Intestinal parasitic infection with relation to socio-economic status of Jalari and Kumal communities in Lekhnath Municipality, Kaski, Nepal

Jamarkattel MP[a] and Ghimire TR[b]

Abstract

Introduction Intestinal parasitic infections have always been an important public health problem in the tropical and sub-tropical areas particularly in developing countries like Nepal, where the humid climate, the unsanitary environment, poor socio-economic conditions and over dispersion of parasites within the human communities contribute to the problem.

Objectives The general objective of the study was to determine the prevalence of intestinal parasites in the people of two ethnic groups (Jalari and Kumal) of Lekhnath Municipality ward number 9 and 1 respectively in Kaski District, Nepal.

Methods A total of 236 stool samples of the persons of different age and sex groups were randomly collected as 104 samples from Jalari and 132 samples from Kumal community from June 1, 2003 to September 27, 2003. The samples were preserved in 2.5 percent Potassium Dichromate and were examined by direct wet mount technique in iodine solution. Results were analyzed using Microsoft Excel Sheets (tables and diagrams) and statistical analysis (chi-square test in 95 % Confidence Interval).

Results Out of 236 stool samples examined, 56.0 percent (132) persons were infected with intestinal parasites with the prevalence 54.8 percent in Jalari and 56.8 percent Kumal community without any significant difference ($P>0.05$). The prevalence in males and females was 59.6 percent (31 out of 52) and 50.0 percent (26 out of 52) respectively in Jalari community without any significant difference with age-wise ($P> 0.05$) and sex-wise ($P> 0.05$). The prevalence in males and females was 63.9 percent (39 out of 61) and 50.7 percent (36 out of 71) respectively in Kumal community with statistically significant difference ($P<0.05$) with sex-wise and not significant difference with age-wise ($P>0.05$). The recorded parasites were *Entamoeba histolytica, Giardia lamblia, Ascaris lumbricoides* and *Trichuris trichiura* in both communities. Different factors are considered as risk factors for the parasite transmission. These are infected food, water, soil, pattern of defecation, food habit, water drinking habit, domestic animals in houses, and types of occupation, level of education, family income and knowledge to specific parasites on the basis of statistical analysis in 95 percent confidence interval.

Conclusion The reported intestinal parasites are prevalent in the study areas. Epidemiological studies are important for identifying etiological factors that play a role in risk assessment and in decision-making for the health promotion of these and other ethnic groups in Nepal.

Key words Intestinal Parasites, Socio-Economic Status.

Introduction

Nepalese people have their own unique language, culture, social organization, myths, legends, customs, moral values and traditions. Few countries exhibit such social, ethnical, linguistic and cultural

Corresponding Author: Madan Prasad Jamerkattel **E-mail:** madanparasites@yahoo.com, [a]Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal. [b]Department of Biology, Bagmati Modern College, Naxal, Kathmandu, Nepal.

diversity within such a small compass as Nepal so that the country may rightly be called the ethnic turntable of Asia[1].

Literacy, poverty, malnutrition, high infant mortality rate inadequate health facilities, poor water supply and unsanitary conditions have led the country to a very poor socio-economic condition[2]. Among the many health problems prevalent in Nepal, intestinal parasite infection constitutes a major health problem which is associated with water and sanitation of country. The high prevalence of the intestinal parasite might be indication of human behaviours like walking barefoot, poor sanitation, feeding behaviours, low socio-economic status, illiteracy and lack of awareness.

The feeding habit, education level, housing condition, personal and community sanitation, availability of health services, per capita income have been observed poor in the studied area. There are many NGOs, INGOs and other organization in the city whose aim is concerned with the health and socio-economic status of these groups. But they are always office-centred, city-centred, home-centred due to which the people who are socio-economically low status are unknown to such organizations. People are continuously infected with different types of diseases (such as common cold, typhoid, diarrhoea, dysentery, jaundice, ENT(Ear, Nose, Throat) Infections and viral infections), but no one is here to look, think, study and solve the problems of these ethnic groups. Diarrhoea might be the important result of the parasitic infection in these areas. So there need to study the relationship of intestinal parasitic infections with the socio-economic status of the people. The general objective of the present study was to determine the prevalence of intestinal parasites in the people of two ethnic groups, Jalari and Kumal of Lekhnath Municipality in ward number 9 and 1 respectively.

