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Letter to the Editor

Study of Infection of *Echinococcus granulosus* in Yak in Spring and Its Potential Role in Transmission of Cystic Echinococcosis in Rangtang County of Sichuan, China

Dear Editor,

Cystic echinococcosis (CE), caused by *Echinococcus granulosus* in larval stage, is considered as one of the most dangerous parasitic zoonosis in the world. The obligate 2-host parasitic cycle of *Echinococcus granulosus* is predominantly synanthropic. Dogs are the usual definitive hosts, and lots of mammalian species can be intermediate hosts, including domestic livestock and human[1-2]. In the Tibetan plateau, China, the population is mainly Tibetans primarily engaged in livestock husbandry and CE is therefore a health problem for both people and animal in Tibetan communities. The reported infection rate of *Echinococcus granulosus* in slaughtered yak in slaughterhouses is usually very high, being about 50% or higher as reported, and the liver and lungs are the main affected organs[3-4].

Every spring from March to May, about 20% of yak died in the Tibetan communities. The dead yak would be decorticated before discarded in the field for dogs and other canine animals. During the decortiation, herdsmen may observe whether the yak was infected with larval stage of *Echinococcus granulosus* or not. This provides us an opportunity to investigate the infection of *Echinococcus granulosus* in local yak. Although some previous studies have showed that shortages of feeding, infectious diseases and bad climate may be the leading causes of yak death[5-6], the relationship between the death of yak in spring and the endemic of CE is still an opening question. In order to further understand the local prevalence of echinococcosis, as well as the relationship between death of yak in spring and the infection of *Echinococcus granulosus*, we conducted this study in July of 2009 in Rangtang county in the southeast part of the Qinghai-Tibet Plateau (longitude 100° 30’-101° 20’ N and latitude 31° 30’-32°40’ E).

In July 2009, a retrospective study about infection of *Echinococcus granulosus* in yak died in spring was conducted in 40 of the 60 administrative villages, where were accessible, in Rangtang, in which the households selected according to their willingness were surveyed by interviewing the key household members disposing dead yak.

The village heads were informed about the objective and procedure of the study prior to the filed survey and date of the survey was determined. Then the village heads informed the households about the survey one by one, the villagers who were willing to participate in the survey were convened in the village meeting room on the scheduled day.

The fieldworkers interviewed the family members with photos of *Echinococcus granulosus* infected yak organs to help them to recall the infection status of yak died during March to May in 2009. The participant who could not recall the infection status of dead yak was excluded. According to pre-established “yak infection questionnaire”, related data were collected, such as number of dead yak, age at death, infection status, remaining number of yak, etc.

For exploring the spatial distribution of dead yak, the center of each surveyed administrative village was recorded using a global positioning system (GPS) (GPS 12, Garmin International Inc., Olathe, KS, USA).The fieldworker was taken to the center of each administrative village by vehicle, and recoded the geographical position on a pre-established “geographical position questionnaire”.

This study was reviewed and approved by the academic board of the National Institute of Parasitic Diseases, Chinese Center for Disease Control and Prevention. All participants were informed about the objective and procedure of the study and informed consent was told by all the participants prior to data collection.

Only 40 of the 60 administrative villages were accessible during the field survey due to the bad weather and poor road condition. Besides, the interviews in 5 administrative villages did not collect sufficient information. Hence, the complete data were available for 35 administrative villagess, in which about 20% of households participated in the

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study and more than 90% of the participants could recall the infection status of dead yak. Totally, 390 households from the 35 administrative villages were interviewed. The participants are all Tibetans engaged in livestock husbandry. Almost every participant could recognize CE when fieldworkers showed photos of *Echinococcus granulosus* infected organs.

From the field interview, we found out that the death of yak occurred in all ages and the old, weak and sick ones were the majority. The possible causes of yak death in spring were unknown infectious disease, lack of feeding and bad climate (decreased oxygen content of the atmosphere, low temperature) according to the local herdsmen, which are in accordance with the findings of Yang et al.[5] and Yu et al.[6]

The mortality of yak in each administrative village during March to May was defined as the number of dead yak divided by the total number of yak (dead yak and remaining alive yak in spring) collected during the field survey. In the 35 surveyed administrative villages, the overall mortality of yak during March to May in 2009 was 20.6%, and the average spring mortality of yak with a 95% confidence interval was (21.99±13.861)% with the highest in Sanlang village (66.4%) and the lowest in Nanmuda village (5.8%), the two villages belonged to same township. The spatial distribution map of mortality of yak in spring at each administrative village is shown in Figure 1 and we can see that villages with low mortality and high mortality were mainly located in the northeast region showing an random distribution without obvious clustering.

