among Bangladeshis (33.1%) and *T. trichiura* was more prevalent among Philippines.

Alo *et al.* (1993) determined the prevalence of intestinal helminthiasis among students of Government Secondary school Girei, Nigeria. Out of 200 students between age 10-32 years old examined 86 (43%) were infected. Using formal-ether concentration technique. The most commonly found worms were Hookworms, *A. lumbricoides* and *T. trichiura* with mean egg per gram of 4800, 2600 and 1250 respectively.

Kappu *et al.* (1994) examined 216,257 stool specimens at the State Diagnostic Laboratories, United State, America in 1987. Parasites were found in 20.0% were highest for protozoans. The most common helminthes were Hookworm (1.5%), *T. trichiura* (1.2%) and *A. lumbricoides* (0.8%).

Virk *et al.* (1994) examined 381 individual in some of the villages of Dadraul and Bhawal Khera P.H.C.'s of district Shahjahanpur (Uttarpradesh), India and 111 (29.2%) were found positive for one or the other intestinal parasites. *A. lumbricoides* suppressed all the parasites by showing a positivity of 17.85%. Other parasite found were Hookworm, *H. nana*, Tapeworm, *T. trichiura*, *E. vermicularis*, *E. histolytica*, *E. coli* and *G. lamblia*. The highest positivity was encountered in the age-groups between 6-14 years. The high prevalence of intestinal parasites may be due to lack of awareness about personal cleanliness and hygiene and literacy among rural women.

In Karim *et al.* (1995) a total of 59 people were examined for single stool specimen and investigate the prevalence of helminthic infections on the aboriginal community at Temengor, Hulu Perak, Malaysia during Nov. 1993. The stool samples were fixed in Polyrings alcohol and then were examined by direct preparation and formal-ether concentration technique. The prevalence rates for intestinal helminthes were *T. trichiura* (27.17), *A. lumbricoides* (16.9%), Hookworm (13.6%) and *S. stercoralis* (1.7%). Females had a higher prevalence of helminthic infection than males.

Palmer & Bundy (1995) studied helminthes infections in a rural village in the Gambia, West Africa. Hookworm probably *N. americanus* and *A. lumbricoides* were found to be most prevalent helminthes present at prevalence level of 30% and 25% respectively. Other parasites present were *T. trichiura* (2.4%) and *S. mansonia* (1.5%). The mean eggs count of *N. americanus* and *A. lumbricoides* in all age-groups and in the total population were low. Eggs count between age and sex-groups were not statistically significant. The frequency distributions of both *N. americanus* and *A. lumbricoides* were over dispersed with the majority of the sample population producing none or few eggs and a small minority, producing relatively large amount of eggs.

Bangs *et al.* (1996) examined to determine the prevalence of intestinal parasites on an indigenous, highland community in the Oksibil Valley of Iran, Jaya, Indonesia. Overall 478 subjects from three villages in the study area, about 10% of the available population were sampled. Using standard wet-mount technique 15 different species of parasites were found. Hookworms was predominant in all age-groups with prevalence of 51% - 86% followed by *A. lumbricoides* (46%-57%) and *T. trichiura* (15%-25%).

Udonsi *et al.* (1996) analyzed fresh stool samples from 300 subjects presenting at out patient clinics in two major hospitals in Port Harcourt, Nigeria for the prevalence and intensity of gastrointestinal (GI) nematode infections. 85.3% were found to carry at least one of the four species of GI nematodes recognized during the study. The most common species were *A. lumbricoides* (54%) followed by *T. trichiura* (43.7%), *N. americanus* (42.7%) and *S. stercoralis* (33%). Peak prevalence of *A. lumbricoides* was among the 9 years age cohorts, whilst those for the remaining species all coincided among the 15- 19 years age cohort.

Saito *et al.* (1996) surveyed for intestinal parasitosis by using thin smear and floating methods for fecal 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 parasite prevailing most severely was *N. americanus* (27%) followed by *E. coli* (19.8%), *G. lamblia* (12.7%), *A. lumbricoides* (4.8%) and others. The infection rate with *G. lamblia* and *A. lumbricoides* were conversely more frequent in children than in adults.

Machado *et al.* (1996) studied the clinical and epidemiological aspects of infection with *A. lumbricoides* in a random stratified sample of the population of the sub-district of Covacos, Brazil. A total of 230 fecal were examined by the Kato-katz technique in order to determine the intensity of *A. lumbricoides*. The presence of *A. lumbricoides* and other helminth eggs were also determined in 22 soil samples collected in the Urban Zone of Cavacos. Infection with entero-parasitic helminthes were detected in 21% of the sample.

Norhayati *et al.* (1997) carried out a community study on the age and sex related prevalence intensity infection and frequency distribution of *Ascaris*, *Trichuris* & Hookworm in 205 Aborigines children (95 boys, 110 girls) aged 1-3 years in Orang Asli, South Asia. The overall prevalence of *Ascaris*, *Trichiuris* & Hookworm were 62.9%, 91.7% & 28.8% respectively. A positive correlation ($P<0.01$) was also observed between *Ascaris* and Hookworm.

Tellez *et al.* (1997) performed the study on 1267 stool samples from about 8% of the citizens of the city of Leon. The overall prevalence of intestinal pathogenic parasites among the 1267 individuals were found to be 47.2%. The prevalence of *E. histolytica* was 18.6% followed by *Giardia* (15.9%) and *Ascaris* (13.4%). Other helminthes such as Hookworms and *Strongyloides sps.* were found at very low rates. Intestinal parasites appear to be prevalent in Nicaragua, which motivated a more extensive prevalence study in which socio- economic conditions such as degree of crowding, quality of water supply, type of floor and disposal of excretion were considered.

Zdero Maria *et al.* (1997) collected the faeces from 185 middle-class patients above 18 years of age, both sexes who presented diarrhoea and chronic gastrointestinal disorders and processed in direct microscopy, with and without wet staining by Ritchie's method and faecal sieving macro-parasites. Twenty Eight Percent showed at least one ecto-parasite in their faeces, 48 harboured one parasite and 5 harboured two parasites. The most common species were *Blastocystis hominis* (15.7%), *G. lamblia* (7.5%), *Cryptosporidium sps.* (1.6%), *E. coli* (3.3%), *Chilomastix mensilli* (1.1%), *A. duodenale* and *N. americanus* (0.5%), *A. lumbricoides* (0.5%), *E. vermicularis* (0.5%) and *H. nana* (0.5%).

Albonica *et al.* (1997) during the evaluation of the impact of the Zanzibar Helminthes Control Program, baseline parasitological data on 3,605 school children were collected in Pemba Island, Zanzibar, Tanzania. Prevalence of intestinal helminthic infections were 72%, 94% and 96% for *A. lumbricoides*, *T. trichiura* and Hookworm respectively. Thirty One percent of children tested positive for *Haematuria*, a reliable indicator of urinary schistosomiasis in the study area. Hookworm infections and *Haematuria* were more prevalent in boys. Children living in rural area were more heavily infected with Hookworm and *Schistosoma* compared to children in town.

Chai and Hongvanthong (1998) collected a total of 137 faecal samples from the staffs of the provincial government, their family and primary school children in Pakse city, Champassak Province, Korea and examined by Kato-katz smear technique. The overall positive rate was 75.9% and the Helminthes detected were *Opisthorchis viverrini* (43.8%), *A. lumbricoides* (26.5%), *T. trichiura* (19.0%), Hookworms (19.0%), *S. stercoralis* (2.2%), *Taenia* sps. (0.7%) and *Schistosoma melsongi* (1.5%).

Chacin-Bonilla *et al.* (1998) collected and examined single stool specimens using iron hematoxylin stained fecal smears and formalin ether concentration, to study the prevalence of intestinal parasites in 890 subjects 7 months to 75 years age in Rural Community of Zulia State, Venezuela. The overall parasitic infection rate was 64.5%, 50.7% of the population had multiple infections. *A. lumbricoides* (3.9%) and *T. trichiura* (15.3%) were the most common helminthes and among the protozoa *G. lamblia* was most prevalent (21.8%).

Roche and Benito (1999) assessed the prevalence of intestinal parasitic infections among two different groups of persons on the Island of Bioko, Equatorial Guinea. In the first group, parasitological examinations were performed on stool specimens from a house hold based samples of 557 dwellers from the rural area of the island. In the second rural group, 1633 inpatients and out-patients at the general hospital of Malabo were studied. All age-groups were represented in both groups. The average prevalence of the most common protozoan and helminthic intestinal infections in Rural and Urban area were *E. histolytica* (14.9% and 32.7%), *G. lamblia* (7.2% and 8.6%), *A. lumbricoides* (45.8% and 31.4%) and *T. trichiura*

(25.7% and 36.4%). This study showed that parasitic infections in Equatorial Guinea represent a major health problem.

Paul *et al.* (1999) carried out a study to determine the prevalence and intensity of intestinal helminthic infections among 217 primary school children in Relliveedhi, a slum area in Visakhapatnam, India. The children were between 7 to 13 years of age and belonged to lower socio- economic status. Stool samples collected were processed by modified formalin-ethyl acetate sedimentation technique. One hundred seventy seven (177) children were infected with one or more of the intestinal parasites viz. *A. lumbricoides*, *T. trichiura* and Hookworm. The overall prevalence of infection rate was 82%. *A. lumbricoides* was the most common infection with a prevalence of 75% followed by *T. trichiura* (66%) and Hookworm (9%).

Yassin *et al.* (1999) collected a total of 489 stool sample from school children age 6-11 years in Gaza, Egypt. The targeted areas were over crowded, with un-proper sewage disposal system and low socio-economic standard. Each stool specimens were processed by the direct smear microscopy. Zinc Sulphate flotation technique and formal-ether sedimentation technique were used. The study revealed on overall prevalence of 27.6%. Out of six detected parasites *G. lamblia* (62.2%) was the most frequent species found, followed by *A. lumbricoides* (20.1%) then *E. histolytica* (13.3%). The prevalence of these parasites were found to be related to age, socio economic and sanitary condition.

Landmarks of Human Intestinal Parasites of Nepal

In Sharma (1965) a random sample study of patient in Bhaktapur was conducted to ascertain the incidence of roundworm infection. A total of 976 samples were taken over 5 years period, among them 430 cases were males, 317 cases were females and 220 were children of both sexes under 12 years of age.

Sharma & Tuladhar (1971) a study of 80 students studying in Auxiliary Health Workers Schools was carried out. They found that 87.5% of persons were infected by different parasites.

Acharya (1979) reported Giardiasis, Amoebiasis, Ascariasis, Ancylostomiasis, Tapeworms and flukes in Nepal.

Nepal and Palfy (1980) examined 225 stools. Only 4.4% of the samples showed the presence of more than one parasite. Three percent of the samples had upto five parasites. *Ascaris*, Hookworm and *Giardia* were the most common parasites.

Khetan (1980) examined 2070 stool samples in the pathology laboratory of Narayani Zonal Hospital between 1977 to 1980. One thousand five hundred ninety two had some worm infection. 29% had hookworm, 21.9% had roundworm, 9.9% had *Trichuris* sps. 8.5% had *Giardia* sps. and 4% had *E. histolytica*.

Bol & Reder (1981) examined 668 stool samples showing *A. lumbricoides*, *N. americanus*, *A. duodenale*, *T. trichiura* and *S. stercoralis* in Lalipur district.

In Shrestha (1983) a survey study in Bhaktapur district showed out of 450 stool samples, 99% of stools were positive for the eggs of soil-transmitted helminthes. 94% were *A. lumbricoides*, 42% *Trichuris* sps. and 11% Hookworm. Similarly, from the Panchkhal area out of 240 stool samples, 41% stools were positive for eggs of helminthes. Seventy five percent (75%) was *T. trichiura*, 37% Hookworm, 19% *A. lumbricoides*. During stool test Kato-Katz method was followed.