Materials and methods

Study Area

Lekhnath municipality is located about 181 km west from Kathmandu, the capital of Nepal and it is 10 kilometre east from Pokhara. It lies in Western Developmental Region, in Gandaki zone, in Kaski district. It lies from 28^0-5'- 28^0 12' North to 84^0 02'-84^0 08' east. This municipality was formed by the combination of other three village development committee: Lekhnath, Shisuwa and Begnas. The climate is sub-tropical. It is the region where highest rainfall occurs within Nepal. There are different types of people such as: Hindus, Buddhists, Muslims, Christians. Population distribution on the basis of castes is as follows: Bahun: 38 percent, Gurung: 13 percent, Occupational Castes: 13 percent, Chhetri: 9 percent, Magar: 4 percent, Newar: 3 percent and others: 20 percent[3].

Study population

The studied population was from Jalari and Kumal village. The Jalari village lies in ward number 9 and the Kumal village lies in ward number 1 of the Lekhanath Municipality. The total households observed were 22 (81.5 % out of 27) with the total observed population 104 (81.9 % out of 127) among Jalari community. Similarly, the total households observed were 24 (25.5 % out of 94) with the total observed population 132 (23.4 % out of 564) among Kumal community.

The main occupation of the Jalari people is fishing, however, some Jalari people are engaged in restaurants, and some being in foreign countries. They use fish as their primary food. As they live at the side of Beganas Lake, it is easy to catch fish, and go to near market (around Fewa Lake) to sell them. One can observe the poor sanitary condition of the most of the Jalari children and the women in this community. The main occupation of the Kumal is farming. However, some of these people have gone to foreign countries (golf countries) to earn money and a few of them keep their occupation on fishing. One can observe the poor hygienic condition of the Kumal people, mostly that of the children and old people.

Laboratory methods

A total of 236 stool samples were randomly colleted from the 236 people of Jalari and Kumal villages: 104 samples Jalari persons 132 samples Kumal persons. The samples were examined at Shisuwa Health Post, Mohoriya Community Hospital, Lekhanath Municipality and at Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu. The stool samples were examined microscopically under light microscope at 2.5 percent Potassium Dichromate and Iodine solutions. The significant difference was calculated by chi-square (χ^2-test) and it was considered significant if its value was less than 0.05 at 95 percent confidence interval.

Results

In the present study, out of 104 Jalari persons, 57 persons were infected with intestinal parasites and

the prevalence was 54.8 percent. This is depicted in table 1. It shows the prevalence of intestinal parasites with age and sex of Jalari persons. The prevalence in males and females were 59.6 percent (31 out of 52) and 50.0 percent (26 out of 52) respectively. In males, the prevalence was highest in the age of ≤ 10 years. Whereas, the lowest prevalence was from the age groups 41-50 years and 51+ years age, which is about 50.0 percent. In females, the highest prevalence (60.0 %) was from the age 10 years and the lowest prevalence was from the age 51+ years of age (42.8 %). There was no significant relationship in the prevalence of intestinal parasites with the age-groups (= 1.03, P>0.05) and sex of Jalari persons (χ^2 = 0.94, P>0.05).

Similarly, out of 132 Kumal persons, 75 persons were infected with intestinal parasites and the prevalence was 56.8 percent. The prevalence in males and females were 63.9 percent (39 out of 61) and 50.7 percent (36 out of 71) respectively. In males, the prevalence (80.0 percent) was highest in the age groups of 31-40 years. Whereas, the lowest prevalence (33.3 percent) was from the age groups 21-30 years. In females, the highest prevalence (60.0 percent) was from the age ≤ 10 years and the lowest prevalence (30.8 percent) was from the age groups of 21-30 years of age. There was significant relationship in the prevalence of intestinal parasites with the age-groups (= 20.42, P<0.05) and no significant relationship in the prevalence of intestinal parasites with the sex (χ^2 = 2.32, P>0.05). This is depicted in table 2.

