1	Assessment of compliance and therapeutic efficacy of albendazole treatment in Chinese
2	patients with echinococcosis
3	Min Qin ^{1,2+} , Guobing Yang ³⁺ , Jun Yan ^{4*} , Liying Wang ^{1*} , Yu Feng ³ , Dong Wang ³ , Qian Wang ⁵ ,
4	Yanyan Hou ⁶ , Jiangshan Zhao ⁶ , Jiaxi Lei ¹ , Zhiyi Wang ¹ , Mingzhe Jiang ¹ , Chenghang Yu ¹ ,
5	Laurent Gavotte ⁷ and Roger Frutos ^{8,9}
6	1. National Institute of Parasitic Diseases, Chinese Center for Disease Control and Prevention
7	(Chinese Centre for Tropical Diseases Research); NHC Key Laboratory of Parasite and Vector
8	Biology; WHO Collaborating Centre for Tropical Diseases; National Centre for International
9	Research on Tropical Diseases, Shanghai, China
10	2. Chaoyang District Center for Diseases Prevention and Control of Beijing, Beijing, China
11	3. Gansu Provincial Center for Disease Control and Prevention, Lanzhou, China
12	4. Chinese Centre for Disease Control and Prevention, Beijing, China
13	5. Sichuan Provincial Center for Disease Control and Prevention, Chengdu, China
14	6. Xinjiang Uygur Autonomous Region Center for Disease Control and Prevention, Urumqi,
15	China
16	7. Espace-Dev, UMR 228, Université de Montpellier, Montpellier, France
17	8. Centre de Cooperation International en Recherche Agronomique pour le Développement,
18	UMR 17, Intertryp, Campus international de Baillarguet, Montpellier, France
19	9. Faculty of Medicine-Ramathibodi Hospital, Mahidol University, Bangkok, Thailand
20	
21	+ Co-first authors.
22	* Corresponding author:
23	Jun Yan
24	yanjun@chinacdc.cn
25	Liying Wang
26	wangliyingcdc@163.com
27	
28	Min Qin: <u>gmkx0106@163.com</u>
29	Guobing Yang: <u>344131175@qq.com</u>

- 30 Jun Yan: yanjun@chinacdc.cn
- 31 Liying Wang: wangliyingcdc@163.com
- 32 Yu Feng: fengyu9022@163.com
- 33 Dong Wang: <u>wangdong8210@sina.com</u>
- 34 Qian Wang: wangqian1967@163.com
- 35 Yanyan Hou: woshihouyanyan@163.com
- 36 Jiangshan Zhao: zjscdc@163.com
- 37 Jiaxi Lei: leijiaxi91@163.com
- 38 Zhiyi Wang: wangzhiyicdc@163.com
- 39 Mingzhe Jiang: <u>Jiangmz0204@163.com</u>
- 40 Chenghang yu: yuch@nipd.chinacdc.cn
- 41 Laurent Gavotte: laurent.gavotte@umontpellier.fr
- 42 Roger Frutos: roger.frutos@cirad.fr

- 44
- 45

46 Abstract

Background: Echinococcosis is an infectious parasitic disease that is extremely harmful to human health. Albendazole is provided free of charge to patients requiring medication under the central government finance transfer payment scheme for echinococcosis control and prevention in China. Our aim is to monitor the state of patient medication and its therapeutic impact, which will help improve medication compliance and the therapeutic effect.

53 **Methods:** Random cluster sampling was used to select 10 echinococcosis-endemic 54 counties in China, and all albendazole-treated patients in these counties were investigated. 55 The chi-square and Kruskal–Wallis tests were used to compare two or more rates or 56 constituent ratios, and multiple logistic regression analysis was used to identify the 57 influencing factors. The records of patients were reviewed to obtain the initial diagnosis 58 results as well as the most recent follow-up results and time, and efficacy was assessed.

Results: We examined 899 patient files treated with albendazole in 10 endemic counties. 59 Of the 582 evaluable files, 7.9% did not take albendazole, and 69.2% did not take 60 61 albendazole regularly. Only 22.9% took albendazole regularly. Of the 536 patients who took albendazole, 242 exhibited adverse reactions. Patients who were Tibetan, herdsmen, received 62 no formal education, used emulsion, and exhibited adverse reactions demonstrated poor 63 compliance. A total of 174 patients with cystic echinococcosis received their most recent 64 imaging follow-up results within one year of the investigation date. Among them, 9 patients 65 met the criteria for cure, accounting for 5.2%; 56 patients showed effectiveness, accounting 66 for 32.2%; 105 patients were deemed ineffective, accounting for 59.8%; 5 patients 67 experienced recurrence, accounting for 2.9%. 68

69 **Conclusions:** Albendazole medication compliance in patients with echinococcosis is not 70 ideal. We must prioritize health education and promotion for Tibetans, herdsmen, and those 71 without formal education. Patients who adhered to their medication regimen achieved higher 72 rates of cure and effectiveness. To improve medication compliance and efficacy, it is 73 particularly important to improve communication and medication guidance for patients 74 receiving emulsions and those with adverse reactions after taking albendazole.

75 Simultaneously strengthen patients' attention to follow-up and re-examination.

76 Keywords: Albendazole, Therapy, Medication compliance, Echinococcosis, Therapeutic

77 effect

78

79 1. Background

Echinococcosis is a parasitic disease that poses a major threat to human health, making 80 it a global public health concern [1]. In 2011 estimates, approximately 200,000 new patients 81 82 are diagnosed with echinococcosis worldwide every year, with a total of 200 to 300 million patients [2]. The global burden of echinococcosis is 871,000 disability-adjusted life years 83 (DALYs) annually [3]. Two kinds of echinococcosis are found in China: cystic 84 echinococcosis (CE) and alveolar echinococcosis (AE). China is the country with the most 85 severe endemic of the disease [4-5]. The DALYs of CE and AE in China account for 40% and 86 95% of the world totals, respectively [6-7]. Echinococcosis is a chronic, space-occupying 87 disease [8-9]. The lesions can accumulate in numerous organs, with the liver being the most 88 prevalent site [10]. The CE cyst grows slowly, with an average incubation period of 5 to 10 89 90 years [11-12]. As the cyst grows, it compresses the surrounding tissues, organs, and blood vessels, causing accompanying symptoms [10]. AE causes more severe damage. The lesions 91 are invasive, infecting surrounding tissues and organs before metastasizing through lymphatic 92 or blood vessels, hence its name of "worm cancer" [12]. If the disease is untreated or partially 93 94 treated, the fatality rate will exceed 90.0% within 10–15 years [13-14].