Rai and Gurung (1986) collected 200 stools samples in Birgunj and examined by direct smear technique over a period of 16 days. The incidence of roundworm was the highest (i.e. 35%) followed by hookworm (i.e. 14%). The infection rate was 69% and the result showed that the infection was more common in girls than the boys.

Gupta (1988) reported the infection rate of human intestinal parasites of Kirtipur, Kathmandu. Out of 285 stool samples 67% were positive for intestinal parasitic infection. Among them, infection of protozoan parasites 19%, helminth 74% and mixed infection 6% were reported.

Rai *et al.* (1991) presented the paper to show the prevalence of various intestinal parasites in Kathmandu valley, Nepal. The overall prevalence of intestinal parasites was 30.9%. There was no significant difference in the prevalence between two sexes. Intestinal parasites were more common among children (less than 15 years) than in adult (more than 15 years).

Rai *et al.* (1994) studied status of soil-transmitted helminthic infection in Nepal during 1985 to 1992. An average of 6,537 faecal samples were examined each year. The annual rate of the positivity for soil-transmitted helminthiasis ranged from 18-36.6%.

In Sherchand (1997) studied the intestinal parasitic infections in rural areas of Southern Nepal, Dhanusa district. Out of 604 children aged between 0-9 years examined (63.1%) were found positive for one or more intestinal parasites.

In Rai (2000) a community based study on intestinal helminth parasites was carried out in Bote and Darai communities of Tanahun district. One hundred fifty two stool samples were collected from different age and sex-groups. The overall intestinal helminthes prevalence rate was 61% (92).

In Pradhan (2001) studied on intestinal helminth parasites was carried out in Magar and Majhi communities of Nawalparasi. Two hundred forty stool samples of different age-groups and sex of Magar and Majhi children were collected. The overall prevalence of intestinal helminth was 32% (77).

Rai *et al.* (2001) studied the intestinal parasitic infection in rural hilly area of western Nepal, Achham district.

Central Region

* Anandaban



Total Districts = 19

Map of Central Region Showing Present Study Area

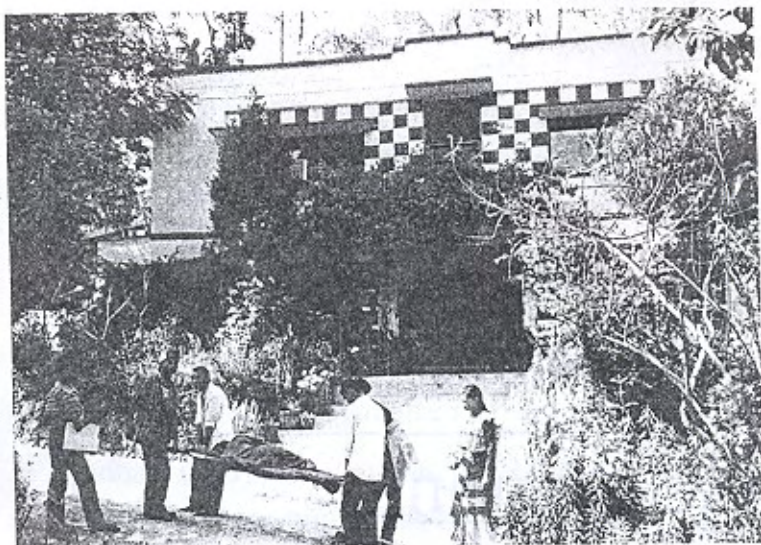


Photo 1: Anandaban Leprosy Hospital.

Photo 2: Leprosy Patients of Anandaban Leprosy Hospital.



Photo 3: Consent-form being signed by Non-leprosy People.

IV

METHODOLOGY

Study Area

The study area, Anandaban Leprosy Hospital is situated at almost the middle of Lalitpur district. It is situated 16km. south of Kathmandu at scenic spot amongst the hills. It is linked with Lalitpur sub-municipality by motorable road. The Hospital is sprawled over 50 acres of land upon south face of Bhagaban Hill.

Anandaban Leprosy Hospital (ALH) is owned and run by The Leprosy Mission International (TLMI). This hospital was opened in 1957. ALH is completely financially supported and administered by TLMI.

Anandaban Leprosy Hospital is the largest Leprosy Hospital in Nepal. It serves as the main leprosy referred hospital for the Central Region of Nepal.

Leprosy services

In-patients medical and surgical cares were carried out at high levels and the weekly Leprosy Clinic at Patan Hospital on Wednesday continues to be very well attended. 6,684 leprosy cases were seen during the year, with 146 new leprosy cases being registered. 16 of these new cases were from Lalitpur district (Annual Report, 2001, ALH).

General Laboratory Services

Mycobacterial Research Laboratories was started in 1982. As part of the general medical services, general laboratory services are available for patients needing further laboratory examinations, both as part of the outpatient and inpatient services. The laboratory carried out a total of 7,057 general laboratory test (i.e. stool test, blood test, urine test etc.) for general medical patients and 6,328 test for leprosy patients for 2001. (Annual Report, 2001, ALH).



Photo 4: Consent-form
being signed by Leprosy
Patients.

Photo 5: Interview with
Leprosy Patients.



Photo 6 : Interview with
Non-leprosy People.

The study was divided in two parts:

1. Stool sample collection

Out of the 280 stool samples, 150 samples belonged to leprosy patients and 130 belonged to non-leprosy (i.e. attendants of the leprosy patients and general patients of Anandaban Leprosy Hospital & Leprosy Clinic, Patan Hospital). The samples were mostly of the people belonging to hill regions such as: Lalitpur, Bhaktapur, Kavre, Sindhuplanchok and Nuwakot. Some samples were of the people belonging to the Terai region such as: Dhanusha, Mahottri, Sharlahi, Rautahat and Bara districts and some people from Bihar, India. The pathological work was conducted in Anandaban Leprosy Hospital, Lalitpur & Leprosy Clinic, Patan Hospital from August 2001 to June 2002.

Out of 150 stool samples of leprosy patients, 70 stool samples were collected from Leprosy Clinic, Patan Hospital and 80 stool samples were collected from Hospital ward of ALH. Similarly, out of 130 stool samples of non-leprosy people, 70 stool samples were collected from Leprosy Clinic, Patan Hospital and 60 stool samples from ALH.

To ensure better condition during sample collection the following precautions were taken:

- (i) The sampling vials were properly washed, dried and filled with 2-5 ml of 5% formalin solution.
- (ii) Each stool container was distributed after interviewing individually and the stool samples were collected later for the examination.
- (iii) The consent (Annex -2) form was also filled while collecting the stool sample.
- (iv) Immediately after collecting the vials, they were brought to the nearest laboratory for further processing such as slide preparation & identification of ova and cysts of the parasites.

2. Questionnaire study

Surveillance study with prepared questionnaire by means of interview was also conducted (Annex-1).

Examination of stool samples

The stool samples were direct examined by naked eyes for the worm of the helminth parasites (adult worm of *A. lumbricoides*, Hookworm, *Trichuris*, *Enterobius*, and other intestinal flukes) or a segment of it (*T. solium*, *T. saginata*) as well as mucous and blood.

Microscopical Examination of the stool

The smear prepared slides were first examined under the low power of microscope starting from one end of the cover slip to another end and vice-versa after changing field. If any suspicious object was seen it was centered and focused under the high power objective for a detailed diagnosing. During the examination of such preparation precaution was taken in that the films did not get dry up for this propose.

The collected stool samples were examined under microscope under 10x and 40x objectives. Specific attention was given to the characters of the helminth eggs such as shape, size, colour and marking on the surface of egg shell, the presence of yolk granules, ovum or a differentiated embryo the existence of an operculum and in specific case, as in cestodes the 6 embryonic hook-lets.

(a) Smear preparation

- (i) Saline preparation: One drop of (physiologically fresh) normal saline (0.9%) was placed on a clean glass slide. Using an applicator stick, a small amount of faecal specimen about 2mg was mixed with saline. Smooth thin preparation was made & covered with fine cover slip by the help of a needle, so as to spread out the emulsion into a thin, fairly uniform and transparent layer. The entire saline preparation was examined systematically under an electric microscope.
- (ii) Iodine stain preparation: To prepare an iodine mount one drop of Iodine solution (2 %) was put on clean glass slide and with an applicator stick a

small portion of the faecal specimen (size of a match head) was picked and mixed with the drop of Iodine. A fine cover slip was put over it by the help of a needle. Then microscopic examination was performed.

Both the preparations were made on the same glass- slide.

(b) Concentration Method

- (i) Zinc Sulphate (Zn SO_4) Floatation Technique: A small amount of faecal sample was mixed in about 8-10 ml. of distilled water in a 15 ml. centrifuge tube. Then it was centrifuged at 1,800rpm for 2 minutes. The supernatant was then poured off and discarded. It was shaken well, centrifuged and the process was repeated until the supernatant fluid was fairly clear.

The clean supernatant was poured off and a small amount (3-4 ml.) of 38% Zinc Sulphate solution was added to the washed sediment and was mixed by using a stick or a glass rod. The tube was filled with Zn SO_4 solution and was centrifuged at 1800rpm for 1 min. Sample was taken from the surface meniscus using wire loop of about 5mm diameter and was placed on two spots of a glass slide. Then one drop of lugal's Iodine was added to one of the spots and a drop of normal saline to the other. A cover slip was applied to each of the two areas and examined microscopically (for ova and cysts).

This method is preferred and is more effective than the saturated saline method because of the initial 'washing' and use of the centrifuge which can be done more quickly and has less faecal materials and artifacts in the final preparation. Zinc sulphate concentration method is the most widely used.

RESULTS

Questionnaire Survey

The study was conducted upon Leprosy patients and non-leprosy people (i.e. attendants of the leprosy patients and general patients visiting Anandaban Leprosy Hospital and Leprosy Clinic, Patan Hospital) .It was studied by two ways:

- (A) Data collection on questionnaire basis regarding sanitation behavior, literacy, profession, hygienic condition, source of water, food habit, walking bare-foot and awareness about parasites etc.
- (B) Stool sample collection and examination.

(A) Result based on Questionnaire

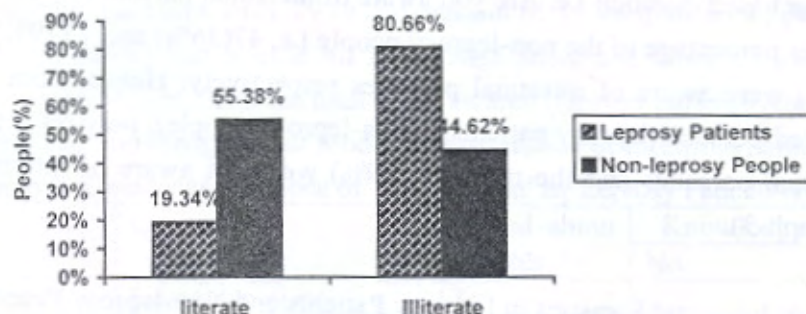
During the process of study, 150 leprosy patients and 130 non-leprosy people were interviewed individually with the help of questionnaire.

1. Literacy response among Leprosy Patients & Non-leprosy People

Out of 280 persons interviewed, 101 (36%) were literate whereas 179 (64%) were illiterate. Out of 150 leprosy patients interviewed only 29 (19%) were literate. Similarly, out of 130 non-leprosy people interviewed 72 (55%) were literate. The result (table-1, graph -1) shows that the non-leprosy people were more literate than the leprosy patients.

Table1: Percentage of literate /illiterate people in the Interviewed Leprosy Patients & Non-leprosy People

SN.	Group	Interviewed No.	literate		Illiterate	
			No.	%	No.	%
1.	Leprosy patients	150	29	19.34	121	80.66
2.	Non-leprosy people	130	72	55.38	58	44.62
	Total	280	101	36.00	179	64.00



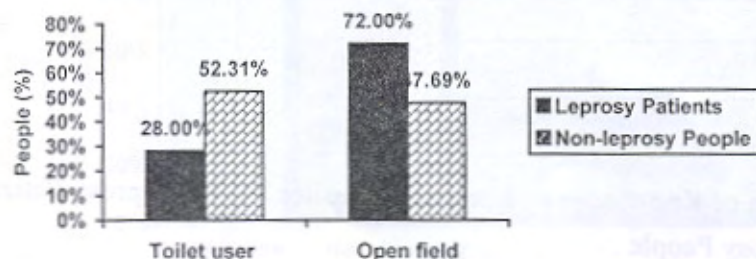
Graph 1: Representation of Literate /Illiterate Response among Leprosy Patient & Non-leprosy People.

