Chapter 3

Review of Literature
The present study is concerned with various broad aspects of lifecycle (experimental trials) epidemiology and drug trial on Nitazoxanide against *Taenia saginata* infection in Kashmir. There was no data available pertaining to above mentioned parameters for Jammu and Kashmir state. The present work was therefore taken up with the objective to present the actual status of this infection in human population as the region is an important beef consumer and faces this infection as a major public health problem. Therefore, the literature consulted for the purpose was searched and is presented below.

Nabiers and Dubreuith (1889) found some cysticerci of *Taenia saginata* developed in man. Neumann (1892) reports that Zurn noted in an experimentally calf with *Taenia saginata* segment, the temperature rose 40° C, accelerated pulse, abdominal distention, emaciation, and difficulty in standing up. Maggit (1924) includes man in the list of intermediate hosts of *T. saginata*, in whom *C. bovis* was observed by Arndt (1867).

Skrjabin and Schultz’s (1929) point out that Geller and Fontan (1919) diagnosed the presence of *C. bovis* in the eye and in the region of the mammary gland in the patient who was a carrier of *T. saginata*. They note correctly, however, that cases of finding *C. bovis* taking into consideration the presence of malformations in *C. cellulosae*, which may result in complete disappearance of the hooks. Naumov (1929) described for the first time *C. bovis* in man in the then USSR, during autopsy of a 40 year old man. He observed 9 cysticerci in the heart and on the piamater, as well as *T. saginata* in the intestine. These cysticerci were diagnosed as *C. bovis* by Naumov.
Damaso de Rivas (1932) also reported a case of *C. bovis* detected in a man in Pennsylvania Aragentine as also reported by Castillano, Orgas and Lugne (1928).

Ershov (1933) described manifestations of acute cysticerciosis in experimentally infected calves and adult bulls. In all the ten experimental he found body temperature rose to 39.8-41.8°C on the 2nd -4th day of infection, and remained high until 6th -7th day. The general condition of infected animals was impaired; the animal lay moaning; appetite was poor, rumination absent the proventriculus atonic, constipation present.

Ramsay (1934) reported a prevalence of 10.18% in the plateau due to *Taenia saginata*. Plum (1935) reported that two-thirds of the human population was parasitized; only 14% of the cattle were found to have Cysticercosis, a rate less than half the average for stock from African areas. Brumpt (1936) Watkins-Pitchford in 1924, diagnosed twice *C. bovis* in man in the case in Trasvaal, USSR.

Pod et al. (1937) assume that man is not the intermediate host for *T. saginatus*, and *C. bovis* infection in man is very rare, in that the incidence of *Taeniarhynchiasis* exceeds that taeniasis many times. Moreover, with taeniasis segments are excreted daily leading to a high infestation of man’s surrounding habitat. Whereas, there are only isolated incidents of *C. bovis* infections in man.

Boer and Vscvododov (1939) reported finding Cysticercosis in the muscles of a Manchurian roe. They did not give these species name. Subsequently, Sokolova (1955) tentatively related them to *Cysticercus bovis*, but in 1960 Boev determined that they were *Cysticercus cervi*. Thus the Roe is not an intermediate host of this species. Fisk (1939) reported a *Taenia saginata* prevalence of 50% in Northern Nigeria.

Culbertson (1940) was the first to use quinacrine (Mepacrine, Atebrin) in mice for treatment of *H. fraterman*. Since then its efficacy in *Taenia saginata* has been tested by many workers. But now, in 2007 it is not being used especially in
America. Heisch (1947) found that the Borana and Murille were frequently infected with tape worms.

Bachigalupo J. and Bacigalupo A. (1950) in Argentine reported interesting observations of the possibility of human infection by *C. bovis* where beef was the staple meat diet, 20% of human Taeniasis were caused by *T. saginata* and only 3 cases of *T. solium* were recorded. Meanwhile in 55 cases of human Cysticerciasis, only 4 were identified as *C. bovis* and the others were either *C. cellulosae* or possibly the larva cysts of other types of hooked *Cysticercus*. The authors observed that it was possible to expect a wider distribution of *C. bovis* in man because in 37% of *T. saginata* carriers, oncosphers of this *Taenia* were found in subungual spaces. The infestation of human by ingestion of *T. saginata* eggs is obviously very unlikely.

Hoekanga (1950) found quinacrine effective in 91% patients, suffering from *Taenia saginata* at a dose of 0.8gm orally. There was treatment failure in 3 patients only. Hornbontel (1952) found quinacrine 100% efficacious in 43 patients who had tried 91 previous unsuccessful treatments.

Japsen and Roth (1952) reports that despite of high level of sanitation in any country, it still is possible for cattle to be exposed to eggs of this parasite. One infected person who defecates in a pasture or cattle-feeding area can quickly infect an entire herd. The use of human faeces as fertilizer can have the same effect. Shelled larvae can remain viable in liquid manure for 71 days, in untreated sewage for 16 days, and on grass for 159 days.

Lloyd (1955) reported 100% efficacy of quinacrine in 8 patients of taeniasis at a dose of 1gm orally. Mckinnon (1956) reported a 91% cure rate with quinacrine, in *Taenia saginata* infections in total of 494 patients.

Jopling (1959) compared the therapeutic efficacy of quinacrine based on two routes of administration. A cure rate of 84% was seen in patients who were given the drug orally and a cure rate of 95% was seen in patients who received the drug via nasogastric tube.
Safronov (1960) notes that in examining the panenchymatous organs and Carcasses of deer in the Lench District of the Yakutian USSR he found *Cysticercus* of undetermined species. Of the 10 Carcasses 4 (40%) proved to be infected. The author suggested that those were *T. saginata* larvae, as it is possible that *C. bovis* is parasite in the reindeer. This was supported by the rate of infection in the Olench District (29.5% of 200 pupils examined, 59 were infected), with much of the population being helminth carriers, where no cattle are raised, reindeer being the only meat consumed.