In Jalhari community, out of 52 males, the lowest (3.8 %) and the highest (17.3 %) prevalence was those of *Trichuris trichiura* and *Ascaris lumbricoides* respectively. Similarly, out of 52 females, the lowest (2.0 %) and the highest (13.5 %) prevalence was those of *Trichuris trichiura* and *Ascaris lumbricoides* respectively. It has been predicted in figure 1.

Similarly, in Kumal community, out of 61 males, the lowest (3.3 %) and highest (21.3 %) prevalence was those of *Trichuris trichiura* and *Ascaris lumbricoides* respectively. Similarly, out of 71 females, the lowest (2.8 %) and highest (17.0 %) prevalence was those of *Trichuris trichiura* and *Ascaris lumbricoides* respectively. It has been shown in figure 2.

Table 1: Age and sex wise prevalence of intestinal parasites of Jalari Community

Age groups (yrs.)	Male Samples examined	Infected number	+ve %	Female Samples examined	Infected number	+ve %	Total Samples examined	Total infected number	+ve %
≤10	22	14	63.6	18	10	55.5	40	24	60.0
11-20	9	5	55.5	14	7	50.0	23	12	54.5
21-30	12	7	53.8	11	5	45.4	23	12	48.0
31-40	5	3	60.0	2	1	50.0	7	4	55.0
41-50	2	1	50.0	2	1	50.0	4	2	50.0
51	2	1	50.0	5	2	40.0	7	3	42.8
Total	**52**	**31**	**59.6**	**52**	**26**	**50.0**	**104**	**57**	**54.8**

Table 2: Age and sex wise prevalene of intestinal parasites of Kumal Community

Age groups (yrs.)	Male Samples examined	Infected number	+ve %	Female Samples examined	Infected number	+ve %	Total Samples examined	Total infected number	+ve %
10	9	7	77.8	20	13	65.0	29	20	69.0
11-20	18	13	72.2	20	9	45.0	38	22	57.9
21-30	15	5	33.3	13	4	30.8	28	9	32.1
31-40	10	8	80.0	13	8	61.5	23	16	69.5
41-50	3	2	66.7	3	1	33.3	6	3	50.0
51	6	4	66.7	2	1	50.0	8	5	62.5
Total	**61**	**39**	**63.9**	**71**	**36**	**50.7**	**132**	**75**	**56.8**

The table 3 depicts that the Jalari community, educational status and knowledge of parasites seem to be significant factors for the parasites transmission ($P< 0.05$). Similarly, the table 4 depicts that in Kumal community, occupation and knowledge of parasites seem to be the statistically significant factors for the parasites transmission ($P< 0.05$).

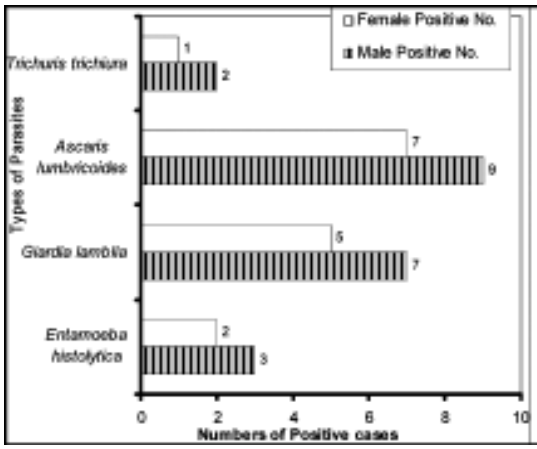

Figure 1: General prevalence of specific parasites in Jalari Community

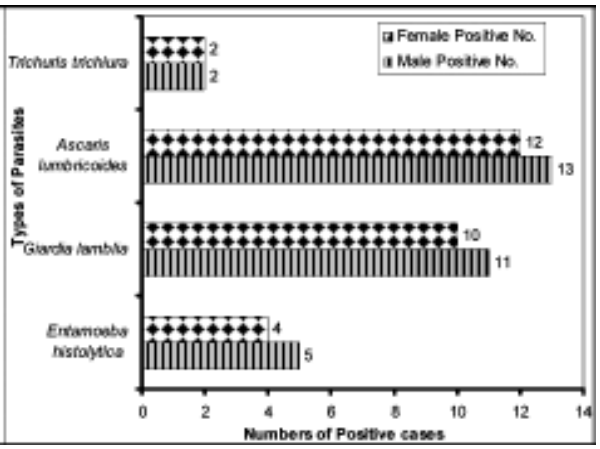

Figure 2: General prevalence of specific parasites in Kumal Community

Table 3: Prevalence of intestinal parasites with different risk factors in Jalari Community