95 The treatment methods include surgery and medication. Medication is the most effective 96 alternative treatment for patients who cannot undergo surgery [15]. The most commonly used therapeutic medications are benzimidazole drugs, specifically albendazole and mebendazole, 97 98 which are effective at decreasing parasite growth and stabilizing disease [16-17]. The World Health Organization recommends albendazole as the first line of clinical treatment [17]. 99 Patients with echinococcosis who follow medical instructions and take medication regularly 100 101 have a significantly increased life expectancy [18]. In albendazole treatment, patient adherence to taking medication regularly is key to preventing lesion recurrence and disease 102 103 control [19].

In 2006, China launched the national project for echinococcosis control and prevention, 104 which provides free albendazole tablets and emulsions to patients in need of medical 105 treatment to reduce the economic burden. Patients undergo different treatment durations 106 owing to the location, type, and size of the cyst, as well as other criteria (reexamination and 107 liver function results), and the dosage is determined by the health service personnel based on 108 body weight [20]. Tablets and emulsions have dosages of 15 and 0.8 ml/(kg·d), respectively, 109 and are taken twice daily [20]. Although albendazole is a clinically effective therapeutic 110 111 medication, its low bioavailability necessitates prolonged use [21]. Albendazole tolerance varies among patients. Some patients are intolerant of albendazole and will have adverse 112 reactions if taken for an extended period, affecting medication compliance [21]. 113

Therefore, monitoring the state of patient medications and their therapeutic impact will help improve medication compliance. To provide a valuable reference for designing appropriate intervention strategies and community health services, we examined the files of 899 patients with echinococcosis who were treated with albendazole in 10 endemic counties of China.

119

120 **2. Methods**

121 **2.1. Data source**

Random cluster sampling was used to select 10 echinococcosis-endemic counties (Daofu, Ganzi, Ruoergai in Sichuan Province; Huining, Tianzhu, Zhang, Maqu in Gansu Province; and Gaochang District, Jimusar, and Fukang City in Xinjiang Uygur Autonomous Region). We examined all patient files treated with albendazole that were registered with the Centers for Disease Control and Prevention in these counties. These patients all need to take the prescribed treatment drug albendazole, and divided into tablets and emulsions. Tablets and emulsions have dosages of 15 and 0.8 ml/(kg·d), respectively, and are taken twice daily [22].

129 **2.2 Investigation contents**

130 **2.2.1 Patient medication**

In 2019, data were collected by reviewing case files and conducting telephone followups to collect general demographic data (sex, age, nation, education level, and occupation),

disease type, diagnosis date, medication initiation date, dosage forms, occurrence of adversereactions, and reasons for not taking medication.

Using medical records and follow-up information, we determined the theoretical duration of albendazole therapy. We evaluated albendazole compliance by comparing the actual and theoretical durations of albendazole therapy (R_m).

Based on the distribution of R_m , we defined regular medication use as $R_m \ge 0.8$ and irregular medication use as $R_m < 0.8$. Albendazole therapy duration was measured in months and excluded if it was less than 15 days.

141 **2.2.2 Adverse reactions of albendazole**

According to the Diagnosis and treatment protocol for echinococcosis (2017 edition) 142 [22], severity was determined based on the adverse reactions. Mild symptoms include a mild 143 headache, dizziness, stomach discomfort, anorexia, nausea, diarrhea, skin itching, and liver 144 145 acupuncture-like pain. Moderate symptoms include an aggravation of the aforementioned symptoms, vomiting, and a significant decrease in food intake. Severe symptoms include the 146 aforementioned symptoms, noticeable alopecia, anemia, edema, jaundice, and a significant 147 148 increase in bilirubin levels, decreased albumin and white blood cells, and increased albuminuria and creatinine levels revealed by laboratory examinations. Patients with mild 149 symptoms usually do not need treatment and may continue taking albendazole. Moderate 150 responders should discontinue albendazole use; it is recommended that they seek 151 confirmation from a hospital and establish a treatment plan after blood, urine routine, and 152 liver and kidney function tests. Severe responders should discontinue albendazole 153 154 immediately and be referred to hospitals for treatment, if necessary.

155 **2.2.3 Therapeutic efficacy**

Patient records were reviewed to collect the initial diagnosis results and the most recent follow-up examination results and dates, and therapeutic efficacy assessments were conducted. Patients who had received imaging follow-up within one year of the investigation date were selected, with a focus solely on patients with CE owing to the limited number of patients with AE. Based on the most recent B-ultrasound examination results, the following criteria were used to determine the therapeutic efficacy for patients with CE (with lesions located in abdominal organs and the abdominal cavity) in accordance with the TechnicalScheme for Drug Treatment of Hydatid Disease [22]:

i) Cure: Disappearance of the cyst; complete calcification of the cyst wall; solidificationof cyst contents.

ii) Effective: A cyst diameter reduction of over 2.0 cm; signs of inner membrane
 detachment; increased echogenicity within the cyst contents, characterized by more
 pronounced bright spots.

169 iii) Ineffective: No changes or progressive enlargement of the lesion.

170 iv) Recurrence: Discovery of new lesions.

171 **2.3 Statistical analysis**

The counting data are presented using frequency and constituent ratios. The comparison 172 between groups was performed using the chi-square, Kruskal-Wallis, chi-square trend, and 173 Fisher's exact tests. P < 0.05 was considered statistically significant. The influencing factors 174 were analyzed using multivariable logistic regression. The dependent variable was whether to 175 take albendazole regularly. The estimated correlation strength was confirmed by the odds 176 177 ratio (OR) with a 95.0% confidence interval (CI). Study participants were standardized by sex, age, education, occupation, and other patient-specific characteristics (Table 1). EpiData 178 (version 3.1, EpiData Association, Odense, Denmark) was used to collect relevant 179 information and establish a database. Data analysis was performed using SPSS software 180 (version 22.0, IBM Corporation, Armonk, US). 181

182

183 **2.4 Quality control**

During the on-site investigation, specially assigned individuals in each county were responsible for reviewing the questionnaire and establishing quality control archives to ensure the authenticity and reliability of the data. During the data processing phase, missing values, outliers, and logic errors were rechecked, cleaned, and reprocessed.