Chandler and Read (1961). Evaluate, cattle and coprophagous and often will eat human dung, wherever they find it. The author further writes In India, where cattle roam at will; it is common for a cow to follow a person into the woods, in hopes of obtaining a faecal meal.

Collard (1962) reported a prevalence of 2.4% in both the natives and Fulani populations in Katsina province. Nagety (1962) found Niclosamide resistance in 86% of patients after two months of treatment. Turner (1964) noted that Niclosamide was ineffective at the manufacturers recommended dosage.

Froyd (1965) evaluated the survey which covered 42,873 cattle from 18 districts from which 13,392 animals were found to be infected with *C. bovis*; an overall infection rate of 32.05% was recorded. Taeiniasis in human was found to be in parallel with *C. bovis* infection in cattle.

Keeling (1968) suggested that thermotherapy of tapeworm infection must be effective, safe and without development of resistance. Chinese traditional medicine like pumpkin seeds, areca nuts, pomegranate roots have been used in past. *Aspidium Oleoresin* (extract of male fern). Birthmonol were tried in the past but discarded due to unacceptable side effects.

Dada and Usman (1970), in Sudan observed the distribution of human Taeniasis by age and sex in three ecological zones revealed that although both sexes were affected, males were more frequently infected than females. They attributed it to the fact that females were not exposed to grilled meat "Suya", as the
males, since they would normally eat well cooked meals in the house. This was more so since it has been shown that “Suya”, to which males by habit were more exposed, does often contain viable *Cysticercus bovis*.

Pawlowski and Schultz (1972a) reviewed the problem of Cysticercosis and stressed that the use of the term *Cysticercus bovis* should be abandoned since it is illogical to give separate generic and specific names to the larval stage of a parasite that already has a distinctive name (*Taenia saginata*). For the term ‘*Cysticercus bovis*’ they use *Taenia saginata* Cysticercus and for infection with ‘*Cysticercus bovis*’ they use *Taenia saginata* Cysticercosis and *Taenia saginata* infection causes two types of losses. (a) Losses due to the medical complications caused by adult tape worm, which are difficult to assess, and (b) the evident economic losses due to Cysticercosis in slaughtered animals.

Pawlowski and Schultz (1972b) estimated the losses due to Cysticercosis as US $ 25 per animal in developing countries and US $ 75 per animal in industrialized countries. Arfaa (1972) reported human infection due to *T saginata* high (14-17%) in many parts of Iran.

Slonke *et al.* (1973) near Phoenix, AZ, reported an increased incidence of bovine Cysticercosis. Approximately 10% of cattle sent to slaughter from January to April, 1973, were infected with Cysticercus stage of *Taenia saginata*. One employer who worked at the feed mill and loaded hay in the feeds was also found to be infected with *T saginata*.

Vakil (1975) found mebendazole totally ineffective in doses of 100mg, 200mg, 300mg twice daily (BD) each for 4 days. However mebendazole has been used in different therapeutic regimens with varying cure rates by other workers also.

Juraneck *et al.* (1976) revealed that heart and masticatory muscles were more heavily and more frequently infected with *Taenia saginata* cysts. Then were any other muscle groups. This was found after dissection of infected Carcasses of cattle. Meat inspection would increase the efficacy in detecting beef Cysticercosis.
complete dissection of cattle found to have a single viable or dead cyst by routine
inspection revealed dead or viable cysts in portions of the carcass not routinely
examined. These findings justify the recent change in routine meat inspection
procedure whereby all Carcasses with a single cyst (whether viable or dead) are
now cooked or refrigerated, instead of having the offending cysts excised.

Rickerd and Adolph (1977) studied the prevalence of cysticerci of *Taenia
saginata* in cattle reared on sewage-irrigated pasture and found the heart, masseter
muscle, tongues and laryngeal muscles from 200 cattle aged 10 to 11 months, and
100 cattle aged 20-21 months which had been reared on sewage-irrigated pastures
at Melbourne and Metropolitan Board of Works Farm, Werribee, Victoria, were
examined for infection with cysticerci of *Taenia saginata* by slicing in the
laboratory and the result obtained were compared with those recorded during
normal meat inspection procedures at the abattoir. of the 10-11 month old cattle 51-
5% were found to be infected and 8% of the total animals harboured viable
cysticerci. Of the 20-21 month old animals 33% were infected, and even at this
age, 8% of the animals still carried viable cysticerci. On line meat inspection at the
abattoir detected significantly fewer infections then did laboratory slicing.

Slonke (1978) reported 4.75% of the animals sent to slaughter from a
Southern California-feed lot during a 9 month period were found to be infected
with the Cysticercus of *T. saginata*

Dewhirst *et al.* (1978) reported that meat inspection is a useful for detecting
heavily infected Carcasses. However, lightly infected Carcasses can easily be
missed and passed on for human consumption.

Arembulo *et al.* (1978) reported the use of mebendazole in the treatment of
*Taenia saginata* taeniasis in an endemic area in the Philippines. 41 subjects
ascertained to have taeniasis based on the history of passage of gravid segments
and positivity for *Taenia* eggs were treated with 300 mg mebendazole b.i.d. for 3
days without need for fasting. No side-effects were observed. The drug acted as a
taenicide, the worms were expelled either as degenerated boluses or fragmented
segments on the 2\textsuperscript{nd} to the 4\textsuperscript{th} day (Mean: 2, 4 days) after the initial dose. 33(84.6\%) of the 41 subjects expelled the worm. A follow-up of all the subjects 2-3 months after treatment revealed that all those who expelled the worm following treatment and 6 of those who were not negative for both Taenia egg and gravid segments or a curve rate of 95\%.

