

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

SHER AHMED, MUHAMMAD NAWAZ, ROOMANA GUL,
MUHAMMAD ZAKIR AND ABDUL RAZZAQ

Department of Zoology, University of Balochistan, Quetta (SA, MN, MZ), Department of Botany,
Government Girls College, Quetta Cantt, Quetta (RG), and Arid Zone Research Centre, P.O.
Box No. 63, Brewery Road, Quetta, Pakistan (AR)

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 Qayuum,

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 goats of Faisalabad. Cabaret *et al.* (1989) did not come across this parasite in their survey on dairy goat farms in northwestern France, and it was suggested to be due to better farm management and application of antifasciola drugs. Durrani *et al.* (1981) and Malik *et al.* (1995), on the other hand, reported very high prevalence of fasciolosis in Jhelum valley and Punjab. Bilquees (1988) identified *F. hepatica* to be one of the most common infections in sheep but relatively less common in goats.

An interesting feature was that no sheep or goat was infected with *F. gigantica* alone. Ashraf (1977) also did not report it in goats of Peshawar.

Heavy infection with *F. gigantica* has been reported from areas of low altitude such as 73.2% from Jhelum valley (Durrani *et al.*, 1981) and 60% from Punjab (Malik *et al.*, 1995) in ovine and caprine species of animals. Similar situation was seen in other parts of the world. Egbe-Nwiyi and Chaudrai (1996) worked on infection in sheep, goats as well as cattle in Borno state, Nigeria where they found high but seasonally variable infection with this parasite. In present study, overall mixed infection of the two species of *Fasciola* was 20.93% in goats, while Iqbal *et al.* (1986) found extremely low infection *i.e.* 3%.

In sheep, overall 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 carpological 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* 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 (Yamagutti, 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. Yamagutti (1952) however, considered genus *Gigantocotyle* (Nasmark, 1937) synonymous to *Paramphistomum* (Fischoeder, 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 paramphistomiasis 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 (Gymnocephalous 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 Razaq *et al.* (2002) in Asghara 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 semiarid 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.

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

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.

ACKNOWLEDGEMENTS

We thank Dr. M.A. Valero and Dr. J.G. Esteban of Universidad de Valencia, Spain; Dr. A.G.M. Tielens of Utrecht University, the Netherlands; Dr. J.S. Gray of University College Dublin, Ireland; and Major M.A. Saleem of Pakistan Army for providing valuable literature regarding *Fasciola*.

