SUMMARY
The present study was undertaken between January 2004 to January 2007, to assess the actual situation of prevalence of gastrointestinal helminths; to study the pathology of helminth infections with reference to haematological and biochemical parameters and to determine the relation of helminth infections with the nutritional status of the children in Kashmir valley. Since there has been no detailed study on the incidence and effects of the intestinal helminth infections in the children of Kashmir valley, other than the hospital based studies; the present study is a step towards bridging the gap. The thesis comprises of seven chapters, a brief resume of which is given as under:

Chapter 1. Introduction: This chapter starts up with the present scenario of the helminth infection on global level and includes a brief introduction about Kashmir valley and the socio-economic conditions of people, which are in direct relation with helminth infections.
Chapter 2. Review of Literature: This chapter gives an account of the work done on different aspects of the present study. Since the present study was multidimensional and in order to have a clear understanding and background information about the work done related to the these aspects, a comprehensive survey of the literature was conducted.

Chapter 3. Material and Methods: This chapter includes the techniques applied for obtaining the materials and methods used to process the same during the study period. In view of the diverse nature of the work the chapter is given under four headings. An elaborate account of these was necessary since the related methods are scattered in literature and not in a compiled form.

Chapter 4. Observations: The observations, aimed at finding the prevalence of helminth infections and pathology caused by them in children of Kashmir valley, has been broadly carried out by studying the prevalence patterns of helminth parasites, followed by haematological, biochemical and nutritional studies. For clear understanding and for finding a relationship, Observations have been divided into four headings as under: Prevalence and associated risk factors of gastrointestinal helminthiasis in children of Kashmir valley; Haematological and Biochemical studies; Nutritional status of infected and uninfected children and Effect of anthelmintic drug- Ivermectin. The observations made during the present endeavour are summarized as under:
1. Various demographic and social characteristics like Age group, Gender, Residence, Water source, Maternal education, Defecation site and Personal hygiene were considered as proxy exposure factors associated with gastrointestinal helminthiasis.

2. Overall 71.18% children of the study population were infected with at least one species of intestinal helminth parasites.

3. Four types of intestinal helminths viz., *Ascaris lumbricoides*, *Trichuris trichiura*, *Enterobius vermicularis* and *Taenia saginata* were encountered, with *Ascaris lumbricoides* and *Trichuris trichiura* being the most common.

4. Prevalence of *Ascaris lumbricoides* was 68.30%, followed by *Trichuris trichiura* 27.92%, *Enterobius vermicularis* 12.67% and *Taenia saginata* 4.60%.

5. Prevalence of infection was highest in district Budgam (79.28%), followed by Baramulla (75.28%), Pulwama (73.36%), Kupwara (72.84%), Srinagar (71.52%) and Annantnag (56.98%).

6. The prevalence of infection in the rural areas was significantly higher in rural children (72.65%) than in urban children (67.83%) (P≤0.05).

7. The prevalence of infection peaked at the 6-10 year age group (79.57%), followed by 76.83% and 48.46% in the age group of 11-15 years and 0-5 years respectively.
8. The prevalence of *Ascaris lumbricoïdes* peaked in the age group of 6-10 with prevalence of 78.51%, followed by the age group of 11-15 years (71.22%), and 0-5 years (48.8%).

9. Prevalence of *Trichuris trichiura* peaked at the age group of 11-15 years (34.79%), followed by 6-10 year age group (26.92%) and 0-5 years age group (16.47%).

10. Prevalence of *Enterobius vermicularis* was high in the age group of 0-5 years (22.60%), followed by the age group of 6-10 years (21.08%). In the age group of 11-15 years, prevalence of Enterobiasis was negligible (0.91%).

11. Taeniasis peaked in the age group of 11-15 years (6.02%), followed by 6-10 year age group (3.71%) and 0-5 year age group (3.2%%).

12. Children using water from rivers and streams were more infected (88%) than those using well water (87.21%), followed by those using water from other sources (All or some sources at a time) (85.7%) and tap Water (68.55%).

13. Prevalence of infection was higher (81.02%) in the children drinking unboiled water than those drinking boiled water (49.35%).

14. Children defecating in open fields were more infected (93.02%) than those using the open toilets (73.98%). Children defecating in modern toilets were least infected (57.66%).

15. Children with unhygienic conditions were more infected (82.05%) than those with better hygienic conditions (52.30%).
16. Children whose mothers were illiterate had significantly higher prevalence of infection (74.46%) than those with secondary level (65.03%), Graduate level (68.57%) and Postgraduate level of education (50%).

17. 57.10% infected subjects were light infected and 42.89% subjects were having moderate infection by *Ascaris lumbricoides*. No individual was found to be heavily infected by *Ascaris lumbricoides* in Kashmir valley.

18. In case of *Trichuris trichiura*, 92.38% of the infected subjects were light infected, whereas 7.61% were having moderate infection. Not a single surveyed subject was heavily infected by *Trichuris trichiura* in Kashmir valley.

19. In rural children moderate intensity of infection by *Ascaris lumbricoides* was observed in 44.09% where as in urban children, moderate intensity was observed in 40.04%. The mean EPG of *Ascaris lumbricoides* was higher in case of rural children 5071±3539 than urban children 5014±4530.