Lloyd (1979) observed haematological and immunological response of calves infected with \textit{Taenia saginata}. No changes were observed in the Erythrocyte levels but a leukocytosis developed. This was contributed to primarily by a lymphocytosis, but also by an eosinophilia. Antigen induced lymphocyte blastogenesis measured the antigen-sensitive cell population in peripheral blood and this population showed a maximum increase at 11 and 32 days after infection. however, antigen sensitive cells remained at above normal level for the remainder of the infection. Ten weeks after infection 11 calves were treated with albendazole at 50mg/kg. Inter alia this resulted in an 86\% destruction of the metacestodes in the treated animals as compared to the placebo treated animals and four days after treatment there was a significant leucopoenia and lymphopaenia. Coincidently, there was an increase in the responsiveness of the peripheral blood lymphocytes to antigen. Upon challenge infection with 15,000 eggs the infected calves showed a marked secondary eosinophilia, but no change was apparent in the other blood elements. At this time there was a marked increase in the response of the peripheral blood lymphocytes to antigen.

Arundel and Adolph (1980) carried out a preliminary observation on the removal of \textit{Taenia saginata} eggs from sewage using various treatment processes and evaluates by saying "It appears that modern sewage purification methods do not efficiently remove \textit{T. saginata} from the final effluent and that prolonged setting is necessary before effluent is used to irrigate cattle pastures if \textit{C. bovis} infection is to be reduced to very low levels".

Groll (1980) found praziquantel 95.5\% efficient against \textit{T saginata} infection. Dada \textit{et al.} (1980) in Sudan Zone, found 0.9\% of total stool specimens examined were positive for Taeniasis while 0.6\% of total stools examined in Northern Guinea and Bauchi plateau were positive. Males were more frequently
infected than females. Human Cysticercosis was not documented in any of the three ecological zones.

Walther and Koske. (1980) found in 79 calves aged between 2-12 months, originating from a known *Taenia saginata* endemic area, after slaughter and Carcasses subjected to routine meat inspection and afterwards dissected and sliced, 75.9% were detected infected at meat inspection. Of these, 21.7% had cysts in triceps muscle only. During slicing 34 out of 60 infected animals (56.7%) were negative for cysts at the so called predilection sites, muscles of mastication, tongue, heart, oesophagus and diaphragm.

Rickerd *et al.* (1981) evaluated the efficacy of immunization of cattle with antigens collected during 14-day in vitro cultivation of *T. saginata* oncospheres, for the control of naturally acquired bovine Cysticercosis and was test on a farm which uses sewage effluent to irrigate pasture among a total of 260 of mixed breed 78% had responded and developed resistance for infection to *T. saginata.*

WHO (1981) has noted that human behaviour may influence the prevalence and intensity of intestinal infection. Cheruiyot (1981) recorded prevalence ranging from 0.74% in the coast province to 18% in Kisii District in Nyanza province. Gracey *et al.* (1981) recorded the highest incidence in autumn and summer in some European countries. The reason attributed might be the conducive weather for the survival of eggs and easy access of animals to acquire infection with grass. The suitable temperature and high humidity during spring and autumn play an important role in the epidemiology of this infection, age having no significant effect on prevalence in this study which suggested that once infected, the animals acquired life-long immunity to super-infection.

Schandevyl and Vercuvaal (1982) reported the hearts of 51 and the masticatory muscles of another 51 cattle from the slaughter-house in Daker, were examined by careful dissection. *Cysticerci* and/or cystic lesions were found in 13.7% of the hearts and in 25.5% of the masticatory muscles. The cystic lesions were examined histologically in an attempt to identify *Taenia saginata*
Cysticercosis. A final inspection rate of 5.8% in hearts and 15.7% in masticatory muscle was thus obtained. Lower percentages were recorded after inspecting 2088 slaughtered cattle by routine meat inspection technique.

Gellie and Sewell (1983) observed duration of immunity and absorption of cysticerci in calves after treatment of *Taenia saginata* Cysticercosis with praziquantel and found complete immunity against challenge lasted for at least 12 weeks following anthelmintic treatment. Six months after drug treatment over 90% of the cysticerci had been completely absorbed but some were still detectable especially in the heart. An increase was observed in the ELISA, values of sera from infected calves following treatment with praziquantel, but no such rise was detected in sera from resistant calves after challenge infection.

Feachem *et al.* (1983) helminthic infections requiring an intermediate host can be prevented not only by improved excreta disposal practices, but also by proper cooking of beef meat.

Mann (1983) demonstrated life cycle and transmission of the parasite (*Taenia saginata*) occur most commonly in environments characterized by poor sanitation, primitive livestock husbandry practices, and inadequate meat inspection, management and control policies.

Walther and Bhogel (1983) evaluated the resistance to reinfection of calves following chemotherapy of *T. saginata* Cysticercosis with praziquantel in East Africa, for this purpose thirty animals from the treated group were compared with thirty animals from the untreated group after 15 months following chemotherapy, slicing revealed that 100% in the untreated group were infected compared with 43.5% of the animals in the treated group. 52% of the untreated group had viable cysts in contrast to only one animal (4.3%). In the treated group, serological investigations were also conducted on sera obtained before and after chemotherapy. Successful chemotherapy resulted in temporarily increased titres in the treated group as compared to the untreated group.
Harrison et al. (1984) observed the absorption of cysticerci in cattle after treatment of *Taenia saginata* Cysticercosis with praziquantel by taking two groups of calves aged 10-15 weeks and were orally infected with either 6000 or 30,000 *T. saginata* eggs. Three to four months later they were treated with praziquantel, three doses of 500mg kg⁻¹ on three consecutive days. All the cysticerci were killed by the drug and most were absorbed between six and nine months after treatment, residual calcified cysts were still formed in the Carcass up to 24 months after drug treatment. These residual calcified cysts were particularly tumour in the heart muscles and would probably have been detected at meat inspection.