CATEGORIES	Total No. of respondents	Total No. of Infected	Prevalence (%)
A. Food habit (= 1.12, P>0.05, not significant).			
Vegetarian	8	3	**37.5**
Non-vegetarian	96	54	**56.3**
B. Pattern of defecation (χ^2= 0.349, P>0.05, not significant).			
Toilet	98	53	**54.8**
Open place	6	4	**66.7**
C. Water drinking habit (χ^2= 5.41, P>0.05, not significant).			
Direct tap water	79	44	**55.7**
Boiled	7	3	**42.9**
Filtered	9	4	**44.4**
Direct well water	6	4	**66.7**
Direct lake water	3	2	**66.7**
D. Domestic animals in house (χ^2= 5.31, P>0.05, not significant).			
Chicken	25	16	**64.0**
Ducks	22	12	**54.5**
Ducks + Chicken	36	22	**61.1**
None	21	7	**33.3**
E. Occupation (χ^2= 2.26, P>0.05, not significant).			
Fishing	29	18	**62.0**
Fishing+ Jobs	58	28	**65.5**
Fishing + Farming	17	11	**64.7**
F. Educational Status (χ^2= 11.31, P<0.05, significant).			
Preprimary	51	32	**66.7**
Primary	19	11	**57.9**
Lower secondary	11	5	**54.5**
Secondary	9	4	**55.6**
Higher secondary	2	1	**50.0**
Illiterate	12	4	**33.3**
G. Economic Status (Annual income in NRS. Thousands) (χ^2= 2.53, P>0.05, not significant)			
≤10	45	28	**62.2**
11-20	21	10	**47.6**
21-30	14	7	**50.0**
31-40	11	6	**54.5**
41-50	8	3	**37.5**
51	5	3	**60.0**
H. Knowledge of Intestinal Parasites (= 7.57, P<0.05, significant)			
Nothing (having misunderstanding about parasites and its transmission by telling that parasites are transmitted through taking sweat, overexposure of sugars etc.)	93	52	**55.9**
Little (can say names and simple cause of parasites	9	4	**44.4**
Much (can fully discuss intestinal protozoa and helminths and its causes, effects and transmission)	2	1	**50.0**

Table 4: Prevalence of parasites with different risk factors in Kumal Community

CATEGORIES	Total No. of respondents	Total No. of Infected	Prevalence (%)
A. Food habit (χ^2= 1.12, P>0.05, not significant).			
Vegetarian	11	4	**36.4**
Non-vegetarian	121	71	**57.2**
B. Pattern of defecation (χ^2= 0.172, P>0.05, not significant).			
Toilet	124	70	**56.5**
Open place	8	5	**62.5**
C. Water drinking habit (χ^2= 2.33, P>0.05, not significant.).			
Direct tap water	98	58	**59.2**
Boiled	9	3	**33.3**
Filtered	15	8	**53.3**
Direct well water	10	6	**60.0**
D. Domestic animals in house (χ^2= 8.8, P>0.05, not significant).			
Chicken	46	34	**74.0**
Ducks	22	10	**45.4**
Ducks + Chicken	24	12	**50.0**
Ducks + Pigs	17	9	**53.0**
None	23	10	**43.5**
E. Occupation (χ^2= 9.39, P<0.05, significant).			
Farming	87	50	**75.9**
Farming+ Jobs	31	17	**54.8**
Farming + Fishing	14	8	**57.1**
F. Education (χ^2= 8.49, P>0.05, not significant).			
Pre-primary	59	39	**66.1**
Primary	22	14	**63.7**
Lower secondary	16	10	**62.5**
Secondary	14	6	**42.9**
Higher secondary	3	1	**53.3**
Illiterate	18	6	**33.3**
G. Annual income (in NRS. Thousands) (χ^2= 4.84, P>0.05, not significant).			
≤10	55	36	**65.5**
11-20	26	14	**53.8**
21-30	21	10	**47.6**
31-40	13	8	**41.5**
41-50	10	4	**40.0**
51	7	3	**43.9**
H. Knowledge of Intestinal Parasites (= 50.48, P<0.05, significant)			
Nothing (having misunderstanding about parasites and its transmission by telling that parasites are transmitted through taking sweat, overexposure of sugars etc.)	114	68	**59.6**
Little (can say names and simple cause of parasites)	15	6	**40.0**
Much (can fully discuss intestinal protozoa and helminths and its causes, effects and transmission)	3	1	**33.3**