2. Sanitary Condition among Leprosy Patients and Non-leprosy People

The analysis of questionnaire showed that out of 150 leprosy patients 42, (28%) were using toilet for safe disposal of latrine. Similarly, out of 130 non-leprosy people only 68 (52%) were using toilet. Rest of leprosy patients i.e. 108 (72%) and non-leprosy people i.e. 62 (48%) preferred open field for night soil disposal (table -2, graph-2). Hence, most of the interviewed leprosy patients and non-leprosy people preferred open field for night soil disposal.

Table. 2: Sanitary Condition regarding use of Toilet among Non-leprosy People & Leprosy Patients

S.N.	Group	Interviewed No.	Toilet user		Open field	
			No.	%	No.	%
1.	Leprosy patients	150	42	28.00	108	72.00
2.	Non-leprosy people	130	68	52.31	62	47.69
	Total	280	110	39.29	170	60.72



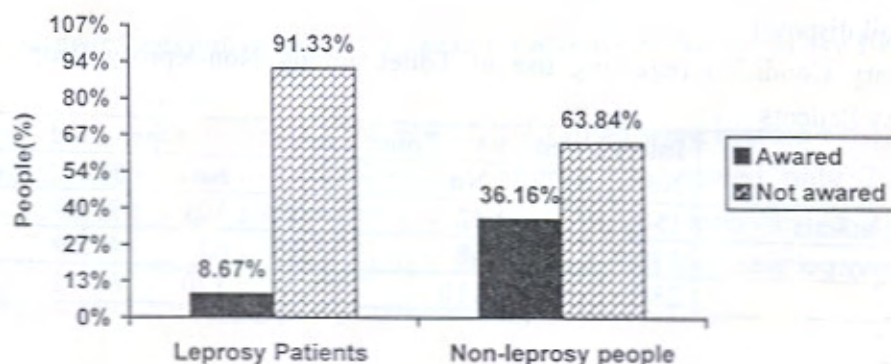
Graph 2: Representation of Toilet user in Leprosy Patients & Non-leprosy People.

3. Knowledge of Parasites

Yes /No answer based question i.e. Are you aware of intestinal parasites? (Annex-I) revealed that a larger percentage of the non-leprosy people i.e. 47(36%) and 13 (9%) of leprosy patients (150) were aware of intestinal parasites respectively. Hence, from the total of 280 interviewed persons (leprosy patients & non-leprosy people), only 60 (21%) were aware of intestinal parasites and the rest 220 (79%) were not aware of intestinal parasites (table -3, graph-3).

Table 3: Knowledge of Intestinal Parasites in Leprosy Patients and Non-leprosy People

S.N.	Group	Interviewed No.	Awared		Not awared	
			No.	%	No.	%
1.	Non- Leprosy people	130	47	36.16	83	63.84
2.	Leprosy patients	150	13	8.67	137	91.33
	Total	280	60	21.43	220	78.57



Graph 3 : Representation of Knowledge of Intestinal Parasites among Leprosy Patient & Non-leprosy People .

4. Knowledge of Mode of Transmission of Intestinal Parasites

Yes /No question among 47 non-leprosy people which were aware about the intestinal parasites, only 29 (62%) and out of 13 aware about parasites leprosy patients only 6 (46%) had a little bit knowledge about the mode of transmission of intestinal parasites. Hence, from the total of 60 aware (leprosy patients & non-leprosy people) only 58% had knowledge about mode of transmission of intestinal parasites (table-4).

Table 4: Knowledge of 'Mode of Transmission' in Leprosy Patients & Non-leprosy People

S.N.	Group	Aware about parasites	Knowledge about MOT	
			No.	%
1.	Leprosy patients	13	6	46.00
2.	Non-leprosy people	47	29	61.70
	Total	60	35	58.33

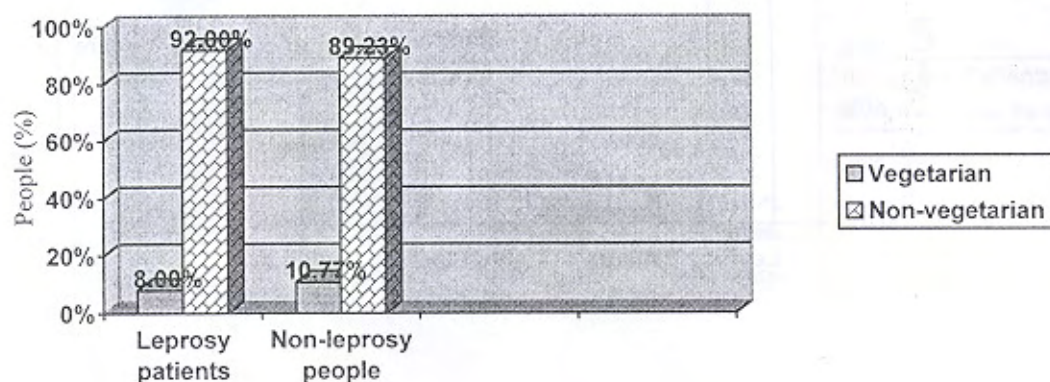
(MOT- Mode Of Transmission)

5. Food Habit in Leprosy Patients and Non-leprosy People

Out of 280 persons interviewed 26 (9%) were vegetarian whereas 254 (91%) were non-vegetarian. Out of 150 interviewed leprosy patients only 12 (8%) were vegetarian. Similarly, out of 130 interviewed non-leprosy people only 14 (11%) were vegetarian. Hence, most of the interviewed leprosy patients and non-leprosy people were non-vegetarian (table-5, graph-4).

Table 5: Food Habit in Leprosy Patients & Non-leprosy People

S.N	Group	Interviewed No.	Vegetarian		Non -vegetarian	
			No.	%	No.	%
1.	Leprosy patients	150	12	8.00	138	92.00
2.	Non-leprosy people	130	14	10.77	116	89.23
	Total	280	26	9.28	254	90.72



Graph 4: Representation of Food-habit in Leprosy Patients & Non-leprosy People.

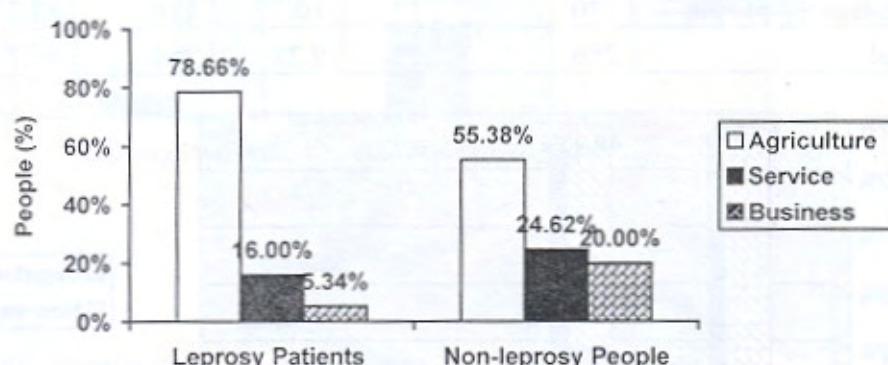
6. Occupation of Interviewed Leprosy Patient & Non-leprosy People

Out of 280 persons interviewed (leprosy patients & non-leprosy people) 190 (68%) were dependent on agriculture, 56(20%) were service holders and 34(12%) were businessmen. Out of 150 leprosy patients 118 (79%) were farmers, 24 (16%) were service holders and 8(5%) were businessmen. Similarly, out of 130 interviewed non-leprosy people only 72(55%) were farmers, 32 (25%) were service holders and 26 (20%) were businessmen (table-6, graph-5).

Hence, most of the interviewed leprosy patients and non-leprosy people depended on agriculture.

Table 6: Occupation of Interviewed Leprosy Patients & Non-leprosy People

S.N.	Group	Interviewed No.	Agriculture		Service		Business	
			No.	%	No.	%	No.	%
1.	Leprosy patients	150	118	78.66	24	16.00	8	5.34
2.	Non-leprosy people	130	72	55.38	32	24.62	26	20.00
	Total	280	190	67.86	56	20.00	34	12.14



Graph 5: Representation of Occupation of interviewed Leprosy Patients & Non-leprosy People.

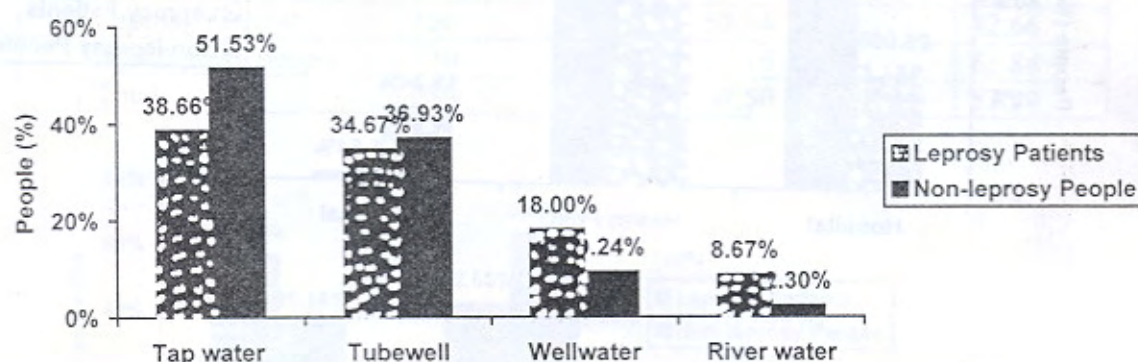
7. Water Supply among Leprosy Patients & Non-leprosy People

The analysis of questionnaire showed that out of 150 leprosy patients, 58 (39%) were using tap-water, 52(35%) were using tube-well water, 27(18%) were using well-water and 13 (9%) were using river water. Similarly, out of 130 non-leprosy people 67(52%) were using tap-water, 48(37%) were tube-well, 12(9%) were using well water and 3(2%) were using river water respectively.

Hence, from the total of 280 interviewed persons (leprosy patients & non-leprosy people) 125 (45%) were using tap-water, 100 (36%) had tube-well, 39(14%) were using well-water and only 16(6%) were using river-water for bathing, washing clothes and even for drinking and cooking purpose. Hence, most of the leprosy patients and non-leprosy people were using tap water. River water was used more by leprosy patients than non-leprosy people (table -7, graph-6).

Table 7: Water Supply among Leprosy Patients & Non-leprosy People

S.N	Group	Interviewed No.	Tap-water		Tube-well		Well-water		River water	
			No.	%	No.	%	No.	%	No.	%
1.	Leprosy patients	150	58	38.66	52	34.67	27	18.00	13	8.67
2.	Non-leprosy people	130	67	51.53	48	36.93	12	9.24	3	2.30
	Total	280	125	44.64	100	35.72	39	13.92	16	5.72



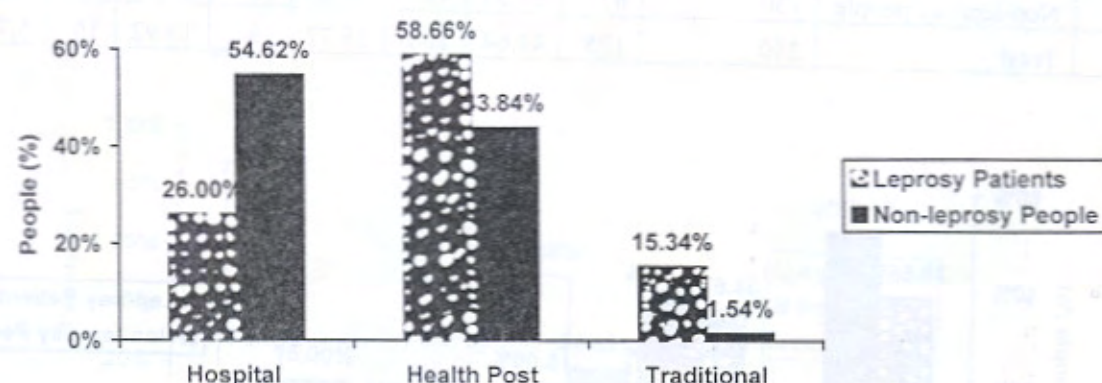
Graph 6: Representation of Water Supply in Leprosy Patient & Non-leprosy People.