189	Table 1. Variable standards.
Variables	Attributes

Sex	Male = 1, $Female = 2$
Age	< 18 years old = 1, (18–40) = 2, (40–60) = 3, ≥ 60 years old = 4
Nation	Han nationality = 1, Tibetan = 2, Others = 3
Education	No formal education = 1, Primary = 2, Junior = 3, Senior = 4,
Education	College and above $= 5$
Occupation	Herdsman = 1, Farmer = 2, Others = 3
Disease type	CE = 1, AE = 2
Disease duration (year)	$< 5 = 1, (5-10) = 2, \ge 10 = 3$
Albendazole dosage form	Tablet = 1, Emulsion = 2, Tablet + emulsion = 3
Occurrence of adverse reactions	Yes = 1, No = 2

190 *CE* cystic echinococcosis; *AE* alveolar echinococcosis

191

192 **3. Results**

193 **3.1 Patient medication**

Three hundred and seventeen files lacked initial diagnostic and follow-up information; 194 hence, we were unable to compute their actual and theoretical albendazole therapy durations, 195 making medication evaluation impossible. Therefore, we evaluated 582 cases, accounting for 196 64.7%: 563 patients with CE (96.7%) and 19 patients with AE (3.3%). There were 368 197 females (63.2%) and 214 males (36.8%), with a sex ratio of 1.7:1. The maximum age was 92 198 years, and the minimum was 11 years. The average age was 64 years. In terms of age, 58.2% 199 (339/582) of the patients were 60 years or older, while 30.6% (178/582) were 40-59 years old. 200 The Tibetan population was the largest, followed by the Han population, accounting for 201 50.3% (293/582) and 46.1% (268/582), respectively. Farmers accounted for 49.1% (286/582) 202 of the population, followed by herders at 42.1% (245/582). The majority had no formal 203 education, accounting for 48.8% (284/582). The longest disease duration lasted 55 years, and 204 205 the shortest lasted three months. The duration was concentrated in 5–9 years, accounting for 206 72.5% (422/582), as illustrated in Table 2.

As displayed in Figure 1, $R_m = 0.4$ was the most concentrated, accounting for 13.4% (78/582), followed by $R_m = 0.5$, accounting for 11.3% (66/582). Only 22.9% of patients exhibited $R_m \ge 0.8$. Stratification based on the theoretical duration of albendazole treatment showed $R_m \ge 0.8$ in 90.5% (19/21), 87.5% (42/48), 75.6% (34/45), 13.5% (26/193), 4.6% (12/261), and 0.0% (0/14) patients taking albendazole for < 1 year, 1 year, 3 years, 5 years, 7 years, and ≥ 10 years, respectively. The proportion of patients with $R_m \ge 0.8$ decreased with increased albendazole treatment duration ($\chi^2_{trend} = 339.94$, P < 0.05) (Table 3).

Among the patients, 7.9% (46/582) had never taken albendazole; 69.2% (403/582) took it irregularly, and 22.9% (133/582) took it regularly. The percentage of regular medication varied significantly by ethnicity, education level, occupation, disease type, duration, and medication dosage form (P < 0.05). The details are presented in Table 2.

218

219 **3.2** Analysis of the factors influencing adherence to albendazole use

220 Multivariate logistic regression analysis revealed that Tibetan patients exhibited an OR of 0.06 (95% CI: 0.03-0.12) for regular medication compared with Han patients. Herdsmen 221 exhibited an OR of 0.08 (95% CI: 0.04–0.15) for regular medication compared with farmers. 222 Senior high school patients exhibited an OR of 1. 4 (95% CI: 1.09-2.90) for regular 223 224 medication compared with those without any formal education. Patients taking emulsions exhibited an OR of 0.46 (95% CI: 0.22–0.93) for regular compared with those taking tablets. 225 Patients without adverse reactions exhibited an OR of 1.81 (95% CI: 1.02-3.20) for regular 226 medication compared with those with adverse reactions. The results are detailed in Table 4. 227

Of the 403 patients who took albendazole irregularly, the main reasons for interrupted medication are as follows: 45.9% for adverse reactions, 26.3% for improving symptoms, 23.3% for doubting the efficacy of albendazole, 4.7% for intolerance, 4.5% for lack of access to drugs for school, work, or travel, and 3.5% owing to missed appointments.

Of the 46 patients who did not take the medication, 58.7% refused because of distrust in
the efficacy of albendazole, and 41.3% refused because of intolerance to albendazole.

Of the 536 patients who took albendazole, 242 exhibited adverse reactions, with an incidence of 45.2%. The majority of adverse reactions were mild, accounting for 85.1% (206/242). The rates for moderate and severe were 12.0% (29/242) and 2.9% (7/242), respectively. Patients without adverse reactions displayed a significantly higher regular medication rate than those with adverse reactions (H = 26.93; P = 0.04) (Table 2).

240 **3.3** Analysis of the impact of patient medication compliance on therapeutic outcomes

The most recent imaging follow-up results from 174 patients with CE within one year of 241 the investigation data were obtained. Nine patients met the cure criteria, accounting for 5.2%; 242 56 patients were considered to have been effectively treated, accounting for 32.2%; 105 243 patients were assessed as having shown no improvement, accounting for 59.8%; and 5 244 patients experienced recurrence, accounting for 2.9%. The actual treatment duration ranged 245 from less than 1 month to 65 months, with an average of 18.7 ± 1.9 months. Patients 246 experienced better treatment outcomes with regular medication use ($\chi^{2}_{trend} = 0.280$; 247 P < 0.001). Of the 65 patients who received regular treatment, 13.9% were cured, 53.9% 248 249 were effectively treated, and 32.3% showed no improvement. Of the 93 patients who did not receive regular treatment, 22.6% were effectively treated, 73.1% showed no improvement, 250 251 and 4.3% experienced recurrence. Of the 16 patients who did not receive albendazole treatment, 93.8% showed no improvement, 6.3% experienced recurrence, and no patient was 252 cured or effectively treated. Patients with higher medication adherence demonstrated better 253 treatment outcomes ($\chi^{2}_{trend} = 0.47$; P < 0.05). The details are indicated in Table 5. 254

In the stratified analysis based on patient treatment duration, among 34 patients who received less than 6 months of medication, 20.6% were effectively treated, while 79.4% showed no improvements, with no patients achieving a cure or experiencing recurrence. Among these patients, 13 took albendazole regularly, of whom 30.8% were effectively treated, while 15.0% of the 20 patients who took it irregularly were effectively treated. No statistically significant differences in treatment outcomes were observed among patients with different medication statuses (*Fisher* = 1.69; P = 0.52). Data are presented in Table 6.