Discussion and Conclusion

In the present study, the total prevalence of the intestinal parasites was about 56.0percent. This prevalence is probably higher than reported from previous studies[4,5,6] and lower than those reported in other studies[7-16] in different areas of Nepal. The difference in the present prevalence might be due to the different materials and methods, different types of observed patients, different seasons, different parasites and other unknown factors.

Ethnically, the prevalence was slightly higher in Kumal (56.8 %) than in Jalari (54.8 %). The high prevalence in the persons of both of these communities might be due to the poor socio-economic status and usual contact with the risk factors of parasite transmission. Other studies showed high prevalence in ethnic groups such as 77.1 percent in Mushahar Community in Chitwan[15], 66.9 percent in Magar Community in Palpa[14], 39.4 percent in Newar and 71.2percent in Jalari (Pode) Community in Kirtipur, Kathmandu area[17], 36.5 percent in Newar and 80.3 percent in Jalari (Pode) Communities in Kirtipur, Kathmandu[18].

The high prevalence in Kumal community might be because of their traditional occupation (farming), poor environmental sanitation and lack of awareness towards personal hygiene and intestinal parasites. One can observe the unwashed hands before and after food, uncut finger nails, usual contact with soil and mud mostly by children, few bathing habit of these Kumal people. The dirty finger nails might play an important role in the transmission of intestinal parasites[19].

In both communities, the presence of high prevalence in males and females, in the children of ≤10 years shows that intestinal parasites are prevalent in

children due to low immune status, usual contact with infected soil, food, water and other risk factors[4,16,20]. The lowest prevalence in males in the age groups 21-30 years might be due to their awareness towards the personal hygiene and intestinal parasites and low contact with risk factors for parasite transmission. Most of these people used to drink treated water, have sandal bearing, bathing and washing of hands before and after food and going to toilet. Besides, they have effective immunity against parasitism[4,16,20,21]. The higher prevalence in males than in females might be explained on the basis of usual contact with soil, fields, water and other risk factors of parasitosis.

The present studies follows the other studies for the highest prevalence of *Ascaris* which shows that *A. lumbricoides* was the most common helminth in Nepal [4,5,11,22-24]. This highest prevalence can be explained on the basis of less sandal wearing habit, usual contact of infected soil, water, fields where water becomes medium for the survival of embryonated eggs of *Ascaris*. The high prevalence of helminths than protozoa shows that soil transmitted helminth has been increasingly recognized as an important public health problem, particularly in developing countries [4,25,26].

In this study, *Cyclospora* and *Cryptosporidium* were not reported either because of the low sensitivity of the single wet mounts for coccidian parasites[4,20] or due to the absence of these coccidian in these areas.

The world Health Organization noted that human behaviour may influence the prevalence and intensity of intestinal infections[27]. Different factors are considered risk factors for the parasite transmission. These are infected food, water, soil, pattern of defecation, food habit, water drinking habit, presence of domestic animals in houses, and types of occupation, level of education, family income, and knowledge to specific parasites.

In both communities, the prevalence of intestinal parasites was higher in the persons who used to defecate in open places because some parasites such as *Entamoeba histolytica, Giardia lamblia, Ascaris lumbricoides, Trichuris trichiura* are directly related to open air defecation because their cysts and eggs can survive several days in moist stool[4,28]. The present prevalence of intestinal parasites was higher in the persons who are non-vegetarians. Infected raw meet, improperly cooked meat and meat prepared by slaughtering near the infected water sources are the possible risk factors.

