[Environmental Health and Preventive Medicine 10, 162–165, May 2005]

Short Communication

Survey of Cattle Fascioliasis in Tsuyama Abattoir

Masahiko KATO[1,2], Yasuyuki MURAKAMI[1], Motota SHIMIZU[3], Hideki YAMAMOTO[2], Yumi YONEMOTO[1], Ken-ichi ISHII[1] and Shohei KIRA[2]

[1]*Meat Inspection Center, Okayama Prefectural Government, Okayama, Japan*
[2]*Department of Public Health, Okayama University Graduate School of Medicine and Dentistry, Okayama, Japan*
[3]*Department of Biology, Kawasaki Medical School, Okayama, Japan*

Abstract

Objectives: The aim of this study was to survey the prevalence of fascioliasis in slaughtered cattle in order to provide breeders with feedback which may prevent cattle fascioliasis, as well as human fascioliasis.

Methods: The results of meat inspection and the information extracted from the Discriminative Data Base on Individual Livestock in Japan were analyzed statistically in 6,224 cattle slaughtered at the Tsuyama Abattoir during the fiscal year 2002.

Results: The age-adjusted fascioliasis and cholangitis rates of all cattle were 2.0% and 7.2%, respectively. When analyzed by cattle breed, both rates were significantly higher in Japanese native cattle than in Holstein or Jersey (Chi-square test, $p<0.01$). The cattle raised in Okayama Prefecture, Tochigi Prefecture and Shimane Prefecture were significantly different from cattle raised in other prefectures in the age-adjusted fascioliasis and cholangitis rates.

Conclusion: The age-adjusted fascioliasis and cholangitis rates of all cattle can be considered as nationwide rates for slaughtered cattle. The results of the comparisons suggest that cattle fascioliasis is related to feeding with rice straw and that the measures to prevent cattle fascioliasis might differ among prefectural governments.

Key words: fascioliasis, cholangitis, cattle, rice, age-adjusted rate

Introduction

Fascioliasis is a parasitic zoonosis. The main symptoms of human fascioliasis are right upper abdominal pain and discomfort. Humans become infected after eating aquatic plants containing encysted organisms or by drinking contaminated water (1, 2). In Japan, this disease occurs in farm villages where both rice growing and cattle raising are practiced. Metacercariae attach themselves to the stems of rice or wild grass and leaves grown around rice paddies. Infection spreads to persons handling the rice crop or wild vegetation and most patients are farmers (3, 4). In Shibaura Abattoir in Metropolitan Tokyo, the rate of fascioliasis for 73,011 cattle was 0.39% during the fiscal year 2001 (from April 1, 2001 to March 31, 2002) (5). On the other hand, in Egypt, the rate of fascioliasis for 2,624,239 cattle in governmental abattoirs was 3.54% over the years 1994–1997 (6). In Venezuela, the rate of fascioliasis for 763,065 slaughtered cattle was reported to be 1.3% in a recent study (7). In 2001, a cow infected with bovine spongiform encephalitis (BSE) was found in Japan for the first time. Since then, many abattoirs have restricted the slaughter of cattle, and many cattle bred throughout Japan are brought to the Tsuyama Abattoir where such restriction has not been imposed. In 2002, the Ministry of Agriculture, Forestry and Fisheries of Japan constructed the Discriminative Data Base on Individual Livestock in Japan (8) in order to trace the BSE cattle back to their breeders. The information on slaughtered cattle, including the breeder, farm and birth date, can be acquired from this Data Base. If fascioliasis in cattle can be prevented, human fascioliasis may also be prevented. We attempted to classify and analyze the information from the Data Base and the results of inspections for fascioliasis conducted by the Meat Inspection Center, Okayama Prefectural Government (MIOP), which has jurisdiction over the Tsuyama Abattoir. These findings and the list of breeders who had reared the cattle with fascioliasis were submitted to the Division of Livestock Industry, Department of Agriculture, Forestry and Fisheries, Okayama Prefectural

Received Jan. 7, 2004/Accepted Jan. 18, 2005
Reprint requests to: Masahiko KATO
Department of Public Health, Okayama University Graduate School of Medicine and Dentistry, 2-5-1 Shikata-cho, Okayama 700-8558, Japan
TEL: +81(86)235-7184, FAX: +81(86)235-0715
E-mail: healthy@md.okayama-u.ac.jp

Government, which is in charge of guiding livestock breeders in Okayama Prefecture and making contact with the other prefectural governments.

