Diversity and Prevalence of Trematodes in Livers of Sheep and Goat in Quetta, Pakistan

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Abstract.- A study was conducted to investigate diversity and prevalence of helminth parasites of livers of sheep and goats in the district of Quetta between August 2001 and March 2002. Fasciola hepatica, F. gigantica and Paramphistomum explanatum were recorded. Overall trematodiasis was 23.75% in sheep and 27.90% in goats. Mixed infection of F. hepatica and F. gigantica was higher (12.26 and 20.93% in sheep and goats, respectively) compared with infection with parasites alone, or in mixed combination with P. explanatum. An increase in prevalence and intensity of parasites was seen during and after the rainy season. Presence of F. gigantica strongly suggests that animal transport influences epidemiological findings.

Key words: Fasciolosis, Paramphistomiasis, animal transport.

INTRODUCTION

The economic impact of helminth diseases on livestock encompasses mortality losses, morbidity losses (measured in terms of less than optimum production of milk, meat and wool), enhanced susceptibility to bacterial and viral diseases, and losses resulting from condemnation of carcasses and organs, as well as the cost of drugs and veterinary care (Herlich, 1978). Among various parasitic diseases of sheep and goats those affecting vital body organs like livers and lungs cause enormous damage (Iqbal et al., 1986). Spithill et al. (1999) have shown economic losses caused by F. gigantica to be more than US$ 3200 million. Torgerson and Claxton (1999) have discussed these economic losses in terms of loss of wool production, milk yield and fertility. Saleem (1985) and Howlader and Huq (1997) reported anemia in sheep and goats.

Fasciolosis, dicrocoeliosis and paramphistomiasis have been reported by many workers from different parts of Pakistan (Ashraf, 1977; Durrani et al., 1981; Saleem, 1985; Hayat et al., 1986; Iqbal et al., 1986; Nawaz and Nawaz, 1987a,b; Bilqees, 1988; Khan et al., 1988a,b, 1989; Pal and Qayyum, 1993; Malik et al., 1995; Azad et al., 1997; Razzaq et al., 2002). Prevalence of Fasciolosis is not uncommon in the province of Balochistan, where sheep and goat raising is the biggest economic resource of rural populace (Nawaz and Nawaz, 1987a). Thus reduction in losses in sheep and goats from diseases would increase food production and per capita income (Ellis et al., 1993) and hence cut down on economic losses (Khan et al., 1989).

The present study was conducted during drought, when animals were transported into the area from other cities.

MATERIALS AND METHODS

In the present study, 261 sheep and 43 goat livers were collected to determine the epidemiological status of trematodiasis, between August 2001 and March 2002. The animals brought to Army Supply Corps (ASC) abattoir, were all female of older age (i.e., between 5-7 years); most had weaned several times.

The livers were brought to the laboratory for recovery of flukes (Saleem, 1985; Hayat et al., 1986; Iqbal et al., 1986). In order to obtain flukes from liver, gall bladder was incised and then bile ducts were opened, starting from common bile ducts to smaller ones at the periphery of liver. Flukes were carefully picked up with the help of needle and...
forceps, and put in 5% saline solution, and then
washed thoroughly with tap water. They were
rapidly killed in 70% ethyl alcohol to avoid
shrinkage. The flukes were then transferred to vials
containing 6-10% formalin for preservation.
Flukes were stained with Borax Carmine
(Cable, 1977), dehydrated in ethanol, cleared in
carbol-xylol (1:3) and mounted in Canada Balsam.
The cephalic cones and shoulders in *F. hepatica*
and their absence in *F. gigantica* was the distinguishing
feature between the two species (Soulsby, 1982),
whereas in the case of *Paramphistomum* sp. and *P.
explanatum*, the acetabular index of 1:3 was used
for identification (Yamaguti 1958).

**RESULTS AND DISCUSSION**

A total of three species of trematodes *i.e.*,
*Fasciola hepatica*, *F. gigantica* and
*Paramphistomum explanatum* were recovered from
the samples examined. However, *P. explanatum* was
absent in goats and found in sheep only. Overall
higher trematodes prevalence was recorded in goats
(27.90%) than in sheep (23.75%). (Table I).

**Fasciolosis**

In goats, overall 6.97% livers were found
infected with *F. hepatica* only (Table I). Razzaq *et
al.* (2002) reported 5% fasciolosis in goats of
Range-Livestock Research Station of Arid Zone
Research Center in Asghara valley of Ziarat, while
10% fasciolosis has been found in goats of private
farmers grazing the same pastures. Iqbal *et al.*
(1986) reported 4% infection of this parasite in
sheep of Faisalabad. Cringoli *et al.* (2002) in a cross-
sectional cariological survey found 4% sheep farms
out of 197 inspected in 3971 km² area of the
southern Italian Apennines to be infected with this
parasite. However, in contrast, very high incidence
has also been reported, as 35% by Durrani *et
al.* (1981) in Jhelum valley, 32.8% by Khan *et
al.* (1988a) in Kovak valley, 26% by Khan *et
al.* (1988b) in upland districts of Balochistan and 40%
by Malik *et al.* (1995) in Punjab. Fecal analysis of
sheep of Tzotzil communities in the highlands of
Chiapas, Mexico by Nahed-Toral *et al.* (2003)
showed 37.5% infection with *F. hepatica*.

