

INFLUENCE OF LIVESTOCK HUSBANDRY ON SCHISTOSOMIASIS TRANSMISSION IN MOUNTAINOUS REGIONS OF YUNNAN PROVINCE

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Abstract. An investigation was conducted in the highly endemic areas of schistosomiasis japonica in Weishan and Eryuan counties, Yunnan Province. The results are summarized as follows: 1) the number of domestic animals was increasing annually; 2) the proportion of animal husbandry gains in the total agriculture income had a yearly escalating tendency; 3) the infection rate of inhabitants was upgrading as a result of the development of and the prevalence in domestic animals in the recent decades. Owing to frequent migration of domestic animals, serious spread of infection sources and high prevalence of schistosomiasis japonica occurred. It is suggested that more attention should be paid to the control of schistosomiasis japonica in mountainous endemic regions during the course of economic development, especially in the development of domestic animals.

INTRODUCTION

Cattle, the major domestic animal, is the important reservoir of *Schistosoma japonicum* in the mountainous regions of Yunnan Province, China. In recent years, the number of domestic animals exceeded that of local residents, and the prevalence of schistosomiasis in domestic animals increased markedly. Seeing that the relationship between the development of domestic animals and the transmission of schistosomiasis japonica is of crucial importance, a survey was made of the incidence of schistosomiasis in residents and domestic animals in Eryuan and Weishan counties, Yunnan Province in the years 1980-1990, to provide a scientific base for plotting strategies of schistosomiasis control.

Introduction of pilot areas

Two highly endemic areas, Weishan and Eryuan counties, Yunnan Province, were selected as pilot areas.

In Eryuan County, there are 17 minority nationalities with Bai as the most populous minority. Rural inhabitants accounted for 93.2% of the total population. Rice plantation is the main rural undertaking and milk-cow breeding is the side-line occupation. The average yearly income per capita is 381 yuan. At the end of 1989, the mean prevalence of

Schistosoma japonicum infection in domestic animals was 10.5%, with prevalence being more than 30% in some places.

In Weishan County, there are 18 minority nationalities, among which the Yi nationality has the largest population. The rural inhabitants, with 420 yuan of average yearly income per capita, amounted to 94.7% of the total population. Rice, corn and broad bean are major crops. At the end of 1991, the prevalence of schistosomiasis in the inhabitants was more than 15% in 37.5% of the townships.

MATERIALS AND METHODS

Coverage of the investigation was as follows:

- 1) Data of annual incidence of human and domestic animals and habitats of *Oncomelania* snails from 1980 to 1991.
- 2) Data of number, kind and migratory status of domestic animals in each year from 1980 to 1991.
- 3) Average income per capita, local GNP as well as revenue from agriculture and livestock husbandry of each year from 1980 to 1991.

Data sources were as follows:

- 1) Data on incidence in man and domestic animals were provided by the schistosomiasis control sta-

tions at county level.

2) Data on the number and kinds of domestic animals were recorded according to field materials in local agricultural administration units.

3) Data on average annual income from agriculture and livestock husbandry were based on the field materials of local statistics departments.

Correlation analysis was made on the collected data, especially on those after economic reform; HARVARD GRAPHICS software was used in computer-based data processing and analysis.

RESULTS

Prevalence of schistosomiasis in two counties is shown in Tables 1, 2.

Table 1

Prevalence of schistosomiasis japonica in man and domestic animals in Eryuan County in 1980-1990.

Year	Inhabitants		Domestic animals	
	No. exam	Positive rate (%)	No. exam	Positive rate (%)
1980	41,130	5.6	8,721	10.4
1981	34,616	6.3	12,421	3.2
1982	26,957	10.5	10,334	3.5
1983	9,680	14.7	15,360	3.7
1984	15,450	11.8	21,288	2.2
1985	10,598	24.8	10,331	3.1
1986	7,442	30.2	7,442	3.4
1987	6,132	33.5	3,307	5.3
1988	10,284	36.7	1,088	5.6
1989	9,007	36.2	565	6.0
1990	6,461	16.5	11,338	6.8

The relationship between development of livestock husbandry and economic development in mountainous regions is shown in Fig 1. From 1980 to 1990, the proportion of livestock husbandry gains in the total agriculture income increased year by year.

The relationship between the number of domestic animals and schistosomiasis transmission is shown in Fig 2.

In Eryuan County, the infection rate of inhabitants correlated positively with the number of domestic animals ($r = 0.7492$, $p = 0.043$). After 1990, the infection rate of inhabitants decreased drastically as a result of mass chemotherapy both of man and domestic animals, implemented in accordance with the schistosomiasis control program supported by the World Bank.