The highest prevalence of intestinal parasites was higher in the persons who used to drink untreated water (direct well water or lake water or tap water). The presence of parasites in the persons who used to drink filtered water or boiled water might be due to ineffective filtration or ineffective boiling for short time other risk factors.

The occupations of the persons greatly play the role in parasite transmission[16,20,29]. The persons whose occupation was both farming and fishing were highly infected with parasites. Similarly, the farmers were highly infected with parasites among Kumal community. This is due to the probability of the contamination of infective stages of intestinal parasites in the persons of these occupations.

The level of education also plays significantly in the parasite transmission. That is because of the awareness among the highly educated persons as they mostly read about the life cycle, epidemiology of the intestinal parasites in their courses.

The family income is also a risk factor of parasite transmission. If the family income is high, they are less susceptible to parasites because they usually take boiled water, have good personal and environmental hygiene, use proper medicines, go to doctors and medical and careful feeding habit with nutritious foods such as fruits and proper soap using habit before and after food and toilet.

This study showed that a significant proportion of the population had lack of awareness about the intestinal parasites. It was reported that causality of helminthic infections attributed to sweet foods in an urban Brazilian population living in the state of Bahia[30]. Similar kinds of responses were obtained during surveillance study, according to respondents' sweet things like sugar, toffee, chocolate, ice creams etc. when taken in excess amount there would be greater chances of parasite infection. This delusion might be spread by parents in childhood to lessen their demands[17].

Finally the reported intestinal parasites are prevalent in the study areas. Epidemiological studies are important for identifying etiological factors that play a role in risk assessment and in decision-making for the health promotion of these and other ethnic groups in Nepal. The molecular method should be applied and the case-controlled study should be made to confirm the roles of risk factors to transmit intestinal parasites in the people in Nepal. Besides, haematological and histopathological studies should

be assessed to confirm other intestinal parasites present in these people.

Acknowledgements

We are thankful to Associate Professor Dr. Raniana Gupta, Central Department of Zoology, Tribhuvan University, Kirtipur for guiding the research, Professor Dr. Tej Kumar Shrestha, head of the department for providing us all the possible requirements and Mr. Hari Krishna Timalsina for his help in laboratory, Lekhnath Community Hospital and Shisuwa Health post, Kaski.