Materials and Methods

The study population (Fig. 1) consisted of cattle aged one year or older slaughtered at the Tsuyama Abattoir, Okayama Prefecture during the fiscal year 2002 (from April 1, 2002 to March 31, 2003). The information in the Data Base and results of macroscopic inspection of the study population by MIOP were tabulated and analyzed. As the criteria of inspection, 'cholangitis' was defined as the detection of a thickened bile duct, and 'fascioliasis' as the detection of adult worms of *Fasciola hepatica* or *Fasciola gigantica* from the liver with cholangitis, because fascioliasis in cattle accompanies cholangitis (3). As a reference, we used the standard population (Fig. 1) of cattle aged one year or older slaughtered in 38 abattoirs nationwide during the fiscal year 1999 (from April 1, 1999 to March 31, 2000) (9). Using this population, we calculated the age-adjusted fascioliasis and cholangitis rates for the study population. We also calculated the two rates by breed of cattle and by prefecture where the cattle were raised for more than 2 months. The reason for setting the raising period to more than 2 months is that liver flukes reach the common bile duct 40–45 days after infection (10) and the young flukes mature into adult worms in the bile duct 2–3 months after infection (11).

Results and Discussion

Fig. 1 shows the age distributions of the study and standard populations. Regarding the study population, the median age and the quartile deviation were 5.9 and 2.5 years, respectively. The corresponding values for the standard population were 2.9 and 0.8 years. The age distribution of the study population was very different from the standard population.

Concerning the study population, the fascioliasis rates and the age-adjusted fascioliasis rates are presented in Tables 1 and 3 and the cholangitis rates and the age-adjusted cholangitis rates are presented in Tables 2 and 4. The present study population

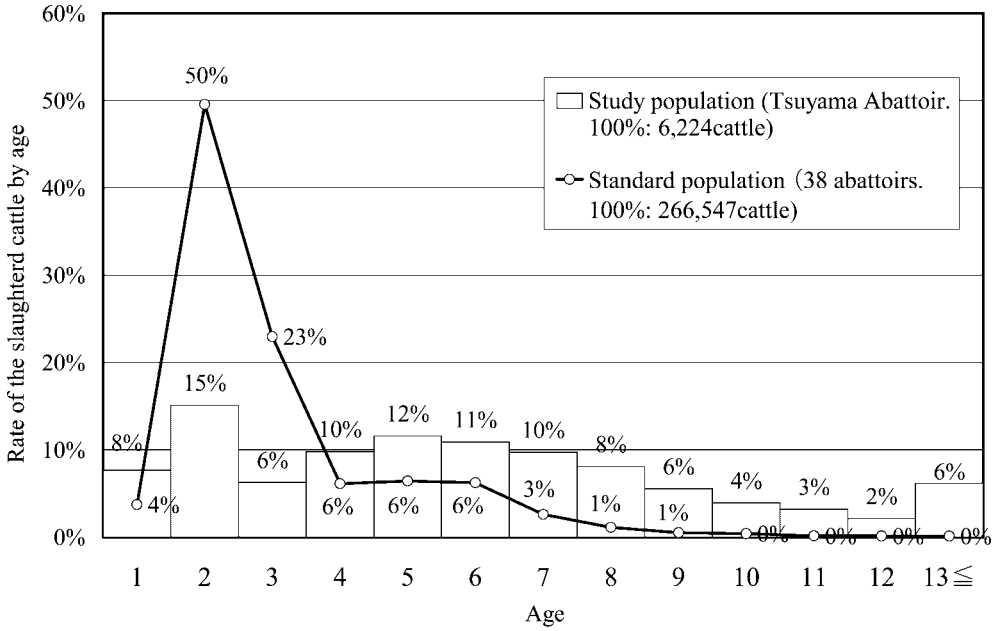

Fig. 1 Age distrubutions of study population and standard population.

Table 1 Fascioliasis rates by cattle breed

Breed	Total no. of cattle slaughtered	No. of cattle affected	Rate	Age-adjusted rate	Age-adjusted rate excluding cattle raised in Okayama Prefecture
Study population	6,224	172	2.8%	2.0%	1.0%
Holstein	4,301	87	2.0%	0.9%	0.5%
Japanese native cattle	1,186	70	5.9%	8.7%	3.1%
	p-value (Chi-square test)		0.000	0.000	0.000
Japanese native cattle	1,186	70	5.9%	8.7%	3.1%
Jersey	437	15	3.4%	1.7%	*
	p-value (Chi-square test)		0.048	0.000	*
Jersey	437	15	3.4%	1.7%	*
Holstein	4,301	87	2.0%	0.9%	0.5%
	p-value (Chi-square test)		0.053	0.000	*

* not calculable, because all Jerseys were raised in Okayama Prefecture.