For the 30 patients who received medication for 6–11 months, 23.3% were effectively treated, 73.3% showed no improvement, and 3.3% experienced relapse, with no patients achieving a cure. Among these patients, 12 took albendazole regularly, of whom 41.7% were effectively treated, while 11.1% of the 18 patients who took it irregularly were effectively treated. However, no statistically significant differences in treatment outcomes were observed among patients with different medication statuses (*Fisher* = 2.16; P = 0.21). Data are displayed in Table 6.

For the 43 patients who received medication for 12–35 months, 7.0% were cured, 34.9% were effectively treated, and 53.5% showed no improvement, with 4.7% experiencing recurrence. Among these patients, 15 took albendazole regularly, of whom 20.0% were cured, 60.0% were effectively treated, and 20.0% were ineffectively treated. However, of the 28 patients who took albendazole irregularly, 21.4% were effectively treated, 71.4% were ineffectively treated, and 7.1% experienced recurrence. Patients with higher medication adherence demonstrated better treatment outcomes ($\chi^2_{trend} = 0.59$; P < 0.05) (Table 6).

For the 67 patients who received medication for 36 months or more, 9.0% were cured, 276 40.3% were effectively treated, and 47.8% showed no improvement, with 3.0% experiencing 277 recurrence. Among these patients, 25 took albendazole regularly, of whom 16.0% were cured, 278 76.0% were effectively treated and 8.0% were ineffectively treated. However, of the 27 279 patients who took albendazole irregularly, 7.4% were cured, 29.6% were effectively treated, 280 59.3% were ineffectively treated and 3.7% experienced recurrence. Additionally, the B-281 ultrasound results of 15 patients who did not receive medication showed an ineffective rate of 282 93.3% and a recurrence rate of 6.7%. Patients with higher medication adherence displayed 283 better treatment outcomes ($\chi^2_{trend} = 0.64$; P < 0.05). The details are displayed in Table 6. 284

285







291	Table 2. Albenda	azole medication in p	atients with echinococ	ecosis in the 10 endemic	counties in 2019).
General characteristics	Total (<i>n</i>)	No medication	Irregular	Regular	Н	P-value
		(n, %)	medication $(n, \%)$	medication $(n, \%)$		
Sex						
Male	214	10 (4.7)	155 (72.4)	49 (22.9)	4 10	0.12
Female	368	36 (9.8)	248 (67.4)	84 (22.8)	4.12	0.12
Age (year)						
< 18	13	3 (23.1)	8 (61.5)	2 (15.4)		
18–40	52	1 (1.9)	36 (69.2)	15 (28.9)	2.90	0.14
40–60	178	15 (8.4)	127 (71.4)	36 (20.3)	3.89	
≥ 60	339	27 (8.0)	232 (68.4)	80 (23.6)		
Ethnicity						
Han	268	1 (0.4)	193 (72.0)	74 (27.6)		
Tibetan	293	44 (15.0)	191 (65.2)	58 (19.8)	34.76	< 0.05
Others	21	1 (4.2)	19 (90.5)	1 (4.2)		
Education level						
No formal education	353	38 (10.8)	224 (63.5)	91 (25.8)	46.10	< 0.05
Primary school	164	6 (3.7)	133 (81.1)	25 (15.2)	40.12	< 0.05
Junior high school	62	2 (3.2)	45 (28.6)	15 (24.2)		

Senior high school and	2	0	1(22,2)	2 (66.7)		
above	3	0	1 (33.3)	2 (00.7)		
Occupation						
Herdsmen	245	37 (15.1)	156 (63.7)	52 (21.2)		
Farmers	286	5 (1.8)	206 (72.0)	75 (26.2)	31.69	< 0.05
Others	51	4 (7.8)	41 (80.4)	6 (11.7)		
Disease type						
CE	563	46 (8.2)	403 (71.6)	114 (20.3)	10.76	< 0.05
AE	19	0	0	19 (100.0)	10.76	< 0.03
Disease duration (year)						
< 5	91	22 (24.2)	25 (27.5)	44 (48.4)		
5–10	422	23 (5.5)	329 (78.0)	70 (16.6)	6.13	< 0.05
≥10	69	1 (1.5)	49 (71.0)	19 (27.5)		
Albendazole dosage form						
Tablet	200	0	150 (75.0)	50 (25.0)		
Emulsion	178	3 (1.7)	146 (82.0)	29 (16.3)	8.70	< 0.05
Tablet + emulsion	111	0	63 (56.8)	48 (43.2)		
Unrecorded	93	43 (46.2)	44 (47.3)	6 (6.5)		
Occurrence of adverse						
reactions (Excluding						

patients without medication,

N = 536)

Yes	242	-	207 (85.5)	35 (14.5)	6.24	< 0.05
No	294	-	194 (66.0)	100 (34.0)	0.24	< 0.03
Total	582	46 (7.9)	403 (69.2)	133 (22.9)		

292

293 Note: * Fewer patients from other ethnic groups and only Tibetan and Han patients were included in the chi-square analysis. ** Fewer patients

in senior high school, college, and beyond, and these patients were merged in chi-square analysis. † *P* values were compared with the 0.05 level.