8. Treatment Method of Intestinal Parasitic Infection in Leprosy Patient and Non-leprosy People

Out of 280 persons (leprosy patients & non-leprosy people) interviewed, 110(39%) people visited Hospitals for the treatment of intestinal parasites. Likewise, 145(52%) people visited Health Posts and 25(9%) were under the treatment of Traditional Healer for the intestinal parasites. Similarly, out of 150 leprosy patients 39(26%) had gone for the treatment of parasitic infection to Hospitals, 88(59%) visited Health Posts and 23(15%) people with traditional types of treatment by Dhamsi & Jhankri. The data shows that leprosy patients (15%) used more traditional type of treatment when compared to non-leprosy people (2%) (table -8, graph-7).

Table 8: Treatment Methods of Parasitic Infections in Leprosy Patients & Non-leprosy People

S.N.	Group	Interviewed No.	Hospital		Health Post		Traditional	
			No.	%	No.	%	No.	%
1.	Leprosy patients	150	39	26.00	88	58.66	23	15.34
2.	Non-leprosy people	130	71	54.62	57	43.84	2	1.54
	Total	280	110	39.29	145	51.78	25	8.93



Graph 7: Representation of Treatment Method of Intestinal Parasites in Leprosy Patients & Non-leprosy People.

(B) Laboratory Diagnosed Stool Test

General Prevalence of Intestinal Protozoan and Helminth Parasites:

A study was conducted to determine the prevalence of intestinal parasitic infections in leprosy patients and non-leprosy people (i.e. attendants of the leprosy patients and general patients of out door visiting ALH and Leprosy clinic, Patan Hospital) of Anandaban Leprosy Hospital and Leprosy clinic, Patan Hospital. The people mostly belonged to the hilly regions such as Lalitpur, Bhaktapur, Kavre, Sindhupalchok, Nuwakot and Terai region such as Dhanusha, Mahottri, Sharlahi, Rautahat, and Bara districts. Some people were from Bihar (India).

Out of 280 stool samples examined, 133 stool samples were positive for one or more specific intestinal parasites, showing 47.5% prevalence of parasitic infection. A total of 280 stool samples comprised of 150 leprosy patients and 130 stool samples of non-leprosy people. Samples were collected from leprosy Clinic, Patan Hospital and hospital ward of Anandaban Leprosy Hospital, Tikabhairav, Lalitpur District.

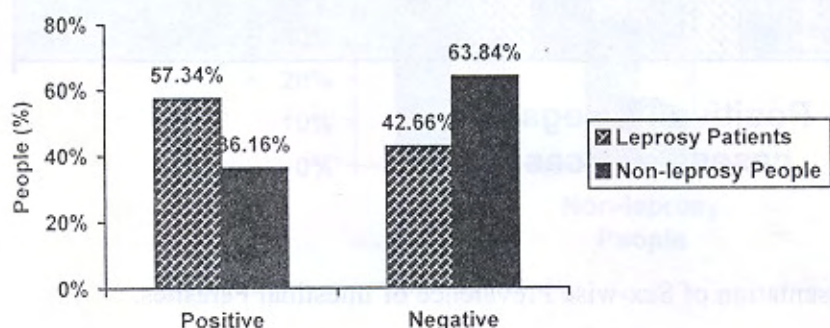
1. Group-wise prevalence

Prevalence of intestinal parasites among leprosy patients and non-leprosy people revealed that out of 150 leprosy patients, 86 (57%) were infected with one or more species of intestinal parasites. Similarly, out of 130 non-leprosy people 47 (36%) were found to be infected (table-9, graph-8).

Hence, the prevalence of intestinal parasites were found to be more in leprosy patients than in non-leprosy people. Statistically, the difference in the prevalence of intestinal parasitic infection between leprosy patients and non-leprosy people was found to be significant. ($\chi^2 = 4.798$, $P > 0.05$).

Table 9: Group-wise Prevalence of Intestinal Parasites

S.N.	Group	Total sample collected	Positive cases		Negative cases	
			No.	%	No.	%
1.	Leprosy patients	150	86	57.34	64	42.66
2.	Non-leprosy people	130	47	36.16	83	63.84
	Total	280	133	47.50	147	52.50



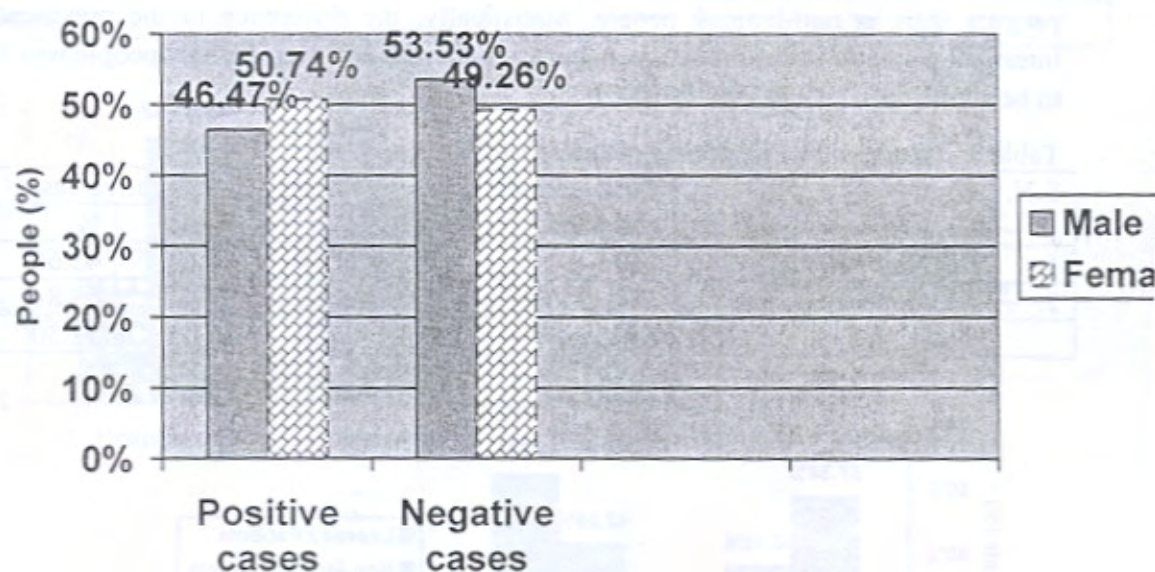
Graph 8 : Representation of Group-wise Prevalence of Intestinal Parasites.

2. Sex-wise Prevalence

Table no. 10, graph -9, reveals that out of 280 examined stool samples of leprosy patients & non-leprosy people, 213 were of males and 67 were of females. Out of 213 male stool samples examined 99 (46%) were found to be positive for intestinal parasites. Similarly, out of 67 female stool samples examined 34(51%) were found to be positive for intestinal parasites. Hence, the infection rate was found higher in females than in males. Statistically, no significant difference was found in the prevalence of intestinal parasites between males and females ($\chi^2=0.187$, $P<0.05$).

Table 10: Sex- wise Prevalence of Intestinal Parasites

S.N	Sex	Total samples collected	Positive cases		Negative cases	
			No.	%	No.	%
1.	Male	213	99	46.47	114	53.53
2.	Female	67	34	50.74	33	49.26
	Total	280	133	47.50	147	52.50



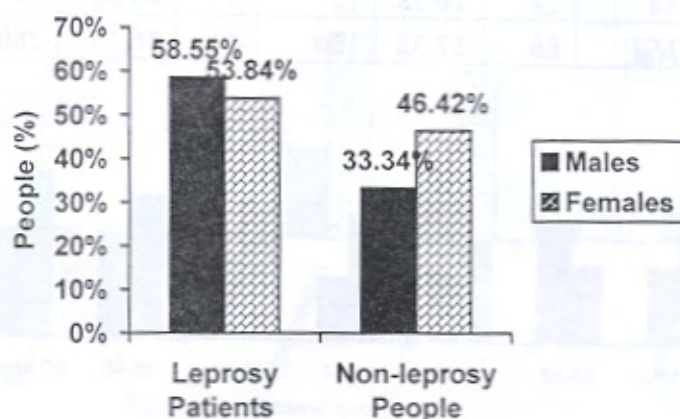
Graph 9: Representation of Sex-wise Prevalence of Intestinal Parasites.

3. Sex-wise Prevalence of Intestinal Parasites in Leprosy Patients & Non-leprosy People

The analytical study of the table no. 11, graph-10, shows that male leprosy patients (59%) were more infected with intestinal parasites than female patients (54%). Similarly in non-leprosy people, females (46%) were more infected than males (33%) with different type of intestinal parasites. Statistically, significant difference was found in the prevalence of intestinal parasites between leprosy patients and non-leprosy people ($\chi^2 = 4.798, P > 0.05$). When intestinal parasitic infection in leprosy patients males and non-leprosy people males were compared the difference was found to be significant ($\chi^2 = 6.922, P > 0.05$). No significant difference was seen between females of leprosy patients and non-leprosy People ($\chi^2 = 0.549, P < 0.05$).

Table 11: Sex-wise Prevalence of Intestinal Parasites in Leprosy Patients & Non-leprosy People

Sex	leprosy patients			non-leprosy people			Total		
	No. of Obs.	Positive cases		No. of Obs.	Positive cases		No. of Obs.	Positive cases	
		No.	%		No.	%		No.	%
Males	111	65	58.55	102	34	33.34	213	99	46.47
Females	39	21	53.84	28	13	46.42	67	34	50.74
Total	150	86	57.33	130	47	36.15	280	133	47.50



Graph 10: Representation of Sex-wise Prevalence of Intestinal Parasites in Leprosy Patients & Non-leprosy People.

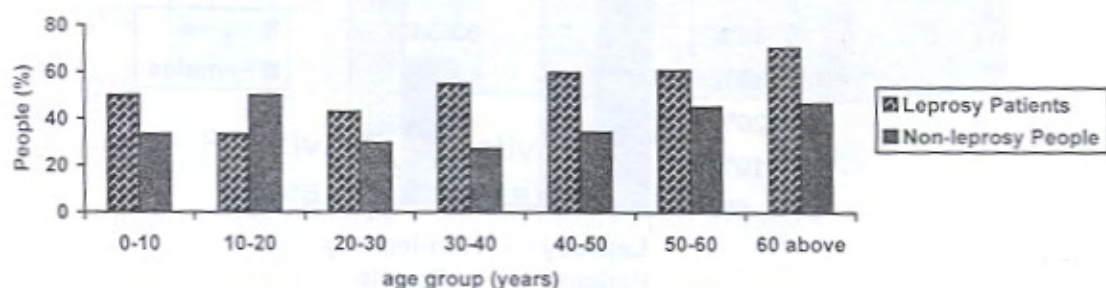
4. Age-group wise Prevalence of Intestinal Parasites among Leprosy Patients & Non-leprosy People.

The table no. 12, graph-11, reveals that in total (both leprosy patients and non-leprosy people) maximum distribution of intestinal parasites was recorded in 60 years above age-group (63%). While 53%, 46%, 43%, 41%, 40% and 35% were recorded in 50-60, 40-50, 30-40, 10-20, 0-10 and 20-30 years age-groups respectively.