Table 2 Cholangitis rates by cattle breed

Breed	Total no. of cattle slaughtered	No. of cattle affected	Rate	Age-adjusted rate	Age-adjusted rate excluding cattle raised in Okayama Prefecture
Study population	6,224	911	14.6%	7.2%	5.8%
Holstein	4,301	467	10.9%	6.2%	4.5%
Japanese native cattle	1,186	394	33.2%	17.4%	11.6%
p-value (Chi-square test)			0.000	0.000	0.000
Japanese native cattle	1,186	394	33.2%	17.4%	11.6%
Jersey	437	43	9.8%	6.2%	*
p-value (Chi-square test)			0.000	0.000	*
Jersey	437	43	9.8%	6.2%	*
Holstein	4,301	467	10.9%	6.2%	4.5%
p-value (Chi-square test)			0.513	0.674	*

* not calculable, because all Jerseys were raised in Okayama Prefecture.

Table 3 Fascioliasis rates according to prefecture where cattle were reared

Prefecture	Total no. of cattle slaughtered	No. of cattle affected	Rate	Age-adjusted rate	Age-adjusted rate excluding Japanese native cattle
Study population	6,229	172	2.8%	2.0%	0.9%
Okayama	3,515	108	3.1%	2.4%	1.1%
Rest of study population	2,714	64	2.4%	0.9%	0.2%
p-value (Chi-square test)			0.088	0.000	0.000
Tochigi	574	5	0.9%	0.0%	0.0%
Rest of study population	5,655	167	3.0%	1.8%	0.9%
p-value (Chi-square test)			0.004	0.000	0.000
Shimane	527	17	3.2%	0.6%	0.4%
Rest of study population	5,702	155	2.7%	2.0%	0.9%
p-value (Chi-square test)			0.496	0.000	0.000

Table 4 Cholangitis rates according to prefecture cattle were reared

Prefecture	Total no. of cattle slaughtered	No. of cattle affected	Rate	Age-adjusted rate	Age-adjusted rate excluding Japanese native cattle
Study population	6,229	912*	14.6%	7.2%	5.7%
Okayama	3,515	428	12.2%	7.8%	6.1%
Rest of study population	2,714	478	17.6%	5.6%	1.6%
p-value (Chi-square test)			0.000	0.000	0.000
Tochigi	574	113	19.7%	3.7%	1.8%
Rest of study population	5,655	793	14.0%	7.2%	5.6%
p-value (Chi-square test)			0.000	0.000	0.000
Shimane	527	141	26.8%	10.2%	6.0%
Rest of study population	5,702	765	13.4%	6.9%	5.2%
p-value (Chi-square test)			0.000	0.000	0.000

* including 6 cattle with unknown breeding place

was large, with cattle coming from 32 prefectures in Japan. Therefore, the age-adjusted fascioliasis and cholangitis rates of the study population, 2.0% and 7.2%, respectively, can be considered as the nationwide rates for slaughtered cattle for one year. The true fascioliasis rate may be presumed to lie between these two figures considering the definitions of 'fascioliasis' and 'cholangitis'.

The breeds of cattle of which the numbers exceeded 5% (311 cattle) of all the cattle in the study population (6,224 cattle) are Holstein (4,301 animals, 69.1%), Japanese native cattle (1,186 animals, 19.1%) and Jersey (437 animals, 7.0%). Tables 1 and 2 show the age-adjusted fascioliasis and cholangitis rates, respectively, for the 3 breeds of cattle. We also calculated the two rates after excluding the cattle raised in Okayama Prefecture, which made up 56.5% (3,515/6,224) of the study population. The large number of the cattle in Okayama Prefecture might be a compounding factor. The results are also shown in Tables 1 and 2. All the age-adjusted rates were significantly higher in Japanese native cattle than in Holstein or Jersey (Chi-square test. $p<0.01$). A possible reason for these higher rates is the difference in cattle feed. Japanese native cattle are generally fed on rice straw, which is more

expensive than any other roughage at present. It is said that rice straw can raise the quality of meat. However, the other breeds of cattle are not fed on rice straw. The high rates in Japanese native cattle suggest that cattle fascioliasis is related to rice straw feeding. To prevent fascioliasis in cattle, the following measures are recommended: examine *Fasciola* eggs in feces of cattle and identify the farms contaminated with liver flukes (12), stop feeding the cattle with rice straw in contaminated farms, store the rice straw for more than 4 months before feeding in order to kill the metacercariae on the rice straw (11), change the feed suppliers of contaminated farms, and administer anthelminthics to the infected cattle. Concerning these measures, the livestock hygiene service centers of each prefectural administration have provided guidance, and local governments have given subsidies to the cattle breeders in order to prevent fascioliasis in cattle.