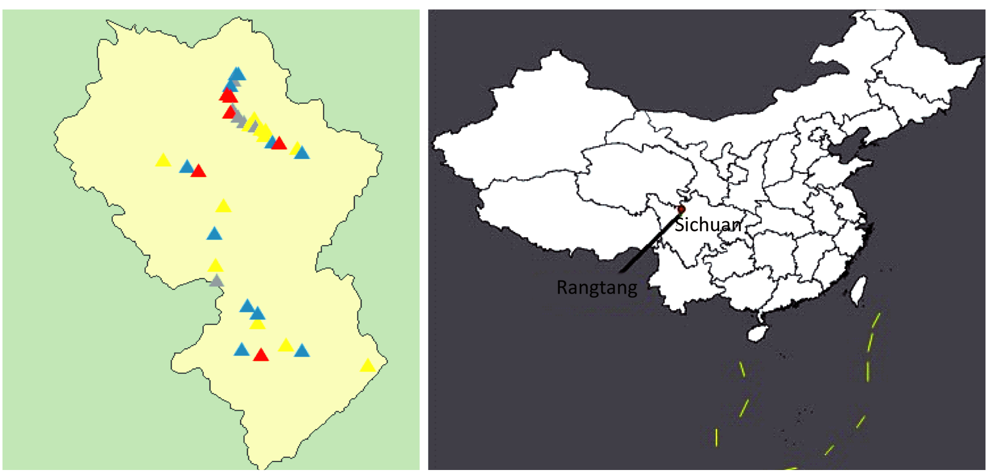

Figure 1. Spatial distribution of death of yak in spring, 2009 and map of China showing Rangtang county in Sichuan Province, China. Legend: Mortality (%) ▲ 0～ ▲ 10～ ▲ 20～ ▲ 30～. Δ represents the location of surveyed village; ▲represents the mortality of yak in spring ≥0% and <10%; ▲represents the mortality of yak in spring ≥10% and <20%; ▲ represents the mortality of yak in spring ≥20% and <30%; ▲ represents the mortality of yak in spring ≥30%.

The infection rate of dead yak in each administrative village during March to May was defined as the number of CE infected yak observed divided by the total number of dead yak. The participants in 15 severe infected administrative villages could recall the number of infected yak. The average prevalence of cystic echinococcosis in yak in these 15 administrative villages (95% CI) was (31.07±21.322)%. No exact number of infected yak was obtained in another 11 administrative villages and no infected yak was found during the research period in the remaining 9 administrative villages, but all the herdsmen interviewed were aware of CE.

Based on the prevalence of CE in yak together with related information obtained from herdsmen, the 35 administrative villages were classified into 4 types of areas (Table 1): Type I, highly endemic (prevalence: >20%); Type II, moderate endemic (prevalence: 9%-20%); Type III, endemic (prevalence: >0-9%); Class IV, suspected (no infected yak were found during the research period, however, herdsmen were aware of *Echinococcus granulosus*).

Previous large scale or small scale studies have shown a variation in the prevalence of CE among geographic locations[7-8]. Our findings also showed a

Table 1. Classification of Administrative Villages Based on the Prevalence of Yak CE

Village	No.of Households Interviewed	No.of Households found Yak CE	No. of Yak with CE	No.of Dead Yak	Prevalence of Yak CE (%)	Type
Renpeng	8	8	55	78	70.5	I
Yigenmenduo	6	6	51	75	68.0	I
Xuemuda	10	10	43	77	55.8	I
Rebuka	10	10	52	102	51.0	I
Bukangda	13	13	106	242	43.8	I
Xiaoyili	8	6	7	23	30.4	I
Qiutang	11	11	26	112	23.2	I
Mingda	7	4	8	40	20.0	II
Zhuokun	6	5	7	36	19.4	II
Jiala	4	3	4	21	19.0	II
Manmuda	10	7	10	66	15.2	II
Ranggu	12	1	1	8	12.5	II
Adou	12	12	3	26	11.5	II
Dari	10	3	4	39	10.3	II
Xingmuda	10	8	12	123	9.7	II
Nanmuda	8	1	~1	4	~0.25	III
Siyuewu	6	1	~1	8	~0.125	III
Xiuka	18	1	~2	23	~0.087	III
Basheng	8	3	~2	25	~0.08	III
Xiayan	11	1	~1	15	~0.066	III
Yangpeng	17	2	~3	52	~0.057	III
Rongmuda	7	1	~1	18	~0.055	III
Wuyi	16	3	~3	69	~0.043	III
Qieluoma	10	1	~2	54	~0.037	III
Gunduo	10	1	~1	34	~0.029	III
Zhangguang	10	1	~1	59	~0.017	III
Ajia	8	0	0	15	0	IV
Sanlang	7	0	0	83	0	IV
Dayili	8	0	0	37	0	IV
Dongwo	10	0	0	38	0	IV
Yageche	8	0	0	43	0	IV
Ergewu	10	0	0	97	0	IV
Zhongdasigou	16	0	0	271	0	IV
Yidong	14	0	0	126	0	IV
Jiasiman	51	0	0	192	0	IV