In leprosy patients, the distribution of intestinal parasite was also found to be maximum in 60 years above age-group (71%) and minimum in 10-20 years age-group (33%). While in non-leprosy people, maximum distribution of intestinal parasites was found in 10-20 years age-group (50%) and minimum in 30-40 years age-group (28%).

Table 12: Distribution of Intestinal Parasites in Different Age-groups in leprosy patients & non-leprosy people

Group Age group (Years)	Leprosy patients			Non-leprosy people			Total (leprosy & non-leprosy)		
	No. of Obs.	Positive cases		No. of Obs.	Positive cases		No. of Obs.	Positive cases	
		No.	%		No.	%		No.	%
0-10	2	1	50.00	3	1	33.33	5	2	40.00
10-20	9	3	33.33	8	4	50.00	17	7	41.17
20-30	21	9	42.85	27	8	29.62	48	17	35.41
30-40	31	17	54.83	22	6	27.27	53	23	43.39
40-50	30	18	60.00	35	12	34.28	65	30	46.15
50-60	23	14	60.86	20	9	45.00	43	23	53.48
60 above	34	24	70.58	15	7	46.66	49	31	63.26
Total	150	86	57.33	130	47	36.15	280	133	47.50



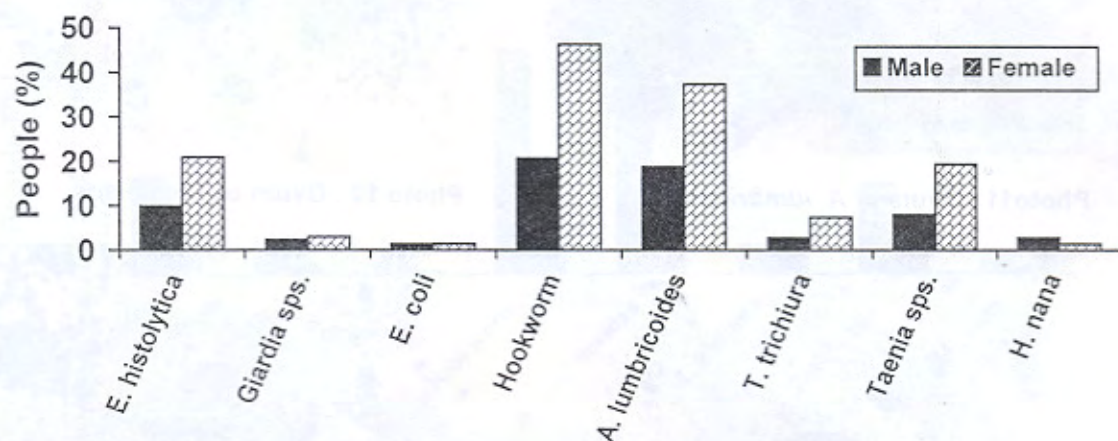
Graph 11: Representation of Prevalence of Intestinal Parasites of Different Age-groups in Leprosy Patients & Non-leprosy People.

5. Infection Rate of Specific Intestinal Parasites

Table no. 13, graph-12, shows the infection rate of specific intestinal parasites in 133 infected stool samples of leprosy patients and non-leprosy people. Out of 133 samples infected with intestinal parasites, the prevalence of specific Protozoan and Helminth parasites are as follows: 35 samples (26%) were infected with *E. histolytica*, 7 (5%) with *Giardia* spp., 4 samples (3%) with *E. coli*, 75 (56%) with Hookworm, 65 (49%) with *A. lumbricoides*, 11 (9%) with *T. trichiura*, 36 (23%) with *Taenia* spp. and 7 samples (5%) with *H. nana*. Regarding sex-wise distribution of each species it was found that statistically, the distribution of *E. histolytica* ($\chi^2=3.95$, $P > 0.05$), Hookworm ($\chi^2=9.79$, $P > 0.05$), *Ascaris* ($\chi^2=6.11$, $P > 0.05$) and *Taenia* spp. ($\chi^2=4.76$, $P > 0.05$) were significant in both leprosy patients and non-leprosy people.

Table 13: Prevalence of Specific Intestinal Parasites

S. N.	Parasites	No. of Males infected	% from total (213) male samples examined	No. of Females infected	% from total (67) female samples examined	Total Infected No.	% from total positive cases (133)	% from total samples examined (280)
1.	<i>E. histolytica</i>	21	9.86	14	20.89	35	26.31	12.50
2.	<i>Giardia</i> spp.	5	2.34	2	2.98	7	5.26	2.50
3.	<i>E. coli</i>	3	1.40	1	1.49	4	3.00	1.42
4.	Hookworm	44	20.65	31	46.26	75	56.39	26.78
5.	<i>A. lumbricoides</i>	40	18.78	25	37.31	65	48.87	23.21
6.	<i>T. trichiura</i>	6	2.81	5	7.46	11	8.27	3.93
7.	<i>Taenia</i> spp.	17	7.98	13	19.40	30	22.55	10.71
8.	<i>H. nana</i>	6	2.81	1	1.49	7	5.26	2.50



Graph 12 : Representation of Prevalence of Specific Intestinal Parasites.



Photo 7 : Cyst of *E. coli*.



Photo 8 : Cyst of *E. histolytica*.



Photo 9: Cyst of *Giardia sps.*



Photo10: Ovum of Hookworm.

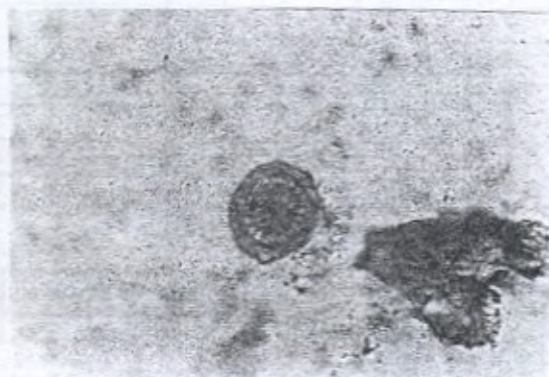


Photo11 : Ovum of *A. lumbricoides*.

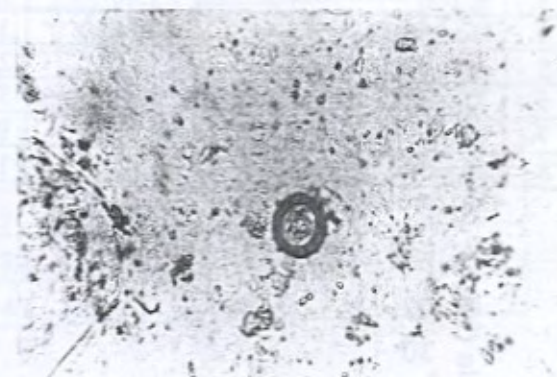


Photo 12 : Ovum of *Taenia sps.*

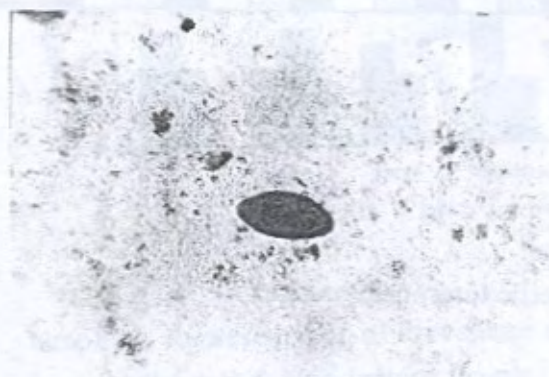


Photo 13: Ovum of *T. trichiura*.

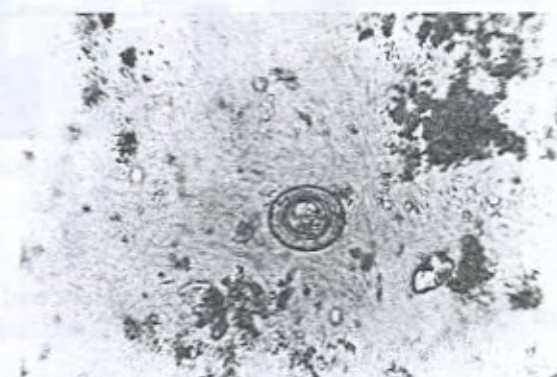


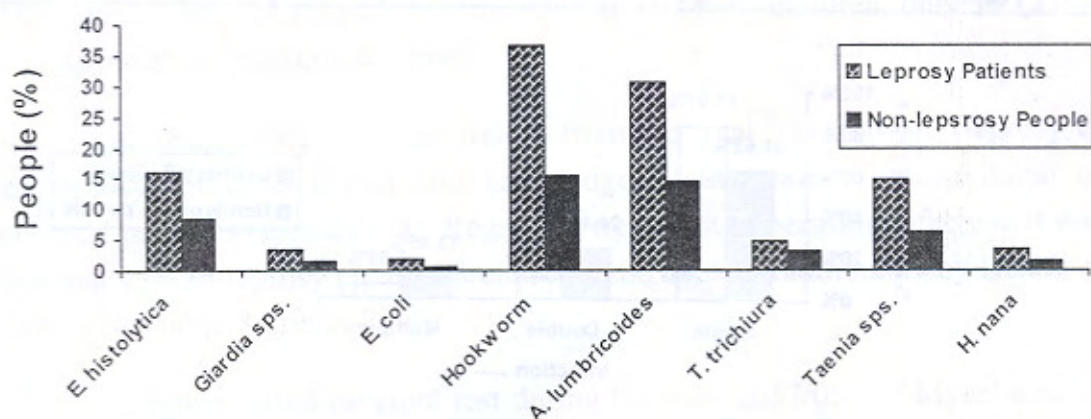
Photo14: Ovum of *H. nana*.

6. Group – wise Prevalence of Specific Intestinal Parasites

The analytical study of the table no. 14, graph-13, reveals that the distribution of Hookworm was the highest in both leprosy (i.e. 37%) and non-leprosy (i.e. 15%) whereas *E. coli* was the lowest in leprosy patients (i.e. 2%) and non-leprosy people (i.e. 1%). The comparative study concluded that the infection rate with different specific types of intestinal parasites was higher in leprosy patients than non-leprosy people. Statistically, significant difference was found in the prevalence of specific intestinal parasites i.e. Hookworm ($\chi^2=8.70$, $P>0.05$) and *Ascaris* ($\chi^2=5.68$, $P>0.05$) between leprosy patients and non-leprosy people. But no significant difference was found in other species among leprosy patients & non-leprosy people.

Table 14: Positivity of different types of Intestinal Parasites in Leprosy Patients and Non-leprosy People

S. N.	Parasites	Leprosy Patients		Non-Leprosy People		Total (Leprosy & Non-leprosy People)	
		Positive cases		Positive cases		Positive cases	
		No.	% (150)	No.	% (130)	No.	% (280)
1.	<i>E. histolytica</i>	24	16.00	11	8.46	35	12.50
2.	<i>Giardia sps.</i>	5	3.33	2	1.53	7	2.50
3.	<i>E. coli</i>	3	2.00	1	0.76	4	1.42
4.	Hookworm	55	36.66	20	15.38	75	26.78
5.	<i>A. lumbricoides</i>	46	30.66	19	14.61	65	23.21
6.	<i>T. trichiura</i>	7	4.66	4	3.07	11	3.93
7.	<i>Taenia sps.</i>	22	14.66	8	6.15	30	10.71
8.	<i>H. nana</i>	5	3.33	2	1.53	7	2.50



Graph 13: Representation of Positivity of different types of Intestinal Parasites in Leprosy patients & Non-leprosy people.