295 The chi-square test compared only with the recorded percentage.

296 Abbreviation: *CE* cystic echinococcosis; *AE* alveolar echinococcosis.

298 1	10 endemic counties in 2019, stratified by the duration of albendazole therapy.							
Duration of		edicati	on (N, %)					
albendazole therapy	Total (N)	$\mathbf{P} = 0$	0 < P <	< 0.2	02 <d <<="" td=""><td>0.5 0</td><td>5 < D < 0.9</td><td>$\mathbf{D} > 0.9$</td></d>	0.5 0	5 < D < 0.9	$\mathbf{D} > 0.9$
(year)		$\mathbf{K}_{\mathrm{m}} = 0$	$0 < \mathbf{K}_{\mathrm{m}}$	< 0.5	$0.3 \leq \mathrm{K}_{\mathrm{m}} \leq$	0.5 0.	$J \leq K_{\rm m} < 0.8$	$R_{\rm m} \ge 0.8$
< 1	21	1 (4.7)	0 (0.	0)	0 (0.0)		1 (4.7)	19 (90.5)
1	48	3 (6.3)	0 (0.	0)	0 (0.0)		3 (6.3)	42 (87.5)
3	45	1 (2.2)	0 (0.0))	1 (2.2)		9 (20.0)	34 (75.6)
5	193	6 (3.1)	20 (10	.3)	56 (29.0)	85 (44.0)	26 (13.5)
7	261	31 (11.9)	54 (20).7)	73 (28.0)	91 (34.9)	12 (4.6)
≥ 10	14	4 (28.6)	6 (42.	.9)	4 (28.6))	0 (0.0)	0 (0.0)
Total	582	46 (7.9)	80 (13	.8)	134 (23.0))	189 (32.5)	133 (22.9)
χ^2				339	9.94			
<i>P</i> -value				<i>P</i> <	0.05			
299								
300 Table	4 Multifactori	al logistic regre	ession analy	vsis of 1	the factors ir	fluencin	a albendazole	۰_
201	tolri		in the 10 or		accumtica in	2010	g albendazore	,- _
301	laki				Wold	2019.		
	Variables		В	SE	wald	Р	OR	95% CI
Eduicity (asf He					X			
Ethnicity (ref. Ha	n)		2 70	0.22	74.04	< 0.05	0.06	0.02.0.12
libetan)		-2.19	0.32	/4.94	< 0.05	0.06	0.03-0.12
Uccupation (ref. r	armer)		256	0.22	61.40	< 0.05	0.08	0.04.0.15
Education loval (m	of No formal a	ducation)	-2.30	0.55	01.49	< 0.03	0.08	0.04-0.15
Education level (re	er. No formar e	soucation)	0.57	0.25	5 2 2	< 0.05	1 77	1.00.2.00
	001 ra farm (raf. T	hlat)	0.37	0.23	5.22	< 0.03	1.//	1.09–2.90
Emulsion	ge 101111 (1e1. 18	aulet)	0.79	0.26	1 26	< 0.05	0.46	0.22.0.02
Occurrence of adv	orga reactions	(rof Vos)	-0.78	0.30	9 4.20	< 0.03	0.40	0.22-0.95
No.	erse reactions	(101. 105)	0.50	0.20	4 17	< 0.05	1 0 1	1 02 2 20
110			0.39	0.29	4.17	< 0.05	1.01	1.02-3.20
302								
303								
304								

Table 3. Medication for Chinese patients with echinococcosis treated with albendazole in the

General	T-4-1	Treatment outcome $(n, \%)$				- 2	מ
Condition	lotal .	Cured	Effective	Ineffecti	ive Relap	sed χ^2 trend	P
Actual							
Albendazole							
Administration							
Duration							
(months)							
< 6	34	0	7 (20.6)	27 (79.4	4) 0		
6 – 12	30	0	7 (23.3)	22 (73.)	3) 1 (3.	3)	
12 – 36	43	3 (7.0)	15 (34.9)	23 (53.:	5) 2 (4.	7) 0.28	< 0.03
≥36	67	6 (9.0)	27 (40.3)	32 (47.	8) 2 (3.	0)	
Medication							
No medication	16	0	0	15 (93.	8) 1 (6.	3)	
Irregular	02	0	21 (22 ()	(0. (72)	1) A (A	2)	
medication	93	0	21 (22.6)	68 (73.	1) 4 (4.	3) 0.47	< 0.05
Regular		0 (12 0)	25 (52 0)	21 (22)			
medication	65	9 (13.9)	35 (53.9)	21 (32.)	3) 0		
306							
07							
100							
08							
09 Table 6. A	nalysis	of medicat	tion and treatm	ent outcomes c	of patients who	took medicatio	n for
10			less tha	n six months.			
Treatment			No	Irregular	Regular		
Effect	Te	otal	medication	medication	medication	Fisher/ χ^2_{trend}	Р
			(n, %)	(n, %)	(n, %)		
< 6							
Effective	7 (2	20.6)	0	3 (15.0)	4 (30.8)	1 60*	0.52
Ineffectiv	e 27 ((79.4)	1 (100.0)	17 (85.0)	9 (69.2)	1.07	0.52
6–12							

Table 5. Treatment outcomes of medication on patients with cystic echinococcosis.

/

/

2 (11.1)

15 (83.3)

5 (41.7)

7 (58.3)

2.16*

0.21

Effective

Ineffective

7 (23.3)

22 (73.3)

Relaps	sed 1 (3.3)	/	1 (5.6)	0		
12–36						
Cured	3 (7.0)	/	0	3 (20.0)		
Effect	ive 15 (34.9)	/	6 (21.4)	9 (60.0)	0.50	< 0.05
Ineffe	etive 23 (53.5)	/	20 (71.4)	3 (20.0)	0.39	< 0.03
Relaps	sed 2 (4.7)	/	2 (7.1)	0		
≥36						
Cured	6 (9.0)	0	2 (7.4)	4 (16.0)		
Effect	ive 27 (40.3)	0	8 (29.6)	19 (76.0)	0.64	< 0.05
Ineffe	ctive 32 (47.8)	14 (93.3)	16 (59.3)	2 (8.0)	0.04	< 0.03
Relaps	sed 2 (3.0)	1 (6.7)	1 (3.7)	0		

312 *: Fisher.

314 4. Discussion

315 **4.1 Medication compliance**

Drug therapy is the primary treatment option, especially for patients who cannot be 316 treated surgically. Cyst becomes inactive or disappears after 1-2 years of albendazole 317 treatment for CE, and patient compliance affects the long-term treatment outcome [20]. If 318 liver lesions were removed and long-term benzimidazole treatment was used, the survival 319 rates of patients with AE would be comparable to those of healthy people [23]. For patients 320 321 with AE who cannot be treated with radical surgery, drug chemotherapy has significantly improved the 10-year survival rate from a range of 6.0%-25.0% to a range of 80.0%-85.0% 322 323 [24].

