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Role of local fowl in the dissemination of *Taenia saginata* infection

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Abstract
Taenia saginata commonly known as tape worm infection is more common in developing countries due to poor hygiene and tradition of eating raw or insufficiently cooked beef. The objective of this study was to evaluate the role of local Kashmiri fowl in the dissemination of eggs of this worm. The gravid proglottids of *T. saginata* were obtained from non-treated taeniasis patients, who were enrolled for this study. Locally available common fowl were raised in the temporary set laboratory and were fed with *T. saginata* gravid segments. Each fowl was inoculated with two gravid segments and were kept for 5 days in individual cages. During this time, their coprological material was collected and screened for the presence of *T. saginata* eggs and the recovered eggs were observed for their viabity by methylene blue technique. In the first week of examination of eggs collected from the caged infected fowl, all the eggs were found viable as demonstrated by methylene blue technique. But in the second week the egg count decreased but retained their viability. Therefore, the 100% viability of *T. saginata* eggs which were artificially inoculated to local fowl indicated their role in the dissemination of *T. saginata* infection.

Keywords: *Taenia saginata*, eggs, viability, dissemination, fowl, Kashmir

1. Introduction
Taenia saginata commonly known as tape worm is a digenetic parasite involving human and cattle as its hosts. The larval form called as cysticercus is present in cattle while as the main adult parasite lodges in the small intestines of man and causes a disease called as taeniasis characterized with severe morbidity. Cysticercosis occurs mainly in cattle; however, infection has also been reported in reindeer, deer, antelope (Machul Shii, 1941; Shpilko, 1956) [11]. *Taenia saginata* infection is more common in developing countries due to poor hygiene and tradition of eating raw or insufficiently cooked beef (Smyth, 1996). However, it is also a problem in developed countries by consuming undercooked or raw beef steaks containing its infective larva (cysticercus). Cattle become infected by grazing on the grasses contaminated by the human faeces and sewage containing its eggs. High prevalence rates of 30 to 80% of cysticercosis have been recorded in many countries of Africa and East Africa. It is significant to note that eggs of *Taenia saginata* survive almost all stages of sewage treatment. The eggs outside the host at optimal conditions of temperature and moisture remain viable for several weeks' even months (Burger, 1984) [1]. Coprophagous insects and birds particularly the sea birds (Gulls) also play an important role in the dissemination of eggs (Pawlowski and Schultz 1972) [13]. The objective of this study was to demonstrate the role of local domesticated fowl in the dispersal of *Taenia saginata* eggs in Kashmir valley.

Materials and methods
Preparation of inoculum of Taenia saginata eggs
Gravid proglottids of *Taenia saginata* were obtained from non-treated local taeniasis patients enrolled for this study. The experimentation was carried at temporary constituted laboratory at Safapora Manasbal of District Ganderbal, Kashmir, India. Around 20 segments from different patients were identified as *T. saginata* by compression between two glass plates and the microscopic analysis of uterine ramification (15 to 32 ramifications) in *T. saginata* (WHO, 1983; Dorny *et al*., 2005) [17, 2]. Two gravid segments were put in five separate test tubes containing 30 ml of saline solution (Hayunga *et al.*, 1991; Kyvsagaard *et al.*, 1991; Fan *et al.*, 1992; Joao Carlos *et al.*, 2002) [5, 3, 7].

Experimental fowl
Locally available common fowl five in number were raised in the laboratory. They were fed for fifteen days then their carpological matter was screened for the presence of any infection/eggs. Each fowl was fed with two gravid segments, kept ready in separate test tubes containing 50 ml each of saline solution (0.85%). Then following the inoculation, they were kept for 5 days in individual cages. During this time, their faeces/coprological material was collected and screened for the presence of *Taenia saginata* eggs and the recovered /collected eggs were observed for their viabity by methylene blue technique (Knaus and Lange, 1987, Lateef *et al.* 2018)

[8, 10].

One gram of methylene blue powder was dissolved in 100 ml of distilled water to make 1% solution of methylene blue. Continuously for 3 weeks' time the coprological material of the infected birds was screened for the eggs of *Taenia saginata* and these collected eggs were then put to viability test using methylene blue staining technique. Briefly eggs were placed on the slide followed with one drop of methylene blue solution and a cover glass was laid over it. Then eggs were observed under microscope. The eggs taking stain were considered as non viable and non staining eggs as viable (Knaus and Launge, 1987) [8]. The percentage of viable eggs was calculated by counting total number of non staining eggs by total number of eggs seen (Parvaiz *et al.*, 1999) [12].

Results and discussion

In the first week of examination of eggs collected from the coprological material of the caged infected fowl, the eggs from all the birds were found retaining the viability. In the second week, the number count went on decreasing but all eggs retained viability. Thus the coprological examination revealed 100% viability of *T. saginata* eggs which were artificially inoculated to local fowl to observe their role in the dissemination of infection in Kashmir. The results can be correlated with Pawlowski and Schultz (1972) [13] who reported that eggs may remain viable for several weeks or months in sewage, in rivers, and on pasture. The viability of eggs demonstrated in experimental fowl by examining their faeces through methylene blue technique revealed that eggs obtained where 100 % viable and suggest that birds act as good source for the dissemination of eggs. The results are also in agreement with Burger (1984) [1] with certain variations i.e., the first two media of NaCl (0.5 %) and dextrose 5 % have not been reported till date for influencing viability of *T. saginata* eggs as reported in current study. This experimental study revealed that in spite of minor sewage and sludge treatments there remains every apprehension of infection of locally raised cattle due to *T. saginata* as if only one taeniasis patient exposes his faeces to the field, pasture or water body, thousands of bovines can get infected. It is significant to note that eggs have been shown to survive almost all stages of sewage treatment (Burger, 1984) [1]. Eggs may remain viable for 71 days in liquid manure, 16 days in city sewage, 33 days in river water and 159 days in open pastures (Jepsen and Roth, 1949) [6]. Similarly, Silverman and Griffiths, 1955 found gulls playing role in the dispersal of *T. saginata* eggs. In temperate zone, survival as measured by infectivity is in the order of 100-200 days and >200 days respectively (Gemmel, 1986) [4]. Comparing our results, it reveals that in Kashmir being a temperate zone where the weather and topographic conditions favour the longevity of the viability of eggs of *T. saginata.* This is attributed to be a good reason for the infection in cattle, as almost sewage treatment is negligible in this region. So while devising control measures for *T. saginata* infection in Kashmir, viability of eggs is to be considered for excellent strategy.

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