Studies on Prevalence, Antigenic Characterization of Hydatidosis and Its Economic Impact on Cattle and Buffalo Meat Production

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Abstract

Present study was undertaken for determination of prevalence of hydatidosis, its economic impact on cattle and buffalo meat production, and to identify and characterize antigenic protein of hydatid cyst. Prevalence was determined by examining 1268 cattle and 1137 buffaloes in Deonar (5.04%) and Kalyan (2.90%) abattoir, respectively. Amongst the predilection sites, hydatid cysts were observed in lung, liver and spleen but not in other visceral organ like heart and kidney with higher incidence of pulmonary than hepatic hydatidosis in both species. In the present study fertility rate of the hydatid cyst was found higher in buffaloes (39.53%) as compared to cattle (30.7%). Analysis of protein content of Hydatid fluid (HF) revealed that cattle contained more protein (Av. 91.41 mg %) than buffaloes (Av.81.33 mg %). Protein content of HF in cattle and buffaloes ranged from 20 to 488 mg% and 24.48 to 349 mg%, respectively. The molecular weight of range of protein fractions of HFc and HFB ranged from 35 to 79 KDa and 31 to 79 KDa respectively. The economic loss was found to be more in cattle as compared to buffaloes.

Keywords: Hydatidosis, Cattle, Buffalo, Prevalence, Hydatid fluid antigen, SDS-PAGE, Economic impact.

1. Introduction

Hydatidosis is a parasitic disease widely recognized since Greek antiquity (Hosemann et al., 1928) and very important in ruminants. Out of five known species of genus echinococcus, Cystic Echinococcosis (CE) is prevalent in India which is caused by the metacestode, Echinococcus granulosus. The parasite perpetuates in the nature with carnivores; primarily dogs as definitive hosts. They harbor adult egg producing stages in small intestine, and herbivores and omnivores as intermediate host. The larval stages harbouring metacestode develop in the liver, lung and other internal organs after ingestion of the eggs (Stefanic et al., 2004). Cystic echinococcosis (CE), caused by Echinococcus granulosus, is an important zoonotic infection causing morbidity and mortality in humans and significant economic losses in livestock (Daryani et al., 2006). The control of hydatidosis in farm animals greatly reduces danger to man and also economic losses to meat industry. These parasites cannot be diagnosed by conventional techniques. They are detected either at the time of necropsy or during the process of evisceration in the abattoir. Therefore there is need to develop rapid and reliable diagnostic methods to know the exact prevalence of this disease.

The scientific work on hydatid disease carried out till today has more emphasis on prevalence of disease and very few studies, have been under taken in the area of molecular characterization and economic impact of hydatid disease in cattle and buffaloes. Thus, the present study was undertaken to study the prevalence of hydatid cysts in the visceral organs of cattle (males) and buffaloes slaughtered in different slaughter houses and to identify and characterize antigenic proteins of the hydatid cysts of cattle (male) and buffaloes by Poly Acrylamide Gel Electrophoresis (PAGE) as well as to estimate the economic loss due to hydatidosis in these slaughtered animals.

2. Materials and Methods

A total of 1268 cattle (male) carcasses, out of which 1234 and 34 cattle in Deonar and Kalyan abattoir respectively; and 1137 buffaloes carcasses, out of which 1046 and 91 buffaloes in Deonar and Kalyan abattoir respectively, were examined systematically on post mortem examination for detection of hydatid cyst during March to May, 2010. The infested organs were collected and packed separately in clean labeled polythene bags and brought to the laboratory, then cleaned with spirit swab and the weight recorded on
The hydatid fluid of fertile cysts from all the cattle (Male) and buffaloes were further subjected to dialysis and concentration separately. The dialysis tubing (M/s Hi-media Pvt. Ltd., Mumbai) was cut in to convenient lengths and cut pieces of the tubing were kept in hot 2% sodium bicarbonate and EDTA solution for 10 min. The dialysis tubes were then thoroughly rinsed in distilled water. Hydatid fluid was filled in the different dialysis membrane tube and dialysed with distilled water up to 5 times the fluid volume at 4°C. The dialysis was continued for 44 hrs during which the water was changed at 4 hrs interval between the first two changes, eight hrs interval between the middle three changes and 12 hrs interval of last change. After dialysis, the hydatid fluid samples were concentrated by per-evaporation in the same dialysis tubing by hanging horizontally near air-conditioner at 4°C for 5 to 6 days as described by Hamm (1966). The content of each dialysis tube including precipitate were transferred to separate glass vial and stored at -18°C in deep freezer. The molecular weights of the electrophoretic protein fractions of concentrated HF from cattle and buffaloes were studied by polyacrylamide slab gel electrophoresis method as described by Laemmli (1970).
2.6 Electrophoresis

After loading the samples and the marker the upper chamber was filled with electrode buffer. Electrophoresis was run at a constant current of 30 mA or 80 V at room temperature for 4-5 hrs. Staining of gel was carried out by using silver nitrate staining. The molecular weights of unknown protein fraction were determined as per method described by Shapiro et al. (1967) by plotting a graph between the molecular weight of protein marker and their relative mobility (Rf) on semilogarithmic graph paper. The Rf value was calculated as follows:

\[ \text{Rf} = \frac{\text{Distance travelled by protein markers}}{\text{Distance travelled by tracking dye}} \]

2.7 Estimation of Economic Loss

Economic loss was estimated by calculating weight of different organs condemned from cattle and buffaloes and their current market prices. Following formula was used to calculate economic loss.