The files of the patients were incomplete, preventing 35.3% of them from being 324 evaluated for medication. These patients might have been lost to follow-up, or their 325 medication information might not have been recorded owing to negligence by follow-up 326 personnel [25]. The medication compliance of the evaluable patients was poor, and 7.9% had 327 never taken albendazole. The majority of patients exhibited satisfactory adherence to 328 329 medication during the early stages of treatment. However, the medication compliance of patients decreased as a result of the prolonged use of albendazole. Patients with 330 echinococcosis demonstrated poor compliance with albendazole owing to poor knowledge of 331 the disease, albendazole treatment, and adverse reactions [26-27]. 332

In this study, Tibetans and herdsmen without formal education comprised the majority of 333 patients who failed to comply with medication. Patients with higher education levels, health 334 awareness, and disease cognition are more likely to actively accept drug treatment. Recently, 335 patients with a short course of disease have been diagnosed with echinococcosis, and their 336 symptoms are more noticeable. Their compliance with medication is higher than that of 337 patients with a long course of the disease. Patients with a long course of the disease feel 338 relaxed because they believe their symptoms have improved. Patients with AE demonstrated 339 higher medication compliance than patients with CE because their symptoms were more 340 noticeable, and the disease was more severe. Additionally, the number of patients with AE in 341 this study was small. AE is more complex and severe than CE, requiring long-term or even 342

343 lifelong medication. This may lead to poor medication adherence among some patients, who 344 may give up taking medication midway. It is important to follow up with these patients and 345 remind them to take medication and undergo follow-up examinations regualarly.

Albendazole emulsion has an unpleasant taste and is unpalatable to some patients. 346 However, it has a higher absorption rate than tablets and can improve treatment effectiveness 347 [28]. We discovered that patients who combined tablets and emulsions exhibited higher 348 compliance, implying that the patients preferred to choose their own suitable dosage form. 349 350 The occurrence of adverse reactions was the main factor that affected patient medication compliance. The findings revealed that 85.1% of patients experienced mild adverse reactions 351 and needed no treatments. However, 45.9% of patients discontinued taking albendazole 352 owing to adverse reactions, indicating that patients exhibited poor knowledge of adverse 353 reactions. We compared the results with those of other studies. Patients with echinococcosis 354 exhibited poor compliance with albendazole owing to poor knowledge of the disease, 355 albendazole treatment, and adverse reactions, indicating that the patients did not know how to 356 deal with the adverse reactions properly. This suggests that patient health education on 357 358 adverse reactions should be increased.

Additionally, patients who did not trust or pay attention to albendazole treatment, nor 359 did understand treatment duration, exhibited poor medication compliance. Some Tibetan 360 patients trusted traditional Tibetan medicine more and preferred to take local Tibetan 361 medicine. Additionally, patients with echinococcosis are mainly herdsmen, especially 362 Tibetans, who engage in nomadism [29]. During summer, they may be unable to obtain 363 albendazole when they are nomadic in remote pastures. Consequently, herders have greater 364 difficulty obtaining medications than farmers. Furthermore, Tibetan areas are located on the 365 Qinghai-Tibet Plateau, making transit difficult. Some patients are unable to take albendazole 366 on time because they are away or attending school. 367

We also suggest that disease control should work with clinical doctors to develop different treatment plans and follow-up times for patients based on their conditions, and judge the patient's medication time based on these indicators. For example, the Tibetan community, especially herdsmen, should be able to appropriately extend their follow-up interval and

distribute more doses of medication. At the same time, a treatment group can be established 372 within the nomadic community to supervise each other's medication, and a healthy supervisor 373 can also be set up. After being informed of the characteristics of the two dosage forms, 374 patients select the matching dosage form based on their sensitivity and convenience to avoid 375 waste. Health education needs to focus on introducing the treatment of echinococcosis, 376 especially the characteristics and necessity of drug therapy, as well as the effectiveness of 377 albendazole treatment. It should also be emphasized that the characteristics of the two dosage 378 379 forms to patients, as well as the possible adverse reactions, symptom manifestations, and treatment methods of albendazole, in order to alleviate patients' fear of albendazole. Follow 380 up and follow-up examinations are important means of reminding patients to take medication 381 and evaluating the effectiveness of their treatment, which requires their cooperation. In health 382 education, it is also necessary to emphasize the necessity of follow-up and re examination in 383 drug treatment, which is related to their course of treatment. Treatment groups can also be 384 established based on the patient's village or community, and healthcare professionals can be 385 arranged to answer their questions, remind patients to take medication or undergo follow-up 386 387 examinations. Health education should pay special attention to patients with relatively low levels of education, who may not be familiar with or even have misunderstandings about the 388 treatment of echinococcosis and albendazole drugs, and may not value the importance of 389 follow-up and re examination. These are the key to providing health education to them, and 390 391 patients who take medication regularly and have good treatment effects can be invited as promoters to educate them. 392

Medication compliance may vary depending on factors such as disease duration, severity, and type. In this study, patients in ten echinococcosis-endemic counties from three endemic provinces in China were investigated for medication compliance, with good representativeness; however, it did not include all epidemic counties.

397 4.2 Therapeutic efficacy

Cure and effectiveness rates were 5.2% and 32.2%, respectively, which are lower than previously reported data where the cure rate of albendazole treatment for patients was approximately 30.0%, with an effectiveness rate ranging from 40.0% to 60.0% and an

inefficacy or recurrence rate of 30.0% [30]. This may be attributed to the fact that only 401 patients with follow-up records within the past year were included in this study, while follow-402 403 up information for other patients who were medication-compliant was not documented, making it impossible to evaluate their treatment outcomes. In this study, patients who adhered 404 to regular medication displayed considerably better treatment outcomes than those who did 405 not adhere to medication or did not take medication, consistent with findings from other 406 studies [30-31]. This implies the need for improved patient health education to enhance 407 408 medication adherence, as albendazole therapy is a long-term procedure, especially for certain cystic types that remain active. This will increase the disease and economic burden on 409 patients. For patients who cannot undergo surgical treatment, standardized medication is the 410 most cost-effective and only treatment option. Regular medication can improve patient 411 treatment outcomes, indicating that relevant departments should increase the intensity and 412 quality of patient follow-up and health education, ensure effective follow-up work 413 implementation, and improve patient medication adherence to further improve cure rates and 414 quality of life. 415