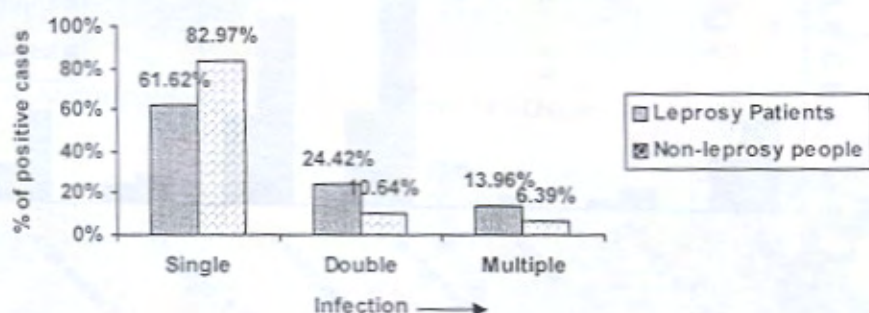
7. Single or Concurrent Infection of Intestinal Parasites in Leprosy Patients and Non-leprosy People

Table no. 15, graph-14, reveals that out of 133 (47.5%) infected people (both leprosy patients & non-leprosy people) the intensity of infection i.e. 92 (69%) showed single infection, 26 (20%) showed double infection and 15 (11%) showed multiple infection. The multiple infection was recorded in both leprosy patients & non-leprosy people with 12 (14%) and 3 (6%) respectively. Double infection was also recorded in both leprosy patients & non-leprosy people with the higher intensity in leprosy patients (24%) and the lower in non-leprosy people (11%). In the same way single infection was more 82.97% in non-leprosy people.

The double infection was of *E. histolytica* & *E. coli* or *E. histolytica* and Hookworm or *E. histolytica* & *A. lumbricoides* or *A. lumbricoides* and Hookworm or Hookworm and *Taenia* sps. or Hookworm and *T. trichiura* or *A. lumbricoides* and *Taenia* sps. The multiple infection were of *E. histolytica*, Hookworm & *A. lumbricoides* or *Ascaris lumbricoides*, *Taenia* sps. and Hookworm or *E. histolytica*, *T. trichiura*, Hookworm & *A. lumbricoides*. Hence, in the double and multiple infection, the Hookworm and *A. lumbricoides* were found to be common in leprosy patients and non-leprosy people.

Table 15: Single or Concurrent Infection of Intestinal Parasites in Leprosy Patients and Non-leprosy People

S. N.	Group	Total Sample Collected	Positive cases						
			Total No.	single		Double		Multiple	
				No.	%	No.	%	No.	%
1.	Leprosy Patients	150	86	53	61.62	21	24.42	12	13.96
2.	Non-leprosy people	130	47	39	82.97	5	10.64	3	6.39
	Total	280	133	92	69.18	26	19.54	15	11.28



Graph 14: Representation of Single or Concurrent Infection of Intestinal Parasites in Leprosy Patients and Non-leprosy People.

DISCUSSION AND CONCLUSION

The present study has been carried out on intestinal parasitic infections in leprosy patients and non-leprosy people of Anandaban Leprosy Hospital, Lalitpur. No article regarding intestinal parasitic infection in leprosy patients has been found. No similar such study regarding intestinal parasitic infections in leprosy patients and non-leprosy people of Anandaban Leprosy Hospital has been conducted previously.

Only the secondary data regarding the prevalence of intestinal parasites in Leprosy patients from the Anandaban Leprosy Hospital is used for the present study. The discussion is mostly based on the non-leprosy people.

In the present study out of 280 interviewed persons, 170 (61%) person were not used toilet, out of this, 108 (72%) were leprosy patients & 62(48%) were non-leprosy people (see table -2, graph -2). Rai *et al.* (2001) had reported from rural village else where in Nepal that over 80.% of house holds had no toilets.

Altogether from the total of 280 interviewed persons only 60(21%) were aware of the intestinal parasites (see table -3, graph-3). Likewise, Pradhan (2001) also reported poor knowledge of parasitic infection in Magar & Majhi children of Nawalparasi district of Nepal. He reported that out of 169 Magar children, 65 (38%) were aware of parasitic worms. Out of 71 Majhi children, only 16 (23%) were aware about parasitic worms.

Regarding mode of transmission, from the total of 60 aware (leprosy & non-leprosy) only 35 (58%) had knowledge about mode of transmission of intestinal parasites (see table -4). Regarding treatment of parasitic infection, it was seen that 15% of leprosy patients preferred to be treated traditionally by Dhimi & Jhankri (see table-8, graph-7).

The report based on stool test during the year 2057/058 of Mycobacterial Research Laboratories (MRL), Anandaban Leprosy Hospital, Lilitpur, showed that 720 leprosy patients and 405 non-leprosy people came to MRL of ALH for their stool test.

Out of 280 stool samples examined, 133(47.5%) samples were found positive for one or more specific intestinal parasites (see table -9, graph-8). Rai *et al.* (2001) found 78.5% prevalence of intestinal parasites in children of Achham district in far-western region of Nepal.

In the present study, 8 different species of intestinal parasites were found belonging to protozoa & helminthes. Three species were of protozoa and 5 species were of helminthes (i.e. three species of nematodes and two species were of cestodes). Trematode infection was not found. The Mycobacterial Research Laboratories record also showed presence of ova of Hookworm, *Ascaris lumbricoides*, *Taenia* *sps.*, *T. trichiura* and cyst or trophozoite of *E. histolytica* & *Giardia* *sps.* in the leprosy patients and non-leprosy people.

The study showed that intestinal parasitic infections of leprosy patients and non-leprosy people of Anandaban Leprosy Hospital was characterized by the high prevalence of soil-transmitted nematode infection. The prevalence of Hookworm was the highest (27%), followed by *Ascaris lumbricoides* (23%), *Taenia* *sps.* (11%), *H. nana* (2.5%) and *T. trichiura* (4%). The *E. histolytica* (12.5%) *Giardia* *sps.* (2.5%) and *E. coli* (1%) were found (see table-13, graph-12).

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

Nepal and Palfy (1980) examined 2070 stool samples in Pathology Laboratory of Narayani Zonal Hospital. 1592 (77%) samples were infected by intestinal parasites.

Estevenz *et al.* (1983) examined 40 stool samples in remote area of western Nepal, 36 (i.e. 90%) were positive for parasites.

Shrestha (1983) showed 99% stools positive for the soil-transmitted helminthes in Bhaktapur district. Ninety four (94%) were *A. lumbricoides*, 42% *Trichuris* *sps.* and 11% Hookworm.

Rai *et al.* (1986) examined 200 stool samples in Birgunj. The incidence of roundworm was the highest (i.e. 35%) followed by Hookworm (i.e. 14%). The infection rate was 69%.

Rai *et al.* (1991) presented the paper to show the prevalence of various intestinal parasites in Kathmandu valley, Nepal. The overall prevalence of intestinal parasites was 31%. There was no significant difference in the prevalence between two sexes. This result is in agreement with the present study.

Similarly, Rai, *et al.* (1994) studied status of Soil-transmitted helminthic infection in Nepal. The annual rate of positivity for soil-transmitted helminthiasis ranged from 18-37%.

Sherchand (1997) did a stool survey on intestinal parasites in rural village of Dhanusa district, southern Nepal. Out of 604 children examined, 60% were found positive, Hookworm infection supposed all parasites by showing positivity of 12% followed by *A. lumbricoides* (8.5%), *T. trichiura* (6%), *S. stercoralis* (4%) and *O. vermicularis* (2%). This result is also similar to the present study.

Rai *et al.* (2001) did similar research in hilly area in western Nepal (Achham). They found nine species of parasites (five species of helminthes and four species of protozoa) of which *A. lumbricoides* was the commonest one (32%) followed by hookworm (29%), *T. trichiura* (24%) and others. This result is in agreement with the present study.

These species are also reported by previous workers in Nepal viz; Yadav (1986), Gupta (1988), Sherchand (1997), Navitsky *et al.* (1998), Rai (2000) and Pradhan (2001).

Out of eight intestinal parasitic species, Hookworm was the commonest (27%) followed by *A. lumbricoides* (23%), *E. histolytica* (12.5%), *Taenia* *sps.* (11%), *Giardia* *sps.* (2.5%) & *H. nana* (2.5%), *T. trichiura* (4%) and *E. coli* (1%) (see table -13, graph-12). In Leprosy patients, the highest prevalence was of Hookworm (37%) followed by *Ascaris lumbricoides* (31%), *Taenia* *sps.* (15%), *E. histolytica* (16%), *E. coli* (2%), *H. nana* (3%), *Trichuris trichiura* (5%) and *Giardia* *sps.* (3%). Similarly in non-leprosy people, the highest prevalence was of Hookworm (15%) followed by *Ascaris lumbricoides* (15%), *E. histolytica* (8%),

Teenia sps. (6%), *T. trichiura* (3%), *H. nana* (2%), *E. coli* (1%) and *Giardia* sps. (2%). The analytical study showed that, the distribution of Hookworm (37%) was the highest whereas *Giardia* sps. (2%) was the lowest in leprosy patients and also Hookworm (15%) was the highest whereas *E. coli* (1%) was the lowest in non-leprosy people (see table-14, graph-13). Statistically, significant difference was found in the prevalence of specific intestinal parasites i.e. Hookworm ($\chi^2=8.70, P>0.05$) and *Ascaris* ($\chi^2=5.68, P>0.05$) between leprosy patients and non-leprosy people. But no significant difference was found in other species between both leprosy & non-leprosy.

Rai. *et al.* (1986) studied the intestinal parasitic infection in students of Birgunj city. The incidence of roundworm was the highest (i.e. 35%) followed by Hookworm (i.e. 14%).

Similarly, Khetan *et al.* (1980) studied the incidence of parasitic infections in Central Nepal Narayani Zone. They observed 29% hookworm, 9% roundworm, 10% *T. trichiura*, 8.5% *Giardia* sps. and 4% *E. histolytica*. In this result hookworm infection was found to be more common. This result is also in agreement with the present study.

In the present study, out of 133 positive cases, 92 (69%) showed single infection, 26 (20%) showed double infection and 15 (11%) showed multiple infection. The multiple infections were recorded in both leprosy patients and non-leprosy people with 12(14%) and 3(6%) respectively. The single infection was more 39(83%) in non-leprosy people than leprosy patients 53(62%).

Pradhan (2001) reported that out of 169 Magar children, 54 (90%) showed single infection and 6(10%) showed double infection. Similarly, out of 71 Majhi children (100%) viz; all of them showed single infection.

In the present study, sex-wise prevalence of intestinal parasites of leprosy patients and non-leprosy people were done. Altogether the females (51%) were more infected than males (46%).

Pradhan (2001) reported that in total females were more infected (i.e. 33%) than males (31%). Male and female Magar children were more or less equally

infected i.e. 36% and 35% respectively. But Majhi children females were more infected than male children (i.e. 27% and 21% respectively).

Sherchand (1997) showed that, the parasitic load was found slightly higher in female (58%) compared to male (42%). This result is in agreement with the present study.

The present result showed that male (59%) leprosy patients were more infected with intestinal parasites than female (54%) patients. In contrast, in non-leprosy people, female (46%) were more infected than males (33%) with different types of intestinal parasites (see table-11, graph10). Statistically, the difference was found to be significant between males of leprosy patients and non-leprosy people ($\chi^2=6.92$, $P>0.05$).

Result of Rai *et al.* (2001) showed that parasites were almost uniformly distributed in both males (76.5%) and females (76%) in rural hill areas in western Nepal (Achham). This result is in agreement with the present study.

According to Rai (2000) the prevalence of Intestinal Helminth parasites of the studied area Kumaltari, Tanahun district of Nepal, on the basis of gender, four localities had different results. The result showed that females were more infective in Baireni and Atreuli (i.e. 85% and 71% respectively) while males were more infective in Bote-tar and Dumsi (i.e. 93% and 46% respectively). Male and female in Bote-Community were more or less equally infected (i.e. 76% and 76% respectively) but in Darai community people, female were more infective than male (i.e. 53% and 48% respectively). In total females were more infected i.e. 63% than males i.e. 58%.