\[ \text{Total economic loss} = \text{Total weight of condemned organ/ Viscera} \times \text{Prevailing price of viscera} \]

3. Results and Discussion

The prevalence of hydatidosis in cattle slaughtered at Deonar and Kalyan abattoir was found to be 5.10% and 2.94%, respectively. In buffalo, the prevalence of hydatidosis slaughtered at Kalyan and Deonar abattoir was found to be 2.96% and 2.19%. The overall prevalence rate was found to be 5.04% and 2.90% in cattle and buffalo, respectively. Similar prevalence rate in cattle (5.10%) and in buffaloes (3.82%) was recorded by Pednekar et al. (2009). Gatne et al. (2001) reported higher prevalence rate (13.17%) than observed in present study in cattle slaughtered at Deonar abattoir. Among all the cattle and buffalo carcasses examined, lung and liver were found to be most preferred sites of predilection (Fig 1, Fig 2). In cattle and buffaloes, occurrence of pulmonary hydatidosis was found to be more than hepatic hydatidosis and splenic hydatidosis. Similar trend of higher percentage of pulmonary hydatidosis than hepatic hydatidosis in bovines was found by Pednekar et al. (2009). Hegde et al. (1975) also reported that hydatid cysts were most common in lung (85.9%) followed by liver (12.5%). Although, there is no precise explanation for higher prevalence of the infestation in pulmonary and hepatic tissues in the literature, infective stages after entering the body of hosts can detect minute differences in the biochemical environment in various organs which decide organ specificity. (Chandler and Read, 1961). Pednekar et al. (2009) also explained that lung and liver may act as the filters for migrating oncosphere and do not allow them to distribute in different parts of the body by trapping them in small vessels resulting in to development of cysts at these location.

In both species, single organ involvement was observed commonly, where as out of 64 positive cattle multiple organ and single organ involvement was seen in only 3 (0.23%) and 61 (4.81%) cattle, respectively. No multiple organ involvement was observed in buffaloes but single organ involvement was found to be 2.9%. The Hydatid Fluid (HF) from each cyst was processed separately and the fertility rate of the hydatid cyst was found to be higher in buffaloes (39.53%) as compared to cattle (30.7%), which collaborate with observation of Munde (1999) who reported fertility rate of hydatid cyst was maximum in buffaloes (40%) followed by cattle (37.69). The number wise intensity in cattle and buffaloes was found to be 0.46% and 0.16%, respectively and the infestation of organ with less than five hydatid cyst was considered as mild infestation, while more than five cysts was considered as heavy infestation.

Analysis of protein content of HF of cattle and buffaloes was carried out by Lowry’s method which revealed that HF of cysts of cattle contains more protein (Av. 91.41 mg %) as compared to buffaloes (81.33 mg %). The protein percentage of HF from lung was highest followed by cysts from liver and spleen in both the species. The SDS-PAGE analysis of concentrated HF from cattle showed eight fractions with molecular weights ranging from 37.58 to 89.13 KDa. The molecular weights of protein components were 89.13, 59.57, 50.12, 47.32, 44.67, 39.81, 37.58, and 42.17 KDa. The six components were found to be common in host tissue and hydatid fluid of cattle with molecular weight ranging from 35.48 KDa to 74.99 KDa. Similarly, the SDS-PAGE analysis of concentrated HF from buffaloes revealed five fractions with molecular weight ranging from 33.50 KDa to 59.67 KDa. The molecular weight of protein components were 33.50, 47.43, 53.09, 56.23 and 59.67. Molecular weight of host tissue antigen from cattle and buffaloes was found to be varied greatly. In cattle, host tissue antigen of liver and lung showed molecular weight ranged from 33.54 to 749.90 KDa and 31.62 to 89.13 KDa, respectively. In buffaloes, liver host tissue antigen showed only two protein bands and in lung showed seven protein bands which ranged from 50.12 to 89.13 and 31.62 to 74.99 KDa, respectively. Protein content of sterile cysts was found to be higher than that of fertile cyst which can be attributed to the additional biochemical requirement of protoscoleces of fertile cysts for their growth and development.

In cattle, economic loss in rupees caused due to condemned lung was Rs. 1434 which was higher as compared to loss caused by condemned lung.
(Rs.620.4) and spleen (Rs.91.75). The percent economic loss was found to be higher in cattle as compared to buffaloes. For comparison in India, no earlier similar reports are available, but in Northwest Iran Daryani et al. (2006) studied prevalence of hydatid cyst in slaughtered animals and stated that *Echinococcus granulosus*, is an important zoonotic infection causing morbidity and mortality in humans and significant economic losses in livestock.

4. Conclusion

In conclusion, hydatidosis is a parasitic disease widely recognized and very important in ruminants, however surveys of hydatid disease in food producing animals in India have revealed that the disease is endemic. Present study was carried out for determination of prevalence of hydatidosis in cattle and buffaloes as well as for identification and characterization of antigenic proteins of the hydatid cysts of cattle and buffaloes by PolyAcrylamide Gel Electrophoresis (PAGE). An attempt has also been made to know the economic impact of hydatidosis on cattle and buffaloes meat production. Based on the present study it was noted that prevalence of hydatidosis in Maharashtra has gradually declined over past few years. The control of hydatidosis in farm animals greatly reduces danger to man and also economic losses to meat industry and this can be attributed to better sanitation practices and stray dog control.

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