Rossignol and Maisonneuve (1984) for the first time in world discovered drug Nitazoxanide and tested it in 22 patients infected with *Taenia saginata* and 18 infected with *Hymenolepis nana*. A single 25mg/kg body wt. dose was effective against *T. saginata*, while twice this dose level (50mg/kg body weight) also as a single dose was required for treating *H. nana* infection. 21 of 22 patients successfully cured i.e. 95.5% having *T. saginata* infection and 100% for *H. nana*. Tolerance of the drug was found good at both dose levels. In this first publication Rossignol suggested that “Nitazoxanide” could be an interesting alternative for the treatment of *T. saginata* and *H. nana* like cestodes if further clinical trials confirm its safety and effectiveness.

Zovlerz and Machinicke (1985) reported the treatment of *Taenia saginata* infection in 61 persons in single doses of 12, 15 and 20 mg/kg BW and in four doses against *Hymenolepis nana* infection (1 person). Only one person not being cured shows that the compound has given a very high cure rate in clinical trial. 10% of patients treated complained of subjective mild side effects which disappeared during 24 hr. after drug administration.

Fertig and Dorn (1985) reported an outbreak of *Taenia saginata* cysticercosis is an Ohio cattle feeding operation. They worked from January to March, 1981, 37 slaughtered cattle from a single Ohio feeding operation were determined, at postmortem inspection, to be infected with *Taenia saginata* cysticerci. This outbreak was more likely associated with sludge application. The
possibility of an infected worker exposing the cattle to infected feces was not excluded definitely as a possible source.

Vermond (1986) reports a case of taeniasis due to *T. saginata* resistant to treatment with 2gms of niclosamide in Ethiopia on four separate occasions over four months. Srivastava and Panday (1986) in India, only 0.9% of sewage farm workers were positive for Taeniasis.

Fan *et al.* (1986) in Taiwan evaluated therapeutic efficacy of mebendazole and praziquantel against Taeniasis. they reported taeniasis a major public health problem among the aboriginal populations in Taiwan and highly prevalent, widespread in the mountain areas of 10 countries. Over 27,000 cases of tapeworm infection, they estimated influencing the health and economy in the endemic areas, they confirmed that praziquantel is highly effective agent against tapeworm infection, but mebendazole is not. Based upon experiments reported praziquantel in a single dose of 150mg and 450mg are highly effective against taeniasis and hymenolepiasis respectively.

Gemmell (1986) reported the he eggs of all taenids are sensitive to desiccation and temperature. In temperate zone, such as those where the summer and winter air temperature range from 10°C to 20°C and -20°C to -10°C respectively, survival as measured by infectivity, is in the order of 100-200 days and >200 days respectively. Fan PC. (1986) established a cure ratio of 100% in 22 patients of *Taenia saginata* with praziquantel.

Knaus and Launge (1987) observed the effect of anthelmintics on the viability of *Taenia saginata* oncosphers. The viability of taeniid egg was investigated by means of methylene blue staining in patients with niclosamide treatment, the degree of dead taeniid eggs and was found 90-100% (19 of 25 cases). However, in patients without therapy the taeniid eggs were vital in 22 of 25 cases. Therefore recognition and treatment of all taenid hosts is a way to reduce the taeniosis-cysticercosis extent.
Pugh and Chambers (1989) in the Metabololand province of Zimbabwe detected *C. bovis* at meat inspection in 2.15% of 102,087 Carcasses of cattle, slaughtered in Bulawayo during a period of 11 months. Lightly infested (detained) Carcasses accounted for 95% of those with Cysticercosis. The head was the only site affected in 58.4% of the detained Carcasses. The shoulder in 20.1% and the heart in 7.9%. In more heavily infested (condemned) Carcasses 81.1% had at least three sites affected. The incidence of cysts was highest in older male animals but in younger animals, it was highest in cows. 98% of cysts were found live and only 2% as dead. Live cysts were found live and only 2% in older cattle and dead cysts were more common in older cattle and dead cysts common in younger animals. The incidence of *C. bovis* in Carcasses of cattle originating from communal areas was 3.2% compared with 1.6% in those originating from commercial farms.

Yilmaz et al. (1989) noticed that 3.5% of school children had *T. saginata* in E.Lazing. They also found 3.5% positivity in municipal sanitary workers in this city.

Hencock et al. 1989 in Washington collected the data from slaughter plants (n=3) and feedlots (n=18) and analysed to characterize occurrence patterns of *Cysticercosis* during 1984. Three concurrent peaks in Cysticercosis rates (0.6/1,000 to 5/1,000 slaughtered cattle) were detected at 3 slaughter plants. Peaks were observed at 8 feedlots from December 1983 to March 1984, at 6 feedlots from April to July, 1984, at 2 feedlots from August to October, 1984, and at 3 feedlots from November 1984 to February 1984. The pattern of Cysticercosis indicated human fecal contamination of a regionally available feed source. Of feedstuffs in use. Potato waste, a byproduct of the processed potato industry appeared to be the most likely source of *Taenia saginata* ova.