In the present study, the leprosy patients and non-leprosy people were grouped into 7 groups i.e. (0-10), (20- 30), (30-40), (40-50), (50 – 60) & (60 above) years. Among these groups, more infection (63%) by the intestinal parasites were recorded in 60 years above age-group. Overall distribution of intestinal parasites in leprosy patients showed maximum infection in 60 years above age-group i.e. 71% and minimum in 10-20 years i.e. 33% while in non-leprosy people maximum infection was indicated in 10-20 years age group (50%) and minimum in 30-40 years age-group (27%) (see table -12, graph -11).

Rai (2000), showed more infection rate (i.e. 68%) in the >30yr. age group in Kumaltari by the intestinal helminth parasites. This result is in agreement with the present study.

Sherchand (1997) showed that the parasitic infection was the highest (31%) in the age - group 6-9 years.

Pradhan (2001) also reported that maximum infection (i.e. 45%) by the intestinal helminth parasites was recorded in 10-15 years age - group.

The leprosy is a disease which was even feared in the past. It distorts the face and cripples a person. In many cultures, the person's value is reduced to almost zero. The leprosy patients spend conservative life, believe and depend on Dharmi & Jhankri. Hence, they are frequently victimized by different types of deformities. In the present study, 15% of leprosy patients preferred to be treated by Dharmi and Jhankri (see table -8, graph-7).

It has been maintained already that immunity is specific to particular disease. When we say that a patient of lepromatous leprosy has no resistance, the lack of resistance is only against leprosy. He is not capable of producing immunity against leprosy but if challenged with other antigens, he is as competent as any other normal person to produce the corresponding immunity. For example, he can develop immunity against typhoid, plague or cholera if vaccinated. Similarly, the heightened cell mediated immunity in Tuberculoid leprosy is only against leprosy and such a patient can be susceptible to a virus infection (Thangaraj & Yawalkar, 1988).

The result showed that the prevalence of intestinal parasites was high in leprosy patients i.e. 86 (57%) than the non-leprosy people 47(36%) (see table -9, graph -8). This may be because of the illiteracy, usual practice of open field, defecation, walking barefoot and lack of knowledge of parasitic infection as well as mode of transmission. This was confirmed by the questionnaire study.

The non-leprosy people were comparatively low infected (36%) than the leprosy patients (57%). This may be because the data collected and analysed for the present studied had non-leprosy people who were more literate, aware and with good sanitary and hygienic conditions when compared to that of leprosy

patients. The non-leprosy people have more knowledge of parasitic infection as well as mode of transmission than leprosy patients.

Unhygienic conditions, poor sanitation, lack of education are most important factors which play an important role in prevalence of intestinal parasitic infections in leprosy patients and non-leprosy people of Anandaban Leprosy Hospital, Lalitpur.

Climatic and other environmental condition or human customs favour the prevalence of a particular helminth. Craig & Faust (1970) reported that in warm and moist climates, infection with several intestinal or other helminths are encountered in a large proportion 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 each parasite in the causation of the clinical picture & multiple methods of attack to reduce the prevalence of the parasites in the individual and the community.

Under their favourable circumstance, intestinal parasites 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 growth other symptom associated with both larval and adult stage includes neumonities, asthma, diarrhoea, nausea, vomiting, abdominal pain and anorexia. The infection of intestinal parasites harm their hosts are by mechanical damage, devouring of tissues or loss of blood by toxic effects.

So, regularly & timely control measure should be undertaken other wise the situation might be aggravated to such an extend that man and animals may become vulnerable to a number of parasitic diseases as well as other transmissible disease which will be beyond our reach. It may be assumed that similar situation might be prevailing in other places of our country, which are yet to be investigated.

VII

RECOMMENDATIONS

1. The people should be made aware of the fact that leprosy is a curable disease and not the curse of god.
2. Avoid any infection through the abraded skin of the limbs of leprosy patient.
3. Better care is to be taken for the leprosy patients because of their low resistance to diseases.
4. Avoid walking barefoot and use gloves & foot wears during working on farms to prevent soil-transmitted helminths.
5. There is a need for educating people about public health and sanitary condition of the community.
6. Prevention of soil contamination with faeces & sewage and dis-infection of contaminated soil.
7. Well established sanitary toilet should be built up in each and every home.
8. Consumption of unwashed fruits and vegetables and washing with contaminated water should be prevented.
9. Proper meat inspection in slaughter houses to eliminate measly pork and avoid eating raw and uncooked meat should be carried out.
10. Public health education in the school curriculum must be made compulsory.
11. The education of people on sanitation and hygiene should be given.
12. The research work on the prevalence of intestinal parasites and prevention should be encouraged.

REFERENCES

- Acharya, S. (1979). "*Malnutrition and Diarrhoeal Disease*". Journal Inst. Med. 1(2) : 21-23.
- Albonica, M., H.M. Chwaya, A. Montresor, R.J. Stolfzfus, J.M. Tielsch, K.S. Alawi and L. Savioli (1997). "*Parasitic Infections in Pemba Island School Children*." East African Medical Journal 75 (5) May: 294-298.
- Alo, E.B., J.C. Anosike and J.B. Danburan (1993). " *A survey of Intestinal Helminthes among Students of Post-Primary Institution in Adamawa State, Nigeria*". Applied Parasitology 34 (3) : 161-167.
- Annual report (1999). "*Working Together to Eliminate Leprosy*". The Leprosy Mission Nepal, Anandaban Leprosy Hospital, Tikabhairav, Lalitpur.
- Annual report (2001). "*Working Together to Eliminate Leprosy*". The Leprosy Mission Nepal, Anandaban Leprosy Hospital, Tikabhairav, Lalitpur.
- Asaolu, S.O., C.V. Holland, J.O. Jegede, N.R. Fraser, R.C. Stoddard and DWT Crompton. (1992). "*The Prevalence and Intensity of Soil-transmitted Helminthiasis in Rural Communities in Southern Nigeria*." Ann Trop parasitol 86 (3): 279-287.
- Bangs, M.J. Purnomo, E.M. Andersen and R.L. Anthony (1996). "*Intestinal Parasites of Humans in a Highland Community of Irian Jaya, Indonesia*." Annual of Tropical Medicine and parasitology 90 (1): 49-53.
- Bol., J.P. and E.L. Reder (1981): "*Soil-transmitted Nematodes in Lalitpur District in Nepal*." Jour. Mstl. Med. 3(2):167-178.
- Chacin-Bonilla, L., E. Bonilla, A.M. Parra, J. Estevez, L. M. Morales and H. Suarez (1998). "*Prevalence of Entamoeba histolytica and other Intestinal*

Parasites in a Community from Maracaibo, Venezuela. Ann Trop Med Parasitol 86(4):373-380.

Chai, Jong-Yil and Bouasy Hongvanthong (1998). "*A small-scale survey of Intestinal Helminthic infections among the Residents neat Pakse, Laos.*" Korean Journal of Parasitology 36 (1) March : 55-58.

Craig and Faust's (1970). *Clinical Parasitology* (Text Book).

Fagbenro- Beyioku, F.A and J.P.O. Oyerinde (1987). "*Parasitic Intestinal Infections of Children in Lagos (Nigeria).*" Niger J. Paediatric 14(314): 89-96.

Goncalves, J.F., M. Tanabe, F. De paulo, De M. Medeiros, F. J. Gomcalves, I. De S. Aca, S. R. N. De Motta, S. Tateno and T. Takeuchi (1990). "*Parasitological and Serological Studies on Amoebiasis and other Intestinal Parasitic Infections in the Rural Sector around Recife, Northeast Brazil.*" Rev. Inst. Med. Trop Sao Paulo 32 (6) : 428-435.

Gupta, R. (1988). "*Studies on the Infection rate of Human Intestinal Parasites of Kirtipur.*" Journal of Nep. Med. Asso. 26, no.4.

Hammouda, N., A. Wagih, M. E.L.Gebali and M. K. Razek (1992). "*Intestinal Parasitic Infection among Sewage Worker in Alexandria, Egypt.*" Journal of Egypt Soc Parasitol 22. (2):299-303.

Hasegawa, H.I. Miyagi, T. Toma, K. Kamimura, J. Nainggolan, M. Tumewu-wagel; H.G. Mandagiwaworuntur, F.X. Kapojos, J.Runtuwene, C. P. Runtupalit and Syafruddin (1992). "*Intestinal Parasitic Infections in Likupang, North Sulawesi, Indonesia.*" Southeast Asian Journal Trop Med Public Health 23. (2):219-227.

Ibrahim, Osama M.G., A. Bener and A. Shalabi (1999). "*Prevalence of Intestinal Parasitic among Expatriate Workers in Al-Ain, United Arab Emirates*". Ann Saudi Med 13 (2):126-129.

International Journal of Leprosy (2002). "*Report of International Leprosy Association Technical Forum, France*". March 2002, Volume – 70, Number-1.

- Kappu, K., D. Raymond, G. Gundrgren, J.R. Dennis, D. Juranek, J. M. Roberts and H. C. Spencer (1994). "*Intestinal Parasitism in the United State update and Continuing problem.*" American Journal of tropical medicine and hygiene 5 (6): 705-712.
- Karim, R., N. Rahman, A. Khairul, A. R. Mehdi and B. Abdullah (1995). "*Parasitic Infection in the Aboriginal Community at Temengor, Hulu Perak, Malaysia*". Malayan Natural Journal 48 (3-4) : 425-432.
- Khetan, R.P.(1980). "*Incidence of Parasitic Infection in Narayani Zone.*" Journal of Nepal Med. Assoc. 18(4):29-31.
- Machado, M. T., M.S. Machado, R. M. Yoshikae, A. L. A. Schmidt, R. De C. A. faria, M. A. Paschoalotti, R. De C. B. Barata and P. P. Chieffi (1996). "*Ascariasis in the Sub-district of Cavacos, Municipality of Alterosa (MG) , Brazil : Effect of mass Treatment with Albendazole of the Intensity of Infection*". Revista do Institute de Medicina Tropical de Sao paulo 38 (4) : 265-271.
- Miller, A.J.W., D.H. Bass and P. V. De Merwe (1989). "*Parasitic Infestation in Cape Town (South Africa) Children : A random Study of 101 Patients.*" S. Afr. Med. J. 76 (5): 197-198.
- Navitsky, R.C., M.L. Dreyfuss, J. Shrestha, S.K. Khatry, R.J. Stoltzfus and M. Albonico. (1998). "*Ancylostoma duodenale is responsible for Hookworm Infections among Pregnant Woman in the Rural Plains of Nepal*". Journal of parasitology 84 (3)June:647-651 .
- Nepal, M. and B. Palfy (1980). "*A Study of Prevalence of Intestinal Parasites in the Mahankal Panchyat and their Relation with Hemoglobin levels*". Jour. of Inst. Med. 2(2) :175-182.
- Norhayati, M., B. Zainudin, C.G. Mohammod, P. Oothuman, O. Azizi and M.S. Fatmah (1997). "*The Prevalence of Trichuris, Ascaris and Hookworm Infection in Orang Asli Children.*" Southeast Asian Journal of Tropical Medicine and public Health 28 (1) : 162-168.
- Obiamiwe, B.A. and P. Nmorsi (1991). "*Human Gastro-Intestinal Parasites in Bendel State, Nigeria.*" Angew Parasitol 32 (3): 177-183.