Note. ~uncertain.

variation in the prevalence of yak CE among administrative villages. The differences in prevalence of CE may be due to the differences in the environmental conditions, definitive host population, livestock husbandry, nature of the pasture and grazing patterns of animals[9-10].

The mean mortality (95% CI) of yak in Type I, Type II, Type III, and Type IV villages was (23.84±10.688)%, (19.65±12.219)%, (18.51±14.968)%, and (26.87±16.377)% respectively. The details were listed in Table 2. Analysis of variance test shows that the differences in mortalities of yak among different type villages were not significant (F=1.284, P=0.297). The information collected in this study, combined with findings from other studies showed that the death of yak in spring may be due to shortages of feeding, infectious diseases and bad climate. The analysis about the association between the death of yak in spring and the prevalence of CE also has shown that the disease may not be the main cause of yak death in spring. However, a large number of yak died in spring may facilitate the transmission of *Echinococcus granulosus* between dogs and livestock considering that households in these rural areas were mainly involved in livestock production, and many of them had one or two herding dogs that were under free-range.

Table 2. Mortality (%) of Yak in Spring, Stratified by Endemic Intensity

Class	N (Village)	Mean	Std	Max	Min
I	7	23.84	10.688	46	15
II	8	19.65	12.219	47	7
III	11	18.51	14.968	48	6
IV	9	26.87	16.377	66	10

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REFERENCES

1. Torgerson PR, Budke CM. Echinococcosis - an international public health challenge. Res Vet Sci, 2003; 74(3), 191-202.
2. Eckert J, Gemmell MA, Meslin FX, et al. WHO/OIE Manual on Echinococcosis in Humans and Animals: a Public Health Problem of Global Concern. World Organization for Animal Health, 2001; 143-54.
3. Wang H, Zhao HL, Ma SM, et al. Investigation on Infections of Echinococcus in Animals in Qinghai Plateau. Endemic Diseases Bulletin, 2000; 15(1), 29-32. (In Chinese)
4. Han XM, Ma YF. Epidemiological survey on the hydatid disease in slaughtered yak storaged in Qinghai cold storage for foreign trade. Endemic Diseases Bulletin, 1998; 13(1), 55-9. (In Chinese)
5. Yang XB, Yin GP, Liu MG, et al. The Cause of death of yak in the spring and control methods in Daocheng county. Livestock and Poultry Industry, 2007; 11, 41-2. (In Chinese)
6. Yu YX, Yang XM. Survey on parasite lines of yak in Linzhi, Tibet. Animal Husbandry & Veterinary Medicine, 2002; 34(7), 20-1. (In Chinese)
7. Ernest E, Nonga HE, Kassuku AA, et al. Hydatidosis of slaughtered animals in Ngorongoro district of Arusha region, Tanzania. Trop Anim Health Prod, 2009; 41(7), 1179-85.
8. Li TY, Qiu JM, Yang W, et al. Echinococcosis in Tibetan Populations, Western Sichuan Province, China. Emerg Infect Dis, 2005; 11(12), 1866-72.
9. Craig P, Pawlowski Z. Cestode Zoonoses: Echinococcosis and Cysticercosis. An Emergent and Global Problem. Emerg Infect Dis, 2002; 8(11), 1362.
10. Arbabi M, Hooshyar H. Survey of Echinococcosis and Hydatidosis in Kashan Region, Central Iran. Iranian J Publ Health, 2006; 35(11), 75-81.