Harrison et al. (1989) developed a monoclonal antibody based enzyme-linked immunoasorbent assay (Ag-ELISA) which detect viable *T. saginata* Cysticercosis. The monoclonal antibody is reactive with a glycoproteins found in the biosynthetically radiolabel led excretion of the parasite are produced by maintaining the parasite in tissue culture medium containing radio-labelled amino
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acids. The parasite metabolise the amino acids and excrete them in the form of radio-labelled parasite proteins. The process is, therefore, used to study proteins being actively synthesized by the live parasites at that particular point in their life-cycle. The assay is specific for *T. saginata*. The Ag ELISA has been successfully by Hughes *et al* (1993) to carry out seroepidemiological studies of *T. saginata* Cysticercosis in Switzerland.

Allen *et al.* (1990) developed the immunodiagnostic tests for *Taenia* specific faecal antigen based on polyclonal rabbit antisera against *Taenia saginata* proglottids extracts in capture-type ELISA assays. They detected *Taenia* specific antigen in detergent solubilized faecal extracts from *T. saginata* infected hosts.

Tesfa-Micheal and Tesfa-Yohanues (1990) evaluated effectiveness of praziquantel against *Taenia saginata* infection in Ethiopia all twenty six individuals either harboring one or two worms were successfully treated with a cure rate of 100%.

Pawlowski (1990 a), documented that *T. saginata* is highly endemic with a prevalence rate exceeding 10% in central and East Africa, New East and Southern Russia. Moderate (below 5%) infection rate occurs in Europe, Southeast Asia and South America.

Pawlowski (1990 b). observed three main patterns of *Taenia saginata* transmission. Endemic, pastoral type characterized by high prevalence in human and bovine Cysticercosis due to close spatial and temporal contact between nomadic, postural societies and their cattle. Endemic, urbanized type, characterized by small number of Urban carriers and moderate bovine Cysticercosis. Epizootic type in feedlots can be caused by a single human carrier frequently an immigrant from an endemically affected region, whose close contact with cattle, can result in outbreak of bovine Cystecercosis.

Verma *et al* (1990) evaluated the efficacy of mebendazole and Niclosamide in two groups of 24 and 38 cases, respectively of patients suffering from taeniasis. Mebendazole with dose schedule of 200mg and 300mg twice daily for 3
consecutive days showed a cure rate of 71-42% and 92-30% whereas Niclosamide at the dose rate of 200mg/patient was 94.76% effective flubendazole showed a cure rate of 66.66% only. Mebendazole and Niclosamide possess high taenicidal activity.

Ramesh et al. (1990) performed epidemiological study of parasitic infestation in lower socioeconomic group in Chandigarh (North India) and found prevalence of *Taenia* as 0.8% through stool samples, but have not disclosed the species.

Saygi et al. (1990) in a study performed with cellophane tape method found that *T. saginata* infestation rate was 7.7% in elementary school children. Orak et al. (1990) noticed that in workers of meat producing shops 3.5% had *T. saginata*. Ozcam et al. (1990) In Adana, *T. saginata* was noticed in 0.47% of women and 0.54% of men.

Kylvgaard et al. (1990) demonstrated the distribution of *T. saginata* cysts in 23 experimentally infected calves. The calves harboured between 2-2569 cysts. A median of 15.7% of cysts were located in the heart and 6.5% in the masseter muscle, the organs usually considered as the most important predilection sites. It was concluded that possibility of detecting infected cattle is limited especially when, as in Denmark, the majority of animals are lightly infected.

Saygi et al. (1990-91) in elementary school children, in municipal sanitary workers and meat handlers, *T. saginata* positivity were reported as 7.9% and 3.1% respectively. Habbari et al. (1991). In Beri Mellal, as in all Morocco, meat is generally well cooked, preventing the population from acquiring *Taenia saginata*.

Saygi and Poyraz (1991) found the difference in *T. saginata* positivity between urban and rural communities. In urban school children, *T. saginata* positivity was 1.2%, whereas this rate in rural children was 6.6%. Saygi et al (1991) In epidemiological studies, noticed that *T. saginata* positivity reached to 34.2% in women over 15 years old in Sivas where raw meat consumption was common.
Durmaz et al. (1991), in a city observed 5.6% positivity for *T. saginata* meat handlers and their families.

Cruz (1991) reported the treatment of human taeniasis in the Philippines in using a tabrine bithionol and mebendazole and reviewed the results of cure rate as 93.7% for Atabrine, 85%-100% for bithionol, and 84.62% for mebendazole. He also reported recent experiences in the treatment of *T. saginata* infections at the Department of Parasitology, College of Public Health, twenty patients referred to the public Health, twenty patients referred to the department were treated. 3 with bithionol, 17 with praziquantel of the 17 patients treated with praziquantel, the study reported curve rates of 47-88.24%.

Pawlowski (1991) found praziquantel 100% efficient in 124 patients of taeniasis at a dose of 2.5 mg/kg body weight without any side effects. Pawlowski (1991) found niclosamide ineffective in 72% to 90% patients.

Gracey et al. (1992) attributed heavy infestation by the larval of *Taenia saginata* in cattle to cause myocarditis or heart failure, responsible for heavy economic losses. Lorenz (1992) analysed the distribution and changes in the incidence of *T. saginata* and found relationship between Taeniasis and Cysticercosis in the district of Halle (Saale). He found that both these infections were parallel to each other in their epidemiological perspective.

Schantz et al. (1993). WHO estimates that *Taenia* infection afflict approximately 50 million people annually and kill 50,000. One may assume all of these deaths to be the result of *T. solium* neurocysticercosis. *Taenia* infection also leads to the death of many cattle and swine and resulting substantial economic losses. The prevalence of *Taenia* is highest in rural areas of Latin American, Asia and Africa, but the parasites are vulnerable to eradication. Current strategies include long and short term interventions developed by the WHO and the Pan American Health Organization based upon the mass treatment of Taeniasis in existing transmission foci.
Onyango-Abuje and Harrison (1993) estimated the loss due to *T. saginata* Cysticercosis in cattle in Kenya as Ksh 56 million per annum or Circa £ UK million.