In Weishan County, the infection rate of inhabitants correlated positively with the number of domestic animals ($r = 0.9151$, $p < 0.01$). The infection rate of inhabitants escalated year by year after the development of livestock husbandry from 1980 to 1989, especially after the economic reform in 1984. Since the practice of the schistosomiasis control program supported by the World Bank starting in 1990, the prevalence of inhabitants was reduced greatly.

The relationship between *S. japonicum* infection rates in man and domestic animals is shown in Fig 4.

A positive correlation ($r = 0.873$, $p = 0.012$) between the infection rate of *S. japonicum* in man and domestic animals in Eryuan County was indicated. The infection rate of man decreased significantly due to the practice of the schistosomiasis

Table 2

Prevalence of schistosomiasis japonica in man and domestic animals in Weishan County in 1980-1990.

Year	Inhabitants		Domestic animals	
	No. exam	Positive rate (%)	No. exam	Positive rate (%)
1980	51,176	1.7	56,861	0.2
1981	14,077	1.3	74,631	2.9
1982	33,391	2.4	12,794	6.8
1983	20,779	13.1	13,226	3.1
1984	10,243	2.5	17,316	3.4
1985	6,230	1.8	8,333	3.2
1986	8,329	7.6	12,731	2.6
1987	4,811	9.3	4,179	5.5
1988	6,060	15.1	67,923	6.5
1989	7,700	19.5	23,593	16.7
1990	4,379	6.6	31,748	12.4
1991	19,083	3.4	24,452	8.7

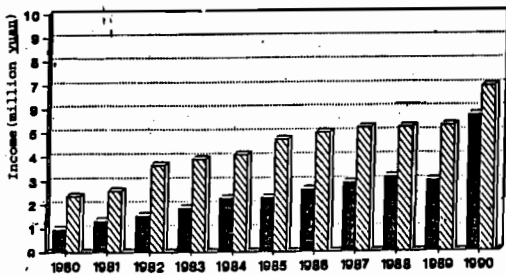


Fig 1-Comparison on income from livestock husbandry and from agriculture in Eryuan County in 1980-1990.

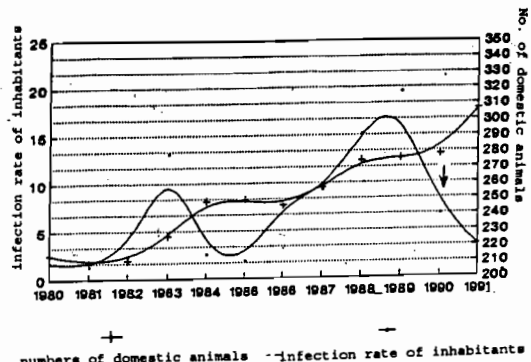


Fig 3-Relationship between the number of domestic animals and infection rate in inhabitants in Weishan County.

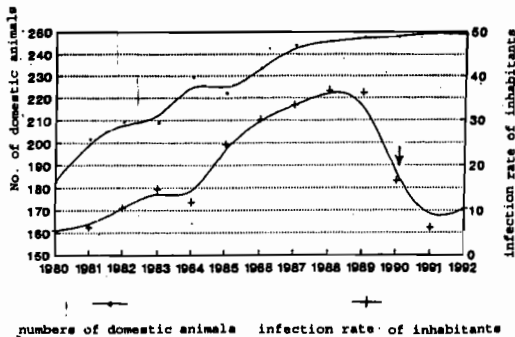


Fig 2-Relationship between the number of domestic animals and infection rate in inhabitants in Eryuan County.

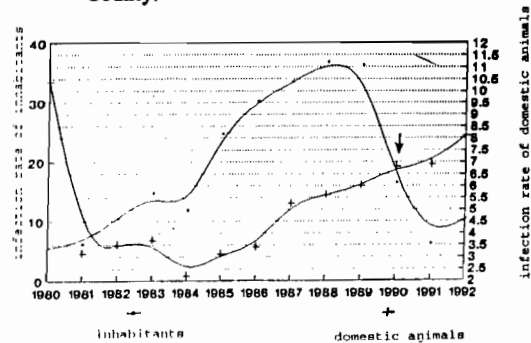


Fig 4-Relationship between *S. japonicum* infection rate of inhabitants and domestic animals in Eryuan County.

control program supported by the World Bank beginning from 1990. Nevertheless, it was not the case in domestic animals, which is presumably attributed to the difficulty of intervention.

A positive correlation ($r = 0.8458$, $p < 0.05$) between the infection rate of *S. japonicum* in man and domestic animals was revealed in Weishan County after statistics analysis (Fig 5). The infection rate of both man and domestic animals decreased significantly after the practice of the schistosomiasis control program supported by the World Bank commencing from 1990.

