Chapter 8

Summary and Conclusion
The present study was undertaken to evaluate the life cycle epidemiology, prevention control and treatment with special reference to chemotherapy in diagnosed cases of taeniasis with Nitazoxanide in Baramulla and Srinagar districts between the December 2004 to March 2007. The various conclusions were drawn from the study were:

1) Taeniasis in Kashmir was found exclusively due to *Taenia saginata* and the diagnosis of species was made on anatomical characteristics of gravid proglottids.

2) *Taenia saginata* taeniasis is a major public health problem in Kashmir region.

3) The prevalence's were found in moderate levels from 2.25 to 3.98% in human population, prevalent in every age group, literates and illiterates thus every body found susceptible to *T. saginata* infection.
4) Most of the infections as per number was concerned were from age group of below 15 years. But prevalence was more found in above 60 years age group.

5) Prevalence of this infection was found more in males (3.4%) than in females (2.05%).

6) Beef sticks have been found influencing at great deal to the increasing prevalence rate of *T. saginata*.

7) Low hygiene in cattle rearing, straying of cattle and use of human feces as fertilizer in agriculture farming making cattle easily accessible to infection. Other factors include open defecation, no/low sewage treatment and improper disposal of human feces are directly attributed to the cattle infection.

8) Taeniasis is a disease in the world which maintains religious barrier as in the current study all the infected persons of *T. saginata* were found Muslim. However social and cultural behavioral practices have been found influencing this infection in Kashmir.

9) In this experimental study the development of metacestode stage (*Cysticercus bovis*) of *Taenia saginata* which is endemic and moderately prevalent (2.33 to 4%) in human population of Baramulla and Srinagar Districts of Kashmir Valley. So, it was essential to demonstrate the development of this stage in normal and unusual hosts i.e., bovines (calves); and caprines (goats and sheep) if any; respectively to know the actual transmission of this zoonotic infection in this region.

10) The concentration of cysticerci had special preferences for heart but localization of the cysticerci were also found in tongue, masseter muscles with a maximum number of them in skeletal muscles and a few were found in liver, oesophagus, lungs and brain but none of the cysts
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were recovered from kidney spleen, gallbladder and rest of the viscera. Thus suggesting that myocarditis or heart failure could be the probable cause of deaths in animals with cysticercosis.

11) The young bovines are more susceptible to cysticercosis as all the experimental calves were less than six months of age.

12) The inspection routine data does not allow estimating the incidence of bovine cysticercosis and the result formed, that in spite of the time taken by meat inspectors looking for the cysticerci at specified predilection sites of carcasses, this method is insensitive and inaccurate.

13) To effectively improve meat inspection procedures, there is a need to increase the area and number of predilection sites observed during inspection and vary them according to the nature of the animals, their husbandry history and the target human population for consumption. In addition, other control approaches such as vaccination, chemotherapy and immunodiagnostics should be developed and implemented to complement meat inspection procedures.

14) The concentration and distribution of recovered cysticerci in experimental bovine carcasses suggest that the beef steaks which are widely being consumed by every group of the society need to be confirmed that it is boiled for 10 minutes before being roasted as tongue, masseter muscles, and other skeletal muscles which are usually being preferred for these steaks may be containing live Cysticerci.

15) No cysts (Cysticercus bovis) were recovered from six non-host animals including sheep (n = 3) and goats (n = 3) infected and dissected in the same way as rest of the infected calves were made with similar age groups. Thus, giving a clear-cut intermediate host association with bovines only in Kashmir.
16) Eggs of *T. saginata* were found viable able to resist their desiccation for years together in medium like NaCl of 0.9 concentration and months together in sewage and sludge thus concluded that these eggs in a Kashmir valley can retain viability for quite long time as the conditions for its survival are favorable in this region, thus may prolong their lives over pastures fields water bodies and can infect cattle easily. The viability of eggs was ascertained with methylene blue staining technique.

17) Local fowl were also found playing a good role in the dispersal of taenia eggs; this was proved after feeding two local fowl with gravid proglottids of *T. saginata*, and later finding of all the eggs viable from their coprological examination using methylene blue staining technique.

18) Resistance of *T. saginata* infection against commonly used taenicides (niclosamide and praziquantel) was found a typically emerging problem and a major hurdle in the management and treatment of *Taenia saginata* infection in Kashmir.

19) Nitazoxanide, which is a synthetic drug of broad spectrum antiparasitic activity proved as a better alternative and safe taenicide against fresh and resistant *T. saginata* infection in the current research study.

20) The efficacy of Nitazoxanide was achieved as 98.33% against fresh *T. saginata* infection as, it treated 221 of 225 cases and against resistant *T. saginata* infection the efficacy of the drug with a cure rate of 98.00% was achieved, treating 69 of 70 resistant cases.

21) Nitazoxanide was given orally with food without any fasting or laxative use. A dose of 500 mg twice daily for three days was given in patients with resistant taeniasis and ageing above 15 years, in patients ageing below 15 years, a dose of 15-20 mg/kg body weight day for three days was proved effective. However in fresh *T. saginata* a single dose of 15-
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20 mg /kg body weight was effective. The dosage used in this clinical drug trial of Nitazoxanide also suggests that it is effective even at lower doses, as in the past two clinical trials Nitazoxanide was given as a single dose of 25 mg /kg body weight treating 21 of 22 (95.5) and 5 of 5(100%) where as in current study even at lower doses, the success rate of 98.2% treating 221 of 225 fresh *T. saginata* infection and 98.6% treating 69 of 70 Niclosamide and Praziquantel resistant cases. Thus suggesting Nitazoxanide is safe, cheapest and better alternative taenicide in the present world.

Control of taeniasis in humans and cysticercosis in cattle from *T. saginata* infections will require a multidisciplinary and multilevel approach because of the complex nature of its epidemiology. A control programme will necessitate establishing a national organization that helps and guides the local effort. The control programme will also demand cooperation and participation by the veterinary, medical and public health sectors. This complex organization of experts and stakeholders must be provided with: in addition to resources, a solid understanding of the epidemiology and biology of the zoonosis, and the rationale for the control strategy that is to be pursued. In addition to basic parasitology of *T. saginata*, a good understanding of the risks associated animal husbandry and human behavioral practices, and the economics of cattle production and marketing is essential. Important to the success of a programme is attention to management and coordination of the various components of the control organization. Therefore, a good deal of effort and investment in training and indoctrination of all participants in the overall control programme will be required upfront. Even pilot or demonstration control projects will require substantial capacity building. Without this level of preparation, controlling this zoonosis, which is so dependent upon long-established risky animal rearing and cultural traits, will remain nearly intractable.