Harrison (1993) in his project dated April 1993 to March 1996 explains Tropical developing countries suffer huge losses (1.8 billion US $ in Africa annually) because of *T. saginata* as, current meat inspection methods were not sophisticated enough to identify all infected Carcasses. That makes eradication difficult as infected cattle populations remain undetected. The project develops new tests to identify *T. saginata* in live cattle. A MAb-ELISA antigen detection assay was successfully field-tested and will, after further refinement, accurately detect the parasite and thus allow identification pre-slaughter. This will reduce Carcasses rejection, facilitate exports and consequently boost farmer livelihoods.

Agridag *et al* and Dogan *et al* in 1993 and 1994 found *T. Saginata* infestation rates were 9.7% and 0.5% respectively.

Oryon *et al* (1994) carried out a study in a 3-year period. Of 9501 cattle examined, 736 (7.7%) were infected with cysticerci of *T. saginata*. The endemic foci were identified and prevalence was significantly higher (p<0.005), Kenarch (10.0%) and Shiraz area (8.5%) than elsewhere. The prevalence was significantly higher (p<0.005) during spring and autumn seasons. There was no variation in the infection rate in animals of different age groups, suggesting that immunity was acquired to super-infection. The most common sites were muscle of the sholder (26.3%). Pharynx oesophagus and diaphragm showed 0.9, 0.5 and 0.4% infection, respectively. The metacestodes were found to cause extensive damage resulting in infiltrative, degenerative changes, hemorrhages, necrosis and exudation mainly in the vicinity of cysts. They also found that infection was the cause of condemnation of 34.6% of infected Carcasses. The rejected Carcasses and infected organs were valued at 100.1 million Rials over the 3-year period.

Neva (1994) reported both adult and larvae forms of *Taenia saginata* hazardously affect health of their respective hosts, either directly or indirectly accompanied with severe secondary infections, particularly in human hosts. The
occurrence of the larval \((C. \text{ bovis})\) in cattle musculature cause bovine Cysticercosis while the adult worms in human small intestine cause Taeniasis. In humans, the infestation is accompanied with mild symptoms ranging from nausea, abdominal discomfort, epigastric pain, diarrhoea, vitamin deficiency, excessive appetite, weakness and loss of weight to digestive disturbances and intestinal blockage.

Chomic \textit{et al.} (1995) studied the oncosphere envelope ultrastructure of \textit{Taenia saginata}. He used gravid proglottids of \textit{Taenia saginata} from human infection before and after treatment of patient with niclosamide (Yomesan). The samples from niclosamide treated and untreated patients were similar with respect to number and kinds of the protective structures surrounding the oncospheres inside gravid proglottids. They found their morphology was generally similar to this described earlier for other \textit{Taeniid species}.

Onyango J.A -Abuje \textit{et al} (1995) adopted antibody and antigen ELISA in the diagnosis of \textit{Taenia saginata} Cysticercosis in Kenyan cattle either experimentally or naturally infected. An antibody response was detected by 3 weeks post infection (P.I), rose to a peak at 10-12 weeks p.i. and was still in evidence 1 year p.i. Parasite antigen was first detected 4-7 weeks p.i. and persisted until the end of the experiment, over 1 year p.i. in the experimentally infected animals. cattle with 14 or more live cysticerci had detectable levels of parasite antigen in their sera at slaughter. While animals with live cyst burdens ranging from 0 to 4 were negative. Furthermore, levels of circulating antigen were positively correlated with live \textit{Cysticercus} burden in the experimental animals. In naturally infected cattle 83\% (5/6) of those with 30 or more live cysts, and 22\%(5/23) of those with 1-29 live cysts, could be detected by the ELISA for parasite antigen, although no significant correlation between antigen level and live cyst burden could be detected. One possible reason is that the ELISA only detects live cysts, while lesions left by dead cysts are more noticeable at meat inspection. The mouse monoclonal antibody-based antigen detection ELISA is of value for the diagnosis of naturally occurring, viable \textit{T. saginata} cysticercoids in live cattle and has an immediate application for field based epidemiological studies designed to determine parasite.
King (1995) related the cause of *T. saginata* infection in humans with their feeding habits as these include raw steak or kebabs and steak tartare. King suggested that as *Taenia saginata* are morphologically indistinguishable from *Taenia solium* eggs but specific diagnosis were adapted by the recovery of parasite gravid proglottid which are usually motile and have large no. of lateral uterine branches in contrast to *Taenia solium* proglottids.

Koul P.A *et al.* (1996) reported for the first time 26 patients of niclosamide resistant taeniasis in Kashmir Valley. Xu *et al.* (1995) in China found prevalence of *T. saginata* as 17.2% and considered one of the most frequent causes of intestinal parasitic infections. Jael *et al.* (1996) in their paper have disclosed the distribution of *Taenia saginata* infection as 1-10% worldwide.

Echert (1996) in Workshop summary: Food Safety: meat and fish-borne Zoonoses in collaboration with WHO discusses Cysticercosis caused by *Cysticercus bovis* in cattle is still a significant problem in many parts of the world. In some countries, the infection rates of cattle with *Cysticercus bovis* have increased, for example under large-scale management conditions, sometimes reaching prevalence rates of about 50%.

Jael *et al.* (1996) conducted sero-epidemiological study of *Taenia saginata* Cysticercosis to determine the prevalence and distribution of the infection in three provinces of Kenya through serum samples and meat inspection records. They recorded the prevalence of *T. saginata* as 15.96% and 9.97% respectively for meat infection and serological samples. With highest prevalence of Cysticercosis for North district as 31.47% and 80.42% of the animals were detected respectively. Only 9.09% of the animals were diagnosed by Ab-ELISA.