In sheep, overall mixed infection with *F. hepatica*
alone was 7.66% (Table I). This finding is in
agreement with Saleem (1985) who found 8% incidence of the same trematode in sheep at Lahore.
Razzaq *et al.* (2002) recorded lower incidence of 6
and 5% infection with *F. hepatica* in sheep of range-
livestock research station and private flock holders.
Hayat *et al.* (1986) and Iqbal *et al.* (1986) found
5.67 and 4% incidence, respectively in sheep of
Faisalabad. Cringoli *et al.* (2002) in a cross-
sectional cariological survey found 4% sheep farms
out of 197 inspected in 3971 km² area of the
southern Italian Apennines to be infected with this
parasite. However, in contrast, very high incidence
has also been reported, as 35% by Durrani *et
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Chiapas, Mexico by Nahed-Toral *et al.* (2003)
showed 37.5% infection with *F. hepatica*.

In sheep, overall mixed infection with *F. hepatica*
and *F. gigantica* was 12.26%. Nevertheless, Hayat *et al.* (1986) and Iqbal *et al.*
(1986) reported mixed infection of both the species of
*Fasciola* to be 2.08 and 6%, respectively.

**Paramphistomiasis of liver**

Presence of *Paramphistomum explanatum* in
livers of sheep but not goats is an important finding of
the present study. Flukes of genus *Paramphistomum* are called as rumen flukes, since a
large number of species have been described from
rumen and reticulum of domestic and wild
ruminants of tropical and subtropical areas (Yamaguti, 1952; Soulsby, 1982; Urquhart et al., 1988). Nevertheless, Soulsby (1982) discussed pathogenicity of Gigantocotyle explanatum in the bile ducts and gall bladder, where they may not just cause a series of superficial haemorrhages indicating the sites of attachments; but fibrosis of liver and its pale color too in heavy infection. Yamaguti (1952) however, considered genus Gigantocotyle (Nasmark, 1937) synonymous to Paramphistomum (Fiocheder, 1901). In Pakistan two species are very common, i.e., P. explanatum and P. cervi (Khan et al., 1988b; Khan et al., 1989; Pal and Qayyum, 1993; Malik et al., 1995; Azad et al., 1997), the later being more prevalent. However, with the exception of Ashraf (1977) and Khan and Anjum (1994) no one has reported P. explanatum from liver or gall bladder. Ashraf (1977) reported 12 specimens from gall bladder of a goat that also carried F. hepatica. While, Khan and Anjum (1994) presented case report of a female buffalo, aged about 8-10 years, in which a large number of flukes (that were identified as Paramphistomum sp.) were recovered from liver. The specimens in our research were found deep in the bile ducts, some even in chamber like formation of bile ducts at about the periphery of liver. Some were lying free, soaking in bad smelling fluid (as in severe fasciolosis); others attached to the walls of chambers or ducts with their oral suckers. We came across liver pararnphistomiasis at ten occasions. In eight (3.06%) cases, P. explanatum was present along with single or both species of Fasciola; while in two (0.76%) livers, it was the only species causing infection.

Seasonal epidemiological findings

As regard the seasonal prevalence, the highest prevalence of these parasites was seen in August and September (rainy season), which gradually decreased towards October, November and so on. Not different has been seen by other researchers inside the country, but also in Bangladesh (Chowdhury et al., 1993; Chowdhury et al., 1994b); Nigeria (Egbe-Nwiyi and Chaudrai, 1996) and Mexico (Nahed-Toral et al., 2003). All these authors have discussed moist weather and rainy season to be responsible for high prevalence of Fasciola sp. Interestingly, Lymnaea auricularia snails infected with Fasciola cercariae (Gymnocephal10us cercariae) were observed by Chowdhury et al. (1994a) to be more prevalent in monsoon season. It is not just Fasciola sp. that is more prevalent in rainy months but Paramphistomum species as well, as seen by Chowdhury et al. (1993) in rectal fecal samples and Pal and Qayyum (1993) in slaughtered animals. Besides rainfall, the later authors have also attributed to the fact that animals drink water from such water channels or graze near them, which are heavily populated by snails of various species that serve as intermediate hosts of these amphistomes. In sheep highest intensity of F. hepatica per liver was 34 (August), F. gigantica 71 (September) and P. explanatum 52 (October). In goats highest intensity of F. hepatica was 32 (August and September) and F. gigantica 19 (November). The high and low intensity of flukes in the livers of sheep and goats may be due to resistance acquired after Fasciola infection, which varies depending on the host species (Torgerson and Claxton, 1999).