20. For *Trichuris trichiura* 8.21% of rural children had moderate infection, whereas only 5.59% of urban children had moderate infection. Mean EPG for *Trichuris trichiura* was higher in urban children 559±500 than rural children 532±468.

21. 34.26% of the study population had single type of infection; whereas as 36.92% of the children were having multiple type of infections.
22. In case of single type infections, *Ascaris lumbricoides* was the most common parasite encountered 31.78%, where as in case of multiple infections, *Ascaris + Trichuris* were most common (20.96%) followed by *Ascaris + Enterobius* (8.46%) and *Ascaris + Trichuris + Enterobius* (7.09%), *Ascaris + Taenia* (1.77%), *Ascaris + Trichuris + Taenia* (1.19%), *Ascaris + Enterobius + Taenia* (1.06%), *Trichuris + Taenia* (0.84%) and *Taenia + Enterobius* (0.24%).

23. Single infection was most common in urban children (54.93%), whereas multiple infections were more found in rural children (54.64%).

24. Infected children were having less mean values of hemoglobin (10.54±1.5) than uninfected children (11.92±1.35).

25. Children infected by *Trichuris*, had lower mean values of haemoglobin (10.17±1.7) than children infected by *Ascaris lumbricoides* (11.27±1.24).

26. Children with infection by intestinal helminths had lower values of Albumin protein in their plasma (3.62±0.32) where as the values of albumin in uninfected children was 4.03±0.43.

27. Children infected by *Ascaris lumbricoides* had lower mean values of albumin (3.42±0.15) in their plasma than in children infected by *Trichuris trichiura* (3.99±0.23).

28. The plasma Globulin level was higher in case of infected children (2.62±0.45) than in uninfected children (2.37±0.41).
29. Children infected by *Ascaris lumbricoides* were having slightly higher levels of globulin (2.58±0.39) in their plasma, than in children infected by *Trichuris trichiura* (2.54±0.45).

30. The mean values of total Protein was significantly higher in uninfected children (6.72±0.8g/dl) than in infected children (6.08±0.6g/dl).

31. Children infected with *Ascaris lumbricoides* were having lower mean values of total protein (5.60±0.3) than children infected by *Trichuris trichiura* (6.64±0.6).

32. Infected children were more prone to malnutrition (52.84%) than uninfected children (20.48%).

33. Children infected by multiple type of helminths were found to be more malnourished (61.33%) than children Infected by single type helminths (43.62%).

34. *Ascaris lumbricoides* was the main helminth responsible for causing malnutrition, when present as a single infecting parasite (49.45%) than *Trichuris trichiura* (34.48%).

35. Out of 52 children treated by Ivermectin, 98% were infected by *Ascaris lumbricoides* and 40.38% by *Trichuris trichiura*.

36. One week after treatment by Ivermectin, the prevalence of *Ascaris lumbricoides* was reduced to (17.30%) and prevalence of *Trichuris trichiura* to 25%.

37. In case of Placebo group, after one week, prevalence of *Ascaris lumbricoides* was 87.5% and that of *Trichuris* remained the same 56.25%.
38. In case of Ivermectin treated group, cure rate after one week for *Ascaris* was 82.36% and for *Trichuris trichiura*, cure rate was 38.08%. But after 5 months, cure rate reduced to 58.82% for *Ascaris lumbricoides* and 33.3% for *Trichuris trichiura*.

39. In case of placebo group, cure rate after one week was 6.6% and after 5 months it was 0% for *Ascaris lumbricoides*.

**Chapter 5. Discussion:** The detailed investigations made during the present study on the prevalence of helminth infection and pathology caused by them in children has been discussed elaborately under following headings: Helminth Infestation in Children; Risk Factors for Intestinal Helminthiasis; Intensity of Helminth Infections; Single and Mixed Type Infections; Helminth Infections and Haemoglobin Value; Helminth Infections and Plasma Proteins; Helminth infection and Nutritional Status; Efficacy of Ivermectin on Helminth Infections.

As per our observations and discussion and research done by various workers, it can be ascertained that if the prevalence of infection has to be controlled, then all the factors, which are contributing in getting infection, have to be checked properly. Present study indicates that there is an urgent need for initiation of control programs like supply of clean piped water, septic lavatory facilities and health education as long term measures and treatment by broad spectrum anthelmintic to all children in community at least twice or thrice a year to curb the resurgence of the infections.
From present study, it is revealed that poor hygienic practices associated with access to water are the probable risk factors for increased helminth infections. The current study demonstrated a positive correlation between, malnutrition and gastrointestinal helminth infections. Malnutrition is highly prevalent and needs early attention of the Medical practitioners, Social scientists, Economists, Governmental and Non-governmental organizations. It is clear that in community, where intestinal helminth infections are highly prevalent, children are at more risk of becoming malnourished.

It was clear during the current endeavour that helminth infection in general and *Trichuris* infection in particular is involved in causing anaemia. Also it was clear that *Ascaris lumbricoides* can be involved in causing protein malabsorption. Present results can be used by authorities to target vulnerable groups in Kashmir valley and should encourage the involvement of mothers in the activities of deworming campaign because intestinal helminth infections will be difficult to control by drugs alone.

**Chapter 6. Recommendations:** This chapter suggests few approaches by virtue of which helminth infestation in children can be minimised.

**Chapter 8. Bibliography:** This chapter presents literature cited in the thesis.