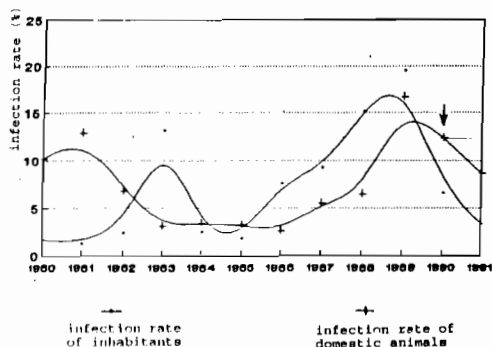


Fig 5—Relationship between the infection rate of *S. japonicum* in inhabitants and domestic animals in Weishan County.

Migration of domestic animals

In Xidengping village of Eryuan County the data showed that the number of cattle imported and exported each year during 1984-1990 accounted for 8.7% - 44.7% (average of 33.4%) and 11.5% - 39.7% (average of 21.9%) of the total cattle exchanged, respectively.

DISCUSSION

Role of domestic animals in the transmission of schistosomiasis in mountainous regions

Schistosomiasis is a zoonotic parasitosis, affecting more than 30 species of mammals other than humans (Mao, 1990). The epidemiological significance of domestic animals as the reservoir varies largely with their population, infection rate and

infection intensity. Domestic animals, especially cattle, followed by swine and dog, play an important part on schistosomiasis transmission in mountainous regions. The released egg per gram (EPG) of man and cattle accounted for 32.8% and 60.9%, 93.7% in total, of the total amount of eggs discharged, respectively, in endemic areas located in plateau valley, Yunnan Province (Zheng, 1990), suggesting that both the infected patients and cattle, particularly the latter, make essential impact on schistosomiasis transmission. Similar results were also reported (Yao, 1989; Chen, 1989). In an investigation conducted in the marsh area of Muping Lake, fecal deposits of cattle and man accounted for 87.1% and 0.2% of the total, respectively, and 99.8% of the feces with Schistosome eggs were from animals; the result confirmed the important role of cattle in the transmission of schistosomiasis (Shen, 1992). Mott (1992) pointed out that for ultimate control of schistosomiasis in China, effective intervention of animal infection should be taken into serious consideration. The results from Eryuan and Weishan counties further showed that the coincident increase of prevalence and the reciprocal role as infection source in man and domestic animals aggravated schistosomiasis transmission.

Relationship between economic development and livestock husbandry in mountainous regions

Recently, development of agriculture and livestock husbandry as a main means to enhance economic growth has been in great progress in mountainous areas. Fig 1 indicated the gains from livestock husbandry, accounting for one-fourth to one-third of the grand total income and more than half of the agricultural income; and a yearly escalating tendency was revealed in Eryuan County. Furthermore, data from Weishan County showed that there was a significant positive correlation of the number of domestic animals and the income. So the increase of the number and kinds of domestic animals due to the economic development exerts important influence on schistosomiasis transmission.

Exacerbation of schistosomiasis transmission after the development of livestock husbandry

With the advancement of economic reform, agricultural undertaking, especially livestock hus-

Table 3
Migration of infected domestic animals in Weishan County in 1990.

	Ox	Buffalo	Horse	Donkey	Mule	Swine
No. exam	5,182	1,535	2,655	909	1,231	3,681
No. posit	682	146	245	93	83	299
No. posit exported	18	43	51	19	45	25
No. posit exported	26.4	29.5	20.8	20.4	54.2	8.4

bandry, is developing rapidly. As a result, domestic animals, the reservoirs of *S. japonicum*, are flourishing in number, exceeding greatly the population of inhabitants in the regions. Figs 2 and 3 showed a positive correlation between the prevalence of inhabitants and the number of domestic animals, indicating close association between human morbidity and the development of the livestock husbandry. It should also be pointed out that the frequent migration of a lot of domestic animals due to rural economic reform caused a serious problem of spread of schistosomiasis, which made the control of schistosomiasis difficult in the mountainous regions.

Conclusion

In view of the present economic and production status, great attention should be paid to schistosomiasis control of domestic animals during economic development, especially in development of livestock husbandry, in mountainous regions. At present, however, it is difficult to accomplish the schistosomiasis control program in domestic animals due to the shortage of funds and inadequacy of professional personnel. To solve the problem, the professional teams are to be strengthened and the coordination between the agricultural sector and the schistosomiasis control department is to be promoted so as to effectively conduct mass chemotherapy both in man and domestic animals as well as control of habitats of *Oncomelania* snails through environment modification. In addition, surveillance and management on domestic animals

should be emphasized to provide a base for planning strategies of schistosomiasis japonica control.

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