416 In this study, the effectiveness and cure rates for patients who had taken medication for more than 36 months were 40.3% and 9.0%, respectively, which are lower than those 417 reported by Li et al., where the effectiveness rate of albendazole treatment for patients with 418 CE after 3-6 months was 30.0%. When treatment was extended for 18-30 months, the 419 number of cysts decreased by 32.7%, and cystic degeneration decreased by 49.0%, yielding 420 an overall effectiveness rate of 81.0% [30]. Due to its low absorption rate in the intestine and 421 low concentration of active ingredients in the capsule, albendazole requires an increased 422 dosage to achieve therapeutic effects. However, high-dose medication can cause some 423 424 adverse reactions, leading to poor medication compliance and liver damage, causing additional physical damage and economic burden to patients. The treatment of CE is related 425 to the size, classification, and quantity of the patient's lesions. However, in this study, no 426 stratified analysis was conducted on the characteristics of patient lesions. 427

428 A small number of patients obtained follow-up results within the previous year, making 429 it difficult to assess patient treatment outcomes. Therefore, only 174 patients were evaluated for treatment effectiveness, reflecting the problems in the management of patients with CE
medication treatment as well as poor compliance and a lack of emphasis on follow-up.

432 4.3 Suggestions

We recommend the following: First, relevant departments must improve the quality of 433 patient management and record-keeping. Second, it is necessary to focus on patient health 434 education to increase their knowledge of the disease, treatment, and reexamination, especially 435 the performance and treatment of albendazole-related adverse reactions, to reduce the fear of 436 437 adverse reactions. Drug therapy is a long-term procedure that requires patients to regularly reexamine and evaluate its efficacy. Third, follow-up personnel should receive more 438 professional and comprehensive training, and they should be required to fully document each 439 follow-up. Albendazole must be dispensed in a flexible manner. After being informed of the 440 characteristics of the two dosage forms, patients select the matching dosage form based on 441 their sensitivity and convenience to avoid waste. Regarding patient nomadism, follow-up 442 personnel should keep open communication with patients, regularly assess the existing 443 albendazole stock of patients, leave a buffer time for drug distribution, and avoid the situation 444 445 of insufficient drugs for patients.

More extensive and diversified health education and professional guidance should be 446 provided to patients receiving medical treatment in community health services to improve 447 their knowledge of the harm caused by echinococcosis, albendazole treatment of 448 echinococcosis, adverse reactions, and follow-up management, thereby increasing their trust 449 and confidence in albendazole treatment and alleviating their fear of adverse reactions. Their 450 families and community doctors and officials should be invited to attend. Actively 451 implementing regular management for patients with echinococcosis undergoing medication 452 453 therapy can increase their adherence to regular treatment, as well as delay and prevent progression and recurrence. Tertiary prevention can increase cure rates, decrease disability 454 and mortality rates, and improve their quality of life.In this study, the medical files of some 455 patients might not have documented timely information about their albendazole use. 456 Additionally, some patients might have had recall bias during the investigation, resulting in 457 an underestimation of medication compliance. 458

459 4.4 Limitations

The limitations of this study include a sample size and a large number of excluded cases. 460 First, 35.3% of the research patients corresponding to the files were excluded from the 461 analysis, which could have resulted in selection bias that could not be evaluated. Second, 462 surveying 10 out of the 370 endemic counties in China resulted in low representativeness. 463 Third, in the analysis of the treatment effect of CE patients, the inclusion of too few patients 464 may lead to selection bias and cannot represent the actual treatment situation of patients. 465 These biases can lead to discrepancies between research results and actual situations. In 466 future research, we recommend conducting long-term follow-up on patients to obtain more 467 accurate information on their medication use and treatment outcomes. And it is also 468 recommended to include more patients in future analyses. There may be differences in health 469 education strategies in different regions. Therefore, we aim to conduct a uniform nationwide 470 special survey in the future. 471

472 **5. Conclusions**

In conclusion, patients demonstrated poor compliance with albendazole use, 473 474 highlighting the need for improved health education and medication guidance, as well as more follow-up to improve compliance. This study recommends that medicated that people-475 awareness should emphasized in in community health services to improve knowledge of 476 echinococcosis drug therapy and albendazole adverse effects. At the same time, it is 477 necessary to strengthen patients' attention to follow-up and re-examination. Regular 478 medication can improve patient treatment effectiveness, implying that relevant departments 479 should intensify their efforts and enhance the quality of patient health education. This ensures 480 that follow-up and re-examination are conducted effectively, patient medication adherence is 481 482 improved, and patient cure rates and quality of life are increased.

483

484

485 **Abbreviations**

486 AE: Alveolar echinococcosis;

487 CE: Cystic echinococcosis;

488	TAR: Tibet Autonomous Region;
489	DALYs: Disability-adjusted life years;
490	CDC: Center for Disease Control and Prevention;
491	R_m : the actual duration of albendazole therapy and the theoretical duration of albendazole
492	therapy.
493	
494	
495	Declarations
496	
497	Ethics Statement and consent to participate
498	Not applicable.
499	
500	Consent for publication
501	Not applicable.
502	
503	Availability of data and materials
504	All data analyzed in the present study are included in the article materials. Any inquiries can
505	be directed to the corresponding author.
506	
507	Competing interests
508	Roger Frutos is an editorial board member of the journal Infectious Diseases of Poverty. He
509	was not involved in the peer-review or handling of the manuscript. The authors have no other
510	competing interests to disclose.
511	Funding
512	NHC Key Laboratory of Echinococcosis Prevention and Control, China (Grant No.
513	2024WZK1001), Gansu Provincial Health Industry Research Plan Project (Grant No.
514	GSWSKY2017-19), and the Natural Science Foundation of Gansu Province, China (Grant
515	No. 21JR11RA182).

517 Author's contributions

MQ contributed to data analysis, verification and analysis, as well as charting and writing. 518 GY participated in data collection, verification, analysis, and funding acquisition and 519 investigation. JY contributed to verification, supervision, conceptualization, project 520 administration and review. LW designed the study and contributed to conceptualization, data 521 collection and screening, verification and analysis, funding acquisition, investigation 522 resources, project administration, and review. YF, QW, YH, and JZ participated in data 523 524 collection, investigation, and resources. DW contributed to data collection and funding acquisition. JL, ZW, and MJ contributed to review. CY participated in analysis and discussion. 525 RF and LG supervised the study. 526

527

528 Acknowledgments

We express our special thanks to the Centers for Disease Control and Prevention in Daofu
County, Ganzi County, Ruoergai County, Huining County, Tianzhu County, Zhang County,
Maqu County, Gaochang District, Jimusar County and Fukang City for their kind help.