The prefectures in which the numbers of cattle exceeded 5% (311 cattle) of all the cattle in the study population (a total of 6,229 cattle) were Okayama Prefecture (3,515 cattle, 56.4%), Tochigi Prefecture (574 cattle, 9.2%) and Shimane Prefecture (527 cattle, 8.5%). Tables 3 and 4 show the age-adjusted fascioliasis and cholangitis rates for the 3 prefectures. We also calculated the age-adjusted fascioliasis and cholangitis rates for these prefectures after excluding Japanese native cattle, because the high rates in Japanese native cattle presented in Tables 1 and 2 might be a compounding factor. Regarding both age-adjusted fascioliasis rates in Table 3, Okayama Prefecture was significantly higher and Tochigi Prefecture and Shimane Prefecture were significantly lower than the rest of the study population (Chi-square test. $p<0.01$). Regarding both age-adjusted cholangitis rates in Table 4, Okayama Prefecture and Shimane Prefecture were significantly higher and Tochigi Prefecture was significantly lower. These results suggest a possibility that the prefectural governments provide difference degrees of guidance and subsidies to the cattle breeders.

We investigated the age-adjusted fascioliasis and cholangitis rates of slaughtered cattle in Tsuyama Abattoir utilizing the information in the Discriminative Data Base on Individual Livestock for the prevention of BSE. The nationwide fascioliasis and cholangitis rates of slaughtered cattle could be estimated. The high fascioliasis and cholangitis rates in Japanese native cattle suggest that fascioliasis in cattle is related to rice straw, and the different fascioliasis and cholangitis rates among prefectures suggest that the measures taken to prevent cattle fascioliasis may differ among prefectural governments. Since we have submitted these findings and the list of farms to the administration of livestock industry, we anticipate that the measures to prevent cattle fascioliasis will be taken in the farms contaminated with liver fluke and that human fascioliasis will be prevented indirectly.

Acknowledgements

We are very grateful to Dr. Osamu Otake, Director of the Tsuyama Veterinary Clinical Center, Okayama Prefectural Federation of Agricultural Mutual Aid Associations, for giving us valuable advice.

References

(1) Maruyama H, Noda S, Mimori T, Nawa Y. Fascioliasis cases recently found in the southern part of Kyusyu district, Japan. Jpn J Parasitol. 1996; 45: 247–254.
(2) Saba R, Korkmaz M, Inan D, Mamikoglu L, Turhan O, Gunseren F, et al. Human fascioliasis. Clin Microbiol Infect. 2004; 10: 385–387.
(3) Oshima T. Fascioliasis as a zoonosis. In: Hayashi S editor. Zoonoses in Japan. Tokyo: Buneido-syuppan; 1983. p. 152–162. (Article in Japanese)
(4) Oshima T. Human fascioliasis. The Saishin-Igaku. 1989; 44: 856–860. (Article in Japanese with English abstract)
(5) Meat Inspection Center, Tokyo Metropolitan Government. Outline of Operations in Meat Inspection Center, Tokyo Metropolitan Government. Tokyo: Tokyo Metropolitan Government; 2003. (Article in Japanese)
(6) Haridy FM, Ibrahim BB, Morsy TA. Fascioliasis an increasing zoonotic disease in Egypt. J Egypt Soc Parasitol. 1999; 29: 35–48.
(7) Mage C, Bourgne H, Toullieu JM, Rondelaud D, Dreyfuss G. *Fasciola hepatica and Paramphistomum daubneyi*: changes in prevalences of natural infections in cattle and in *Lymnaea truncatula* from central France over the past 12 years. Vet Res. 2002; 33: 439–447.
(8) National Livestock Breeding Center. The Discriminative System on Individual Livestock. http//www.id.nlbc.go.jp/top.html. 2002. (Article in Japanese)
(9) The Ministry of Health, Labour and Welfare of Japan. Document No. 7 submitted to the Nationwide Conference of the Prefectural and Municipal Directors in Charge of Emergency BSE Measures. 2001. (Article in Japanese)
(10) Itagaki H, Oishi I. New edition Domestic Animal Parasitology. Tokyo: Asakura-syoten; 1984. (Article in Japanese)
(11) Isobe H. Fascioliasis. In: National Institute of Animal Health in Japan supervisors. The Latest; Cattle Diseases. Tokyo: Ieno-hikari-kyokai; 2000. p. 144–149. (Article in Japanese)
(12) Otake O, Aoki Y, Naka K, Ando A. On the rates of detection of *Fasciola* eggs. Clinical Veterinarian. 1986; 4: 55–58. (Article in Japanese)