- Palmer, D.R. and D.A.P. Bundy (1995). "*Epidemiology of Human Hookworm and Ascaris lumbricoides Infestations in Rural Gambia.*" East African Medical Journal 72 (8) : 527-530.
- Paul I., G. Gnanamani and N.R. Nallam (1999). "*Intestinal Helminth Infections among School Children in Visakhapatnam.*" Indian Journal of Pediatrics 66(5) Sep. -Oct. : 669-673.
- Pradhan, S. (2001). "*Prevalence of Intestinal Helminth Parasites in Magar and Majhi Children of Pragatinagar VDC of District Nawalparasi, A Community Based Study.*" A thesis submitted to The Central Department of Zoology, T.U. :38-44.
- Rai, R.B. (2000). "*Prevalence of Intestinal Helminth Parasites in General and Taenia sps. in Detail, Particularly in Bote and Darai Communities of Vyash Municipality -5, Kumaltari, Tanahun District of Nepal.*" A thesis submitted to the Central Department of Zoology, T.U. : 54-65.
- Rai, S.K. and C.K. Gurung (1986). "*Intestinal Parasitic Infection in High School level Students of Birgunj City.*" Jour. Inst. Med 8 (1a) : 33-38.
- Rai, S. K., M. Nakanishi, J.B. Khadka, C.M. Sharma, M.K. Shrestha and H.G. Shrestha (1991). "*Intestinal Parasites in Kathmandu, Nepal.*" Asian Conference in Medical Laboratory Technology, 4th, Bangkok, Thailand.
- Rai, S.K., M. Takeo, O. Kazuo, O. Yoko, U. Shoji, N. Rai, and H.G. Shrestha (2001). "*Intestinal Parasites in an unknown Disease out-break HIT Rural Hilly area in Western Nepal.*" Nepal Medical Council Journal 2 (2) : 61-64.
- Rai, S.K., T. Kubo, M. Nakamishi, K. Sumi, H. Shibata, A. Matsuoka and H.G. Shrestha (1994). "*Status of Soil-transmitted Helminthes Infection in Nepal.*" The Journal of the Japanese Association of infectious disease 68 (5) : 625-630.
- Ramesh, G.N., N. Malla, G.S. Raju, R. Sehgal, N.K. Ganguly, R.K. Ganguly, R.C. Mahajan and J.B. Dilwari (1991). "*Epidemiological Study of Parasitic Infestations in Lower Socio-economic group in*

- Chandigarh (North India)". Indian Journal, Med Res sect A 93 (Jan):47-50.
- Rawlins, S.C., M. Campbell, K. fox, f. Bennett, W.N. Gibbs and M. Greene (1991). "*Immunogenicity , Reactogenicity and Comparison of two doses of Recombinant DNA Yeast, derived Hepatitis-B Vaccine in Ethiopian Children*". Trop Geogr Med 43 (1/2) : 220-227.
- Roche, J. and A. Benito (1999). "*Prevalence of Intestinal Parasitic Infections with special reference to Entamoeba histolytica on the Island of Bioko (Equatorial Guinea.)*" American Journal of Tropical Medicine and Hygiene 60 (2) Feb: 257-262.
- Saito, S., H. Gemenez, M. Ohnishi, L. G. Ignacia, R. De. Molinas, C. M. R. Arce, T. Kobayakawa and F. Sendo (1996). "*Epidemiological Survey for Intestinal Parasites as a part of Primary care Project in Caazapa Dept. Paraguay.*" Yamagata Medical Journal 14(2): 25-32.
- Sharma, B.P. (1965). "*Roundworm and other infestation.*" Journal of Nep.Med. Assoc. 3(2): 120-123.
- Sharma, R.P. and N.R.Tuladhar (1971). "*A Study on Intestinal Parasites amongst Auxiliary Health Worker's Students in Kathmandu.*" Journal of Nepal Medical Association. 9 (4): 257-261.
- Sherchand (1997). "*Intestinal Parasitic Infections in Rural Areas of Southern Nepa.*" Journal of the institute of Medicine 19 (3 and 4): 115-121.
- Shrestha, I.L. (1983). "*Soil-transmitted Helminthiasis.*" Journal of Inst. Med. 5(2): 193-196.
- Tellez, A., W. Morales, T.Rivera, E. Meyer, B. Leiva and E. Linder. (1997). "*Prevalence of Intestinal Parasites in the Human Population of Leon, Nicaragua.*" Acta Tropical 66(3):119-125 .
- Thangaraj R. H. and S.J. Yawalkar (1988). "*Leprosy for Medical Practitioners and Paramedical Workers.*" Third revised edition, Ciba-Geigy Limited, Basle, Switzerland.
- Udonsi, J.K., J.M. Behnke and F.S. Gilbert (1996). "*Analysis of the Prevalence of Infection and Associations between Human Gastrointestinal*

Nematodes among different age classes living in the Urban and Sub-urban Communities of Port Harcourt, Nigeria". Journal of Helminthology 70 (1) : 75-84.

Virk, K., R.N. Prasad and H. Prasad (1994). "*Prevalence of Intestinal Parasites in Rural areas of District Shajahanpur, Utter Pradesh* ." Journal of Communicable Diseases 26(2):103-108.

Wondimagegnehu, T., T. Woldemichael and T. Assefa (1992). "*Hookworm Infection among the Melka Sedi Banana Plantation Residents, Middle Awash Valley, Ethiopia*". Ethiop Med.Journal 30 (3) : 129-134.

Yadav, S.N. (1986). "*Some Helminth Parasites found in Kirtipur Area, Kathmandu*." A dissertation submitted on the partial fulfillment of degree in zoology, Central Department of Zoology, T.U.

Yassin, M. M., M. E. Shubair, A. L. Al. Hindi and S. Y. Jadallah (1999). "*Parasitic Infection among School Children*." Journal of the Egyptian Society of Parasitology Children in Gaza city, Gaza Strip.

Zdero, M., G. Cabrera, P. P. De Leon, I. Nocito and C. Echenique (1997). "*Parasitosis in an Adult Population with Chronic Gastrointestinal Disorders*." Acta Gastroenterologica Latinoamericana 27 (2) : 67-73.

IX
ANNEX – I
QUESTIONNAIRE

S.No. ----- Date : -----

Name: ----- Sex: -----

Age :----- Locality :-----

1. Family type : Joint / separate
2. Socio –economic : Agriculture / Service / Business / others
3. Sanitary system : Toilet / Open
4. Literacy : Yes / No
5. Water supply : Tap water / Tube-well water / Well water / River water
6. Food Habit : Vegetarian / Non- vegetarian
7. Meat frequently take : Pork / Buff / Mutton/ Chicken / Fish / All
8. Use of any medicine for intestinal parasites : Yes/ No
9. Knowledge about parasites : Yes/ No
10. Knowledge about mode of infection: Yes/No
11. Treatment method: Hospital / Health post / Tradition

Remarks

Interviewers Name

आनन्दवन कुष्ठरोग अस्पताल आनन्दवन, ललितपुर

परजीवि अनुसन्धानात्मक अध्ययन

अनुसन्धानात्मक अध्ययनको मञ्जुरीनामा

यस अध्ययनमा तपाईंको सहभागिता स्वैच्छिक हो र तपाईंलाई यस अध्ययनमा समावेश नरहन तथा कुनै प्रश्नको उत्तर नदिने अधिकार छ । यस अध्ययनमा तपाईंको सहभागिता नरहेको कुनै प्रश्नको उत्तर नदिने तपाईंको अधिकार छ । यस अध्ययनमा तपाईंसँग केही दिशा दिनको लागि अनुरोध गरिनेछ । उक्त दिशाबाट हामी त्यसमा पाइने परिजीविहरूको परिक्षण गर्ने छौं । तपाईंको उत्तरहरू गोप्य रहनेछन् र कसैलाई देखाइने छैन । आवश्यक परेमा अनुसन्धानकर्ताहरूले हेर्न सक्ने छन् । यस अध्ययनमा अन्तरवार्ताकारले केही प्रश्न गर्नेछन् ।

यस अध्ययनमा मेरो सहभागिता स्वैच्छिक हो र अनुसन्धानात्मक प्रकृया परिचालन गर्न सहमत छु । मेरो राजिखुशीले यस फारममा सही गर्दछु ।

सहभागीको सही

मिति:

साक्षीको सही

मिति:

अनुसन्धानकर्ताको सही



Nepal Health Research Council



NHRC

Date :

October 22, 2001

Ref. 256

Mr Dipak Gupta
Central Department of Zoology
Tribhuvan University, Kirtipur

Subject : Approval of the Research Proposal entitled, "Intestinal Parasitic Infections in Leprosy Patients and Non-leprosy People of Anandaban Leprosy Hospital, Tikabhairav, Lalitpur."

Dear Mr Gupta,

Executive Committee

We are pleased to inform you that the above mentioned proposal submitted by you has been approved by NHRC Board following the recommendation of the Technical Review Committee (TRC) and Ethical Review Committee (ERC). This also certifies that the proposal is ethically cleared.

Chairman
Prof. Gopal Prasad Acharya

As per NHRC regulation you are to follow strictly the protocol stipulated in your proposal finalized after the interaction of TRC and ERC with you. Any change in objectives(s), problem statement, research question or hypothesis, methodology, implementation procedure, data management and budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. You are thus strongly advised to submit to NHRC the details of such changes intended or desired with justification prior to instituting actual change.

Vice-Chairman
Prof. Ramesh Kant Adhikari

You are also to abide by the ethical guidelines of NHRC strictly during the implementation of your research proposal. In addition, in course of investigation of any medical health problem needing immediate care, further investigation, or expert consultation you are obliged to inform the subject - study or control. However, during the transmission of such information confidentiality must be maintained.

Member-Secretary
Dr. Kamal Gyawali

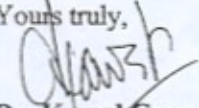
Lastly, you are obliged to submit periodic progress reports every 3 months and submit three copies of the final research report, and financial statement after completion of the research. If an article based upon that research is published, you should submit two copies of that article.

Members
Prof. Sanu Maiya Dali
Dr. Rishi Ram Koirala
Dr. Madhu Ghimire
Dr. Ram Kewal Shah
Dr. B.D. Chataut

If you have any question, please contact our research officers.

Thank you,

Yours truly,


Dr. Kamal Gyawali
Member-Secretary

Representative
Ministry of Finance
National Planning Commission
Ministry of Health
Chief, Research Committee, IOM
Chairman, Nepal Medical Council



Nepal Health Research Council



NHRC

Date :

October 22, 2001

Ref. 256

Mr Dipak Gupta
Central Department of Zoology
Tribhuvan University, Kirtipur

Subject : Approval of the Research Proposal entitled, "Intestinal Parasitic Infections in Leprosy Patients and Non-leprosy People of Anandaban Leprosy Hospital, Tikabhairav, Lalitpur."

Dear Mr Gupta,

Executive Committee

Chairman

Prof. Gopal Prasad Acharya

Vice-Chairman

Prof. Ramesh Kant Adhikari

Member-Secretary

Dr. Kamal Gyawali

Members

Prof. Sanu Maiya Dali
Dr. Rishi Ram Koirala
Dr. Madhu Ghimire
Dr. Ram Kewal Shah
Dr. B.D. Chataut

Representative

Ministry of Finance
National Planning Commission
Ministry of Health
Chief, Research Committee, IOM
Chairman, Nepal Medical Council

We are pleased to inform you that the above mentioned proposal submitted by you has been approved by NHRC Board following the recommendation of the Technical Review Committee (TRC) and Ethical Review Committee (ERC). This also certifies that the proposal is ethically cleared.

As per NHRC regulation you are to follow strictly the protocol stipulated in your proposal finalized after the interaction of TRC and ERC with you. Any change in objectives(s), problem statement, research question or hypothesis, methodology, implementation procedure, data management and budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. You are thus strongly advised to submit to NHRC the details of such changes intended or desired with justification prior to instituting actual change.

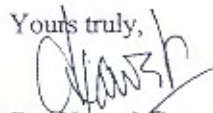
You are also to abide by the ethical guidelines of NHRC strictly during the implementation of your research proposal. In addition, in course of investigation of any medical health problem needing immediate care, further investigation, or expert consultation you are obliged to inform the subject - study or control. However, during the transmission of such information confidentiality must be maintained.

Lastly, you are obliged to submit periodic progress reports every 3 months and submit three copies of the final research report, and financial statement after completion of the research. If an article based upon that research is published, you should submit two copies of that article.

If you have any question, please contact our research officers.

Thank you,

Yours truly,


Dr. Kamal Gyawali
Member-Secretary