Fan (1997) estimated the annual economic loses caused by *Taenia saginata* taeniasis in East Asia and discusses while ill health caused by the adult worms in humans give rise to high medical costs, with a total infestation rate of 2.0% together in bovines, and caused an annual loss of US $ 428 million.
Alfonso et al. (1997) devised certain treatment and control measures for the transmission of *Taenia saginata* in both animals and human. These include Carcass irradiation, public hygiene and education, mass chemotherapy (using praziquantel and/or albendazole and with praziquantel or niclosamide), cooking of meat at 57° C, deep freezing of meat at -10° C for 10 days, pickling meat in 25% salt solution for 5 days and buying only officially inspected meat.

Romero Cabello et al. (1997) presented treatment of 5 *Taenia saginata* patients with Nitazoxanide with 100% successful cure rate. Asci et al. (1998) found 679 (2.3%) samples positive for *Taenia saginata* from a total sample of 25,077 faecal and 5066 cellophane tape preparations.

Putu Butisna et al. (1999) observed the community prevalence study of Taeniasis and and Cysticercosis in Bali, Indonesia and found prevalence of *T. saginata* infection upto 5.22%. Habbari et al. (1999) also found that prevalence of Helminthic diseases was not influenced by factors such as sex, age, family size, and the educational level and profession of the parents of the children studied. Similarly, in India, no significant differences between males and females among sewage-farm washers were noted.

Parvaiz Koul et al. (1999) presented treatment of *T. saginata* infection of Niclosamide-resistant cases with praziquantel in Kashmir, India. A total of 185 consecutive patients with niclosamide-resistant taeniasis who attended the Department of Internal Medicine at Sheri Kashmir Institute of Medical Sciences, Kashmir, India. These patients were administered praziquantel 10mg/kg body weight orally after a light breakfast in the morning without any fasting or premedication. The post chemotherapy follow-up stool specimens at 4 and 12 weeks revealed a cure rate of 95.5%. Eleven patients were lost to follow-up, while 8 still showed passage of proglottids at the end of 12 weeks. A total of 30 patients reported minimal side effects, such as nausea (n=4), abdominal discomfort (n=10) and giddiness (n=16).
Eystein Skjerve (1999) worked on Monte Carlo risk assessment model to estimate the public health risk of importing prime cuts of beef infected with *Taenia saginata* to Norway from an endemic area in Southern Africa. The model predicted that 21 (lower 5%=1, upper 95%=56) viable cysts would be present in domestic prime cuts during 1996 and 1997, with 8 (0-21) of them being ingested without sufficient heat treatment to kill the parasite. These cysts were expected to cause 2 (0-7) human infections.

Habbari *et al.* (1999) evaluated that *Taenia Saginata* endemic infection is common under European conditions where indirect transmission is the predominant mode. This is largely attributable to sewage.

Dorny *et al.* (1999) conducted the sero-epidemiological study of *Taenia saginata* Cysticercosis in Belgium cattle and found 3.09% serum samples were positive in the Ag-ELISA; while by meat inspection on the same animals cysticerci were detected in only three Carcasses (0.26%). The sero-prevalence found in this study was more than 10 times higher than the annual prevalence (0.26%) reported by Institute for Veterinary Inspection.

Nancy Malla *et al.* (2000) in a retrospective analysis of various intestinal parasites identified during the past decade reveal prevalence of *Taenia* species infection as 0.02 to 0.12% through fecal samples. Alain Bricart-See (January 2000) reported treatment of *Enterocytozoon bieneusi* Microsporidiosis in a patient with AIDS with drug Nitazoxanide.

Juan Jo *et al.* (2000) conducted randomized clinical studies to evaluate the efficacy of Nitazoxanide paediatric suspension compared to albendazole in the treatment of ascariasis and trichuriasis and praziquantel in the treatment of *hymenolepiasis* in children from Cajamarea, Peru. Nitazoxanide was administered at a dose of 100mg (age 1-3 year) a 200 mg (age 4-11 years) twice daily for 3 days. Albendazole as a 400 mg single dose and praziquantel as a 25mg/kg single dose. Post treatment parasitological examinations were carried out on 3 faecal sample. Each collected on a different day between 21 and 30 days following initiation of treatment. Nitazoxanide cured 89% (25/28), 89% (16/18) and 82% (32/39) of the
cases of ascariasis, trichuriasis and hymenolepiasis respectively compared with 91% (32/35), 58% (11/19) and 96% (47/49) for the comparator drug.

Scendrett and Geiedhar (2001) found degenerate Taeniid-like eggs consistent with *Taenia saginata* which were recorded from sediment in the water supply of a beef feed lot under quarantine for *Cysticercus bovis*. Lawlor (2002) described epidemiology is the study on the distribution and determinants of health-related events in specified populations, and the application of this study to the control of health problem.

Wayne *et al.* (2002) reported an outbreak of *Cysticercus bovis* (*Taenia saginata*) in Alberta feedlot cattle in United States Plant. A total of 2994 animals slaughtered under federal license, 67 were identified by visual carcass inspection. Two additional animals identified visually were later found to be negative. Assuming these 67 animals to be true positives, at this low apparent prevalence (2-3%) both the positive predictive value (97%) and negative predictive value (97-99%) of visual carcass examination are quite high, despite the reported low sensitivity of this test (50-75%), especially in light infected Carcasses. At higher prevalences, such as in endemic areas, the negative predictive value of this test would drop substantially.

FAO/WHO (2002) Gave detailed studies of Global Forum of Food Safety Regulators, Marrakech, Morocco which showed that 3.7 million cattle slaughtered over an 18 month period in 1995/96. *T. saginata* is shown to have an extremely low prevalence level in New Zealand cattle. Despite this, importing countries (where *T. saginata* may be more prevalent) traditionally insist on invasive post mortem examination of the cattle heart and check masseter muscles where the cysts are more likely to be found.