Animal transport and epidemiological finding

In this study, F. gigantica was recovered, which mostly exceeded F. hepatica in its intensity. Quetta (Balochistan), as well as Dir, Swat and Chitral are upland districts of Pakistan, where according to Kendall (1954) F. gigantica is replaced by F. hepatica and it is for the same reason that Nawaz and Nawaz (1987a, b) in sheep and goats of Quetta district; Khan et al. (1988a,b) in sheep of Kovak valley and upland Balochistan; and Razzaq et al. (2002) in Ashgara valley of Ziarat did not come across F. gigantica, but F. hepatica only.

Though a number of species of snails can act as intermediate host for F. gigantica (WHO, 1995); but it is Lymnaea auricularia sensu lato that is its host in nature. As F. gigantica does not occur naturally outside the range of L. auricularia sensu lato, it seems reasonable to conclude that the contribution of other snails to endemicity of this parasite is minor (Spithill et al. , 1999). Since, this snail species lives in bodies of water that are permanent throughout the year (Kendall, 1954), the arid or semi-arid province Balochistan does not seem to be a favorite geographical location for F. gigantica. Nevertheless, high prevalence of F. gigantica in mixed form with F. hepatica is due to
Table I.- Prevalence and percentage infection of trematodes in livers of goat and sheep from August 2001 to December 2001 and February 2002.

<table>
<thead>
<tr>
<th>Months</th>
<th>No. of livers examined</th>
<th>No. of livers found infected</th>
<th>Fasciola hepatica infection only</th>
<th>Mixed infection of F. hepatica and F. gigantica</th>
<th>Mixed infection of Fasciola sp. and P. explanatum</th>
<th>P. explanatum infection only</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Goat liver infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>August 2001</td>
<td>7</td>
<td>1 (14.28%)</td>
<td>1 (14.28%)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>September 2001</td>
<td>14</td>
<td>8 (57.14%)</td>
<td>2 (14.28%)</td>
<td>6 (42.85%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>October 2001</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>November 2001</td>
<td>10</td>
<td>1 (10%)</td>
<td>-</td>
<td>1 (10%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>December 2001</td>
<td>5</td>
<td>2 (40%)</td>
<td>-</td>
<td>2 (40%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>February 2002</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>12 (27.90%)</td>
<td>3 (6.97%)</td>
<td>9 (20.93%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B) Sheep liver infection</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>August 2001</td>
<td>9</td>
<td>6 (66.66%)</td>
<td>2 (22.22%)</td>
<td>4 (44.44%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>September 2001</td>
<td>51</td>
<td>16 (31.37%)</td>
<td>6 (11.76%)</td>
<td>9 (17.64%)</td>
<td>1 (1.96%)</td>
<td>-</td>
</tr>
<tr>
<td>October 2001</td>
<td>73</td>
<td>17 (23.28%)</td>
<td>5 (6.84%)</td>
<td>5 (6.84%)</td>
<td>6 (8.21%)</td>
<td>1 (1.36%)</td>
</tr>
<tr>
<td>November 2001</td>
<td>31</td>
<td>4 (12.90%)</td>
<td>1 (3.22%)</td>
<td>3 (9.67%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>December 2001</td>
<td>30</td>
<td>8 (26.66%)</td>
<td>4 (13.33%)</td>
<td>3 (10%)</td>
<td>1 (3.33%)</td>
<td>-</td>
</tr>
<tr>
<td>January 2002</td>
<td>38</td>
<td>4 (10.52%)</td>
<td>2 (5.26%)</td>
<td>2 (5.26%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>February 2002</td>
<td>11</td>
<td>1 (9.09%)</td>
<td>-</td>
<td>1 (9.09%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>March 2002</td>
<td>18</td>
<td>6 (33.33%)</td>
<td>-</td>
<td>5 (27.77%)</td>
<td>-</td>
<td>1 (5.55%)</td>
</tr>
<tr>
<td>Total</td>
<td>261</td>
<td>62 (23.75%)</td>
<td>20 (7.66%)</td>
<td>32 (12.26%)</td>
<td>8 (3.06%)</td>
<td>2 (0.76%)</td>
</tr>
</tbody>
</table>

the fact that animals brought to the Army Supply Corps (ASC) abattoir in Quetta were mostly from larger markets in low altitude of the country because of their easy availability, lower cost and also because of their non-availability on large scale in the province of Balochistan due to drought.

According to Kendall (1954), mixed infections of F. hepatica and F. gigantica occurs on the boundaries of highland areas, presumably as a result of the movement of stock between high and low ground or through overlapping of the territories of the snail vector. Transport of animals hence plays an important role in epidemiology. The control measures, therefore, must take into consideration livestock transport across the borders.

CONCLUSIONS

Though the prevalence of trematodes was higher in goats than in sheep, the number of livers found infected and the intensity and diversity of parasites suggested that sheep was more prone to infection. In fasciolosis, mixed infection with both species of Fasciola was predominant. P. explanatum, a rumen fluke, was frequently encountered in sheep liver. The prevalence and intensity increased in rainy season. The presence of F. gigantica, the intermediate host of which is unavailable in Balochistan, suggests role of animal transport in spreading or introducing epidemics, especially when no intermediate host is required.

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