References

1. Toni Hagen. Nepal: the kingdom in the Himalayas. New Delhi, Oxford Book and Stationary, 1961; PP.59-60.
2. Chhetri MK. Parasite Infection in Nepal. *Jour of Nep Med Assoc*1997; 35: 60-5.
3. Lekhnath Municipality "Garden City of Seven Lakes": An overview Year-2002. Published by: Lekhnath Municipality, Tal Chowk, Kaski, Nepal.
4. Ghimire TR, Mishra PN. Intestinal parasites and Haemoglobin concentration in the people of two different Areas of Nepal. *Journal of Nepal Health Research Council.* 2005; 3(2): 1-7.
5. Rai SK, Matsumura T, Ono K et al. Intestinal Parasitoses in "an unknown Disease outbreak" hit rural hilly area is western Nepal. *Nepal Medical. Council Journal* 2001; 2: 61-4
6. Yong TS, Sim S, Lee J, Ohrr H, Kim MH, Kim H. A small scale survey on the status of intestinal parasite inflections in villages in Nepal. *The Korean J of Parasitology*, 2000; 38: 275-7.
7. Sharma RP, Tuladhar NR. A study on intestinal parasites among auxiliary health workers in Kathmandu. *J Nep Med Assoc* 1971; 9: 257 - 61.
8. Nepal M, Palfy B. A study of prevalence of intestinal parasites in the Mahankal Panchayat and their relation with haemoglobin Levels. *Journal of Institute of Medicine*, 1980; 2:175-82.
9. Rai SK, Hiari K, Abe A et al. Intestinal parasitoses among school children in a rural hilly area of Dhading District Nepal, 2002.
10. Integrated Family Planning and Parasite control Project (IFPPCP), Nepal: Annual Progress Report 1980-1985; (1-6).
11. Gupta R, Gupta HN. Studies on the Infestation rate of Human intestinal parasites of Kirtipur. *J Nepal Med Assoc* 1988; 26: 23-9.
12. Fernandez MC, Verghese S, Bhuvaneswari R et al. A comparative study of the intestinal parasites prevalent among children living in rural and urban setting in and around Chennai. *J Com Dis* 2002; 34: 35-9.
13. Chaudhari B, Mishra PN, Sherchand JB. Prevalence of Human Intestinal Parasites in rural village development committee, Machchhegaun, Kathmandu. Fourth National Conference on Science and Technology March 23-26, 2004. Royal Nepal Academy of Science and Technology. SSZ-PS-8. 333.
14. Karki D, Maharian M, Joshi DD. Prevalence of intestinal parasites particularly *Taenia* sp. among Magar ethnic group in Barangdi VDC of Palpa District. Fourth National Conference on Science and Technology, March 23-26, 2004. Royal Nepal Academy of Science and Technology. 2004: SSZ. PS. 1.328.
15. Paraiuli RP, Mishra PN, Joshi DD. Prevalence of intestinal parasites in Mushar Community of Chitwan district. Fourth National Conference on Science and Technology, March 23-26, 2004, Royal National Academy of Science and Technology. 2004: SSZ. PS-9. 334.
16. Ghimire TR, Mishra PN. Intestinal parasites in the Human Immunodeficiency Virus Infected Patients in Kathmandu, Nepal. *The Nepalese Journal of Zoology*, 2006; 1(1): 9-19.
17. Jha A. Prevalence of intestinal parasites in adolescent girls in relation to socio-behavioural aspects in Kirtipur Municipality. *Dissertation submitted in partial fulfilment of Master's Degree in Zoology (Parasitology), Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal.* 2004.
18. Maharian KP. Prevalence of Intestinal Parasites in Children of Kirtipur Area With Respect To Their Socio-Cultural and Socio-economic Status. *Dissertation submitted in partial fulfilment of Master's Degree in Zoology (Parasitology), Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal. 2004.*
19. Soulsa VO. Intestinal Parasitism in Pokhara. *J Nep Med Assoc* 1975; 15: 9-13.
20. Ghimire TR. Cyclosporiasis in HIV and Non-HIV patients: A study in Kanti Children's Hospital, Maharajguni and Shukra Rai Tropical and Infectious Disease Hospital, Teku, Kathmandu, Nepal. *Dissertation submitted in partial fulfilment of Master's Degree in Zoology (Parasitology), Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal.* 2004.
21. Sherchand JB, Larsson S, Shrestha MP. Intestinal Parasites in children and adults with and without

abdominal discomfort from Kathamndu area of Nepal. *Int J Tropical Gastroenterology* 1996; 17: 15-22.

22. Geollman R. Incidence of disease in Paten Hospital in general OPD. *J Nep Med Assoc* 1988; 26: 921.
23. Rai SK, Kubo T, Nakamishi M et al. Soil Transmitted helminthic infection in Nepal. *The Journal of the Japanese Assoc of Infections diseases.* 1994, 68: 625-30.
24. Rai SK, Rai G. Ascaris, Ascariasis and its present Scenario in Nepal. *J. inst. Med.* 1999; 21: 243-5.
25. Estevez EG, Levine JA, Warren J. Intestinal parasites in a remote village in Nepal. *J Clin Microbiol* 1983; 17: 160-1.
26. Sherchand JB, Ohara H, Sherchand S, Cross JH, Shrestha MP. Intestinal Parasitic Infection in Rural Areas of Southern Nepal. *J. Inst. Med.* 1997; 19: 115-21.
27. WHO, Intestinal Protozoan and Helminthic Infections: Report of WHO Expert Committee, 1981; Tech Rep Ser: 666.
28. Smyth JD. *Animal Parasitology*. Cambridge University Press, Great Britain, 1994. ISBN 0 521 566996 7.
29. Sherchand JB, Cross JH. *Cyclospora cavetanensis* in Nepal: A study of Epidemiological and Microbial Aspects. *Journal of Nepal Health Research Council* 2003; 3:1-8.
30. Williams- Blangero S, Subedi J et al. Attitudes towards Helminth Infection in the Jirel Population of Eastern Nepal. *Soc Sci Med* 1998; 47:371-9.