Wanzala *et al.* (2003 a) have revealed the reference of WHO. in the introduction of their work that *Taenia saginata* is a worldwide zoonotic cestode whose epidemiology is ethnically and culturally determined with estimates of
approximately 50 million cases of infestation world wide with 50,000 people dying from this problem annually.

Wanzala et al. (2003 b) has devised control of *Taenia saginata* by post-mortem examination of Carcasses. A total of 55 cattle divided into two groups of artificially (n=30) and naturally (n=25) infested animals were utilized. Total dissection method was used as a gold standard of validity. The results confirmed that in spite of the time and efforts taken by meat inspectors looking for cysticerci at specified predilection sites of carcasses; this method is insensitive and inaccurate. To effectively improve meat inspection procedures, there is need to increase that 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.

Wanzala et al (2003)c. discussed certain control measured based on Kenyan Meat Control act for the transmission of Taeniasis and Cysticercosis in humans and cattle respectively due to *T. saginata*. The Carcasses with 0 cysts should be passed and directly for human consumption, 1-5 cysts should be retained frozen at -10°C for at least 10 days and released "unconditionally". 6-20 cysts should be similarly treated as above but released conditionally to schools/institutions where proper cooling is expected to be done. Carcasses with over 20 cysts should be totally condemned. Also in rural areas where the disease is more prevalent and electricity is unavailable, the Carcasses should be sliced and boiled for 2 hours at 77°C under the supervision of the inspecting officer.

Clinton and White (2003) evaluated Nitazoxanide, as an important advance in anti-parasitic therapy. The paper includes the discovery of Nitazoxanide in the 1980s by Jean Francois Rossignol at the Pasteur Institute and demonstrated this drug a remedy to treat varied parasitic infestations including *T. saginata* resistant parasitoses.
Elvia Diaz et al. (2003) evaluated over all efficacy of Nitazoxanide with cure rate 84% for the protozoa and 95% for helminthes, with good tolerance and no serious adverse effects.

Jerl et al. (2004) adopted preniclosamide and postniclosamide electrolyte-polyethylene glycol salt (EPS) purges to improve bowel cleaning. Retrospective comparison of traditional castor oil with (EPS) purge showed that recovery of tape worm Scolex was significantly improved (20 of 68 V/S none of 46, p=0.0001) in the EPS group. Furthermore, 42 of 68 (62%) individuals receiving EPS excreted identifiable gravid proglottids. The authors suggest that EPS treatment helps the visual in indentification of Taenia spp.

Sayyari et al. (2005) found prevalence of T. saginata infection in the Islamic Republic of Iran as 0.1% in males, 0.2% in females with average of 0.2% with no significant variation in the age groups and 0.1% in urban and 0.2% in rural.

Clinton White et al. (2005) discussed the prevalence of Taenia saginata in all countries where raw or undercooked beef is eaten, almost prevalent in sub-Saharan African and Middle Eastern countries.

Abueier et al. (2006) collected a total of 267 cysts from March to December, 2004 from main abattoirs in Northern Germany. The cysts were classified by the useful organoleptic methods during meat inspection as C. hovis. The reported prevalence of cysticercosis in the abattoirs was 0.48 and 1.08% respectively. The cysts were examined macroscopically for description of their morphology and constituents and classified as viable or degenerating (dead). About 52.4% of the samples tested positive for C. hovis in the PCR using both primers, while 20% of the viable cysts and 49.2% of the degenerating cysts tested negative with PCR.

Wandra et al. (2006) carried out an epidemiological survey of Taeniasis/ Cysticercosis in one semi-urban and two urban villages in three districts of Bali, Indonesia. In total, 398 local people from 247 families were diagnosed by Anamnesis and clinical examinations, and 60 residents were suspected to be Taeniasis carriers. Among 60 suspected carriers, 56 persons expelled a total of 61
Taeniid adult worms after praziquantel treatment. Thus *Taenia saginata* prevalence was highly variable among three villages 1.1-27.5% and only 1 case of cysticercosis due to *T. solium* infection was detected. All expelled tape worms were confirmed to be the *T. saginata* by mt DNA analysis. There was no *Taenia asiatica* human case in Bali.

WHO Third Report on Zoonoses Control. Collection of Teaching AIDS for international Training Course, in its report say “In Eastern Africa, prevalence of *T. saginata* is extremely high, up to 100% infection has been recorded in some groups”.

WHO, 3rd Report on Zoonoses Control, say the larval stage of *T. saginata* (Cysticercus bovis) occurs in almost all countries of the world. In European countries, it is said to be found in 0.25-1.26% of slaughtered animals, however, these figures are based on meat inspection reports, which may not give an accurate indication of the prevalence. High prevalence rates occur in Africa; in some Eastern African countries rates of 30-80% have been noted. In general, prevalence of *C. bovis* parallels that of *T. saginata*. The report also describes the longevity of adults and eggs of *T. saginata* as viable eggs of *T saginata* have been found in city sewage after 10 days, in river water after 33 days, and on pasture after 159 days. While as *T. saginata* larval (*C. bovis*) undergo degeneration and calcification 9-12 months after infection, a small number may remain viable for considerably longer periods. In East Africa, viable cysts may be found several years after the probable time of infection. There is evidence to suggest that cysticerci may live longer in animals that are infected when newly born.

Nayan and Eric (2007) reported an unusual colonoscopy finding in a 63-year-old Lebanese male and found the morbidities related to *Taenia saginata* and risk factors for its transmission, diagnosis, symptoms and treatment.