REFERENCES

- ASHR, AF, M., 1977. *Helminthiasis in goats of Peshawar*. M.Sc. thesis, University of Peshawar, Pakistan.
- AZAD, E., KHAN, S.A., KHAN, R.M. AND KHAN, M.M., 1997. Prevalence of gastrointestinal helminth parasites of sheep and goats in Quetta district of the province of Baluchistan, Pakistan. *Pakistan J. Zool.*, **29**: 259-262.
- BILQEES, F.M., 1988. Parasites of sheep and goat in Karachi with special reference to hydatidosis and fascioliasis. *Proc. Parasit.*, **6**: 50-58.
- CABARET, J., ANJORAND, N. AND LECLERC, C., 1989. Parasitic risk factors on pastures of French dairy goat farms. *Small Rum. Res.*, **2**: 69-78.
- CABLE, R.M., 1977. *An illustrated laboratory manual of parasitology*. Burgess Publishing Company, pp. 265-269.
- CHOWDHURY, S.M.Z.H., MIAN, M.F. AND DEBNATH, N.C., 1993. Prevalence of helminthic infections in zebu cattle (*Bos indicus*) at Savar, Bangladesh. *Am. J. Anim. Sci.*, **6**: 427-431.
- CHOWDHURY, S.M.Z.H., MONDA, M.M.H., HAQ, S. AND RAHMAN, M.H., 1994a. Prevalence of *Fasciola cercariae* in Lymnaeid snails in Bangladesh. *Am. J. Anim. Sci.*, **7**: 404-403.
- CHOWDHURY, S.M.Z.H., MONDAL, M.M.H., HAQ, S., AKHTER, N. AND ISLAM, M.S., 1994b. Quantification of *Fasciola gigantica* infection in zebu cattle of Bangladesh. *Am. J. Anim. Sci.*, **7**: 343-346.
- CRINGOLI, G., RINALDI, L., VENEZIANO, V., CAPELLI, G. AND MALONE, J.B., 2002. A cross-sectional coprological survey of liver flukes in cattle and sheep from an area of the southern Italian Apennines. *Vet. Parasitol.*, **108**: 137-143.
- DURRANI, M.S., CHAUDHRY, N.I. AND ANWAR, A.H., 1981. The incidence of gastro-intestinal parasitism in sheep and goats of Jhelum valley (Azad Kashmir). *Pakistan Vet. J.*, **1**: 164-165.
- EGBE-NWIYI, T.N. AND CHAUDRAI, S.U.R., 1996. Observations on prevalence, haematological and pathological changes in cattle, sheep and goats naturally infected with *Fasciola gigantica* in arid zone of Borno state, Nigeria. *Pakistan Vet. J.*, **16**: 172-175.
- ELLIS, J.A., CHAVERA, A.E.V. AND DeMARTINI, J.C., 1993. Disease conditions in slaughtered sheep from small holder flocks in Peru. *Small Rum. Res.*, **10**: 243-250.
- HAYAT, C.S., IQBAL, Z., HAYAT, B. AND KHAN, M.N., 1986. Studies on the seasonal prevalence of fascioliasis and lungworm disease in sheep at Faisalabad. *Pakistan Vet. J.*, **6**: 131-134.
- HERLICH, H., 1978. The importance of helminth infections in ruminants. *Wld. Anim. Rev.*, **26**: 22-26.
- HOWLADER, M.M.R. AND HUQ, M.M., 1997. Hemoglobin concentration and hematocrit value of black Bengal goats infected with *Fasciola gigantica*. *Am. J. Anim. Sci.*, **10**: 118-121.
- IQBAL, Z., HAYAT, C.S. AND HAYAT, B., 1986. Natural infection of helminthes in livers and lungs of sheep and goats. *Pakistan J. agric. Sci.*, **23**: 136-140.
- KENDALL, S.B., 1954. Fascioliasis in Pakistan. *Ann. Trop. Med. Parasit.*, **43**: 307-313.
- KHAN, A. AND ANJUM, A.D., 1994. Liver paramphistomiasis in buffalo. *Buffalo J.*, **2**: 185-188.
- KHAN, K.N.M., ATIQ-UR-REHMAN AND CHADHARY, M.B.A., 1988a. Incidence of internal and external parasites in sheep in Kovak valley (Kalat district) upland Balochistan. Research report no. 13. The MART/ARZ project, ICARDA-PARC Quetta, Pakistan.
- KHAN, K.N.M., ATIQ-UR-REHMAN, MUNIR, M. AND KHAN, B.R., 1988b. *Incidence of internal parasites of sheep in upland districts of Balochistan*. Research report no. 18. The MART/ARZ project, ICARDA-PARC Quetta, Pakistan.
- KHAN, M.N., HAYAT, C.S., CHAUDHRY, A.H., IQBAL, Z. AND HAYAT, B., 1989. Prevalence of gastrointestinal helminthes in sheep and goats at Faisalabad abattoir. *Pakistan Vet. J.*, **9**: 159-161.
- MALIK, S.Z., HAQ, I.U., JABEEN, F. AND CHAUDHARY, M.A., 1995. Incidence of endoparasites of ovine and caprine species in Punjab. *Pakistan Vet. J.*, **15**: 49-50.
- NAHED-TORAL, J., LOPEZ-TIRADO, Q., MENDOZA-MARTINEZ, G., ALUJA-SCHUNEMANN, A. AND TRIGO-TAVERA, F.J., 2003. Epidemiology of parasitosis in the Tzotzil sheep production system. *Small Rum. Res.*, **49**: 199-206.
- NAWAZ, M. AND NAWAZ, Y., 1987a. Problem of fascioliasis in sheep and goats in the province of Baluchistan, Pakistan. *Proc. Pakistan Congr. Zool.*, **7**: 84-85.
- NAWAZ, M. AND NAWAZ, Y., 1987b. Helminth parasites of liver and respiratory tracts of sheep and goats in the province of Baluchistan, Pakistan. *Proc. Pakistan Congr. Zool.*, **7**: 86-87.
- PAL, R.A. AND QAYYUM, M., 1993. Distribution of gastrointestinal amphistomes and cestodes in small ruminants grazed on irrigated and non-irrigated pasture zones. *Proc. Pakistan Congr. Zool.*, **13**: 307-313.
- RAZZAQ, A., FARIQUE, S., JAN, S. AND TAREEN, S., 2002. Incidence of internal parasites in sheep and goats of Asghara valley in Ziarat district of Balochistan. *Balochistan J. agric. Sci.*, **3**: 43-50.
- SALEEM, M.A., 1985. *Haematological studies, serum bilirubin determination, chemotherapy and incidence of fascioliasis in naturally infected sheep*. M.Sc. thesis, University of Agriculture, College of Veterinary Sciences, Lahore, Pakistan.
- SOULSBY, E.J.L., 1982. *Helminths, arthropods and protozoa of domesticated animals* (7th edition), Bailliere, Tindall

- and Cassell, Ltd.
- SPITHILL, T.W., SMOOKER, P.M. AND COPEMAN, D.B., 1999. *Fasciola gigantica*: Epidemiology, control, immunology and molecular biology. In: *Fasciolosis* (ed. J.P. Dalton), pp. 465-526. CAB International, Oxford.
- TORGERSON, P. AND CLAXTON, J., 1999. Epidemiology and control. In: *Fasciolosis* (ed. J.P. Dalton), pp. 113-150. CAB International, Oxford.
- URQUHART, G.M., ARMOUR, J., DUNCAN, J.L., DUNN, A.M. AND JENNINGS, F.W., 1988. *Veterinary parasitology*. English Language Book Society/Longman.
- WHO, 1995. *Control of foodborne trematode infections*. World Health Organization, Geneva Report of WHO study group. WHO technical report series 849.
- YAMAGUTI, S., 1958. *Systema Helminth* (volume 1). *The digenetic trematodes of vertebrates*. Interscience Publishers, Inc. New York, pp. 951-956.

(Received 21 April 2004, revised 10 July 2004)