- 532
- 533

534 **References**

- McManus DP, Zhang W, Li J, Bartley PB. Echinococcosis. Lancet. 2003;362(9392):1295 1304.
- 537 2. Torgerson PR, Macpherson CN. The socioeconomic burden of parasitic zoonoses: global
 538 trends. Vet Parasitol. 2011;182(1):79-95.
- 3. Li B, Quzhen G, Xue CZ, Han S, Chen WQ, Yan XL, et al. Epidemiological survey of
 echinococcosis in Tibet Autonomous Region of China. Infect Dis Poverty. 2019;8(1):29.
- 4. Wang LY, Qin M, Liu ZH, Wu WP, Xiao N, Zhou XN, et al. Prevalence and spatial
 distribution characteristics of human echinococcosis in China. PLoS Negl Trop Dis.
 2021;15(12):e0009996.
- 5. Torgerson PR, Budke CM. Echinococcosis--an international public health challenge. Res
 545 Vet Sci. 2003;74(3):191-202.

- 546 6. Budke CM, Deplazes P, Torgerson PR. Global socioeconomic impact of cystic
 547 echinococcosis. Emerg Infect Dis. 2006;12(2):296-303.
- 548 7. Torgerson PR, Keller K, Magnotta M, Ragland N. The global burden of alveolar
 549 echinococcosis. PLoS Negl Trop Dis. 2010;4(6):e722.
- 8. Grosso G, Gruttadauria S, Biondi A, Marventano S, Mistretta A. Worldwide epidemiology
 of liver hydatidosis including the Mediterranean area. World J Gastroenterol.
 2012;18(13):1425-37.
- 9. Vuitton DA, Azizi A, Richou C, Vuitton L, Blagosklonov O, Delabrousse E, et al. Current
 interventional strategy for the treatment of hepatic alveolar echinococcosis. Expert Rev
 Anti Infect Ther. 2016;14(12):1179-1194.
- 10. Liu CS, Zhang HB, Lei W, Zhang CW, Jiang B, Zheng Q, et al. An alternative
 mebendazole formulation for cystic echinococcosis: the treatment efficacy,
 pharmacokinetics and safety in mice. Parasit Vectors. 2014;7:589.
- 559 11. Brunetti E, Junghanss T. Update on cystic hydatid disease. Curr Opin Infect Dis.
 560 2009;22(5):497-502.
- 12. Wen H, Vuitton L, Tuxun T, Li J, Vuitton DA, Zhang, W, et al. Echinococcosis: Advances
 in the 21st Century. Clin Microbiol Rev 2019;32(2): e00075-18.
- Torgerson PR, Schweiger A, Deplazes P, Pohar M, Reichen J, Ammann RW, et al.
 Alveolar echinococcosis: from a deadly disease to a well-controlled infection. Relative
 survival and economic analysis in Switzerland over the last 35 years. J Hepatol.
 2008;49(1):72-7.
- 14. Wilson JF, Rausch RL. Alveolar hydatid disease. A review of clinical features of 33
 indigenous cases of Echinococcus multilocularis infection in Alaskan Eskimos. Am J
 Trop Med Hyg. 1980;29(6):1340-1355.
- 570 15. Brunetti E, Kern P, Vuitton DA, Writing Panel for the WHO-IWGE. Expert consensus for
 571 the diagnosis and treatment of cystic and alveolar echinococcosis in humans. Acta Trop
 572 2010;114:1-16..
- 573 16. Craig PS, Giraudoux P, Wang ZH, Wang Q. Echinococcosis transmission on the Tibetan
 574 Plateau. Adv Parasitol. 2019; 104:165-246.

- 575 17. Brunetti E, Kern P, Vuitton DA; Writing Panel for the WHO-IWGE. Expert consensus for
 576 the diagnosis and treatment of cystic and alveolar echinococcosis in humans. Acta Trop.
 577 2010;114(1):1-16.
- 18. Xu X, Qian X, Gao C, Pang Y, Zhou H, Zhu L, et al. Advances in the pharmacological
 treatment of hepatic alveolar echinococcosis: From laboratory to clinic. Front Microbiol.
 2022;13:953846.
- 19. Solomon N, Kachani M, Zeyhle E, Macpherson CNL. The natural history of cystic
 echinococcosis in untreated and albendazole-treated patients. Acta Trop. 2017;171:52-57.
- 20. Chinese Doctor Association, Chinese College of Surgeons (CCS), Chinese Committee for
 Hadytidology (CCH). Expert consensus on diagnosis and treatment of hepatic cystic and
 alveolar echinococcosis (2019 edition). Chin J Dig Surg 2019;18(8):711 21. (In
 Chinese).
- 587 21. Hemphill A, Müller J. Alveolar and cystic echinococcosis: towards novel
 588 chemotherapeutical treatment options. J Helminthol 009;83(2):99-111.
 589 https://doi.org/10.1017/S0022149X0928936X.
- 59022. Ministry of Health of the People's Republic of China. Diagnosis and treatment protocol591forechinococcosis(2017)
- 61/ABUIABA9GAAghaT9yQUo2NMrAI.pdf. (In Chinese)..
- 594 23. Li H, Song T, Shao Y, Tuergan A, Ran B, Wen H. Chemotherapy in alveolar
 595 echinococcosis of multi-organs: what's the role? Parasitol Res. 2013;112(6):2237-43.
- 596 24. Kern P, Menezes da Silva A, Akhan O, Müllhaupt B, Vizcaychipi KA, Budke C, et al. The
 597 Echinococcoses: Diagnosis, Clinical Management and Burden of Disease. Adv Parasitol.
 598 2017;96:259-369.
- 25. Qin M, Wang L, Wang Y, Wang X, Lei J, Cheng X, et al. Investigation on the
 Management for Patients with Echinococcosis Treated with Albendazole Three PLADs,
 China, 2019. China CDC Wkly. 2023;5(20):437-441.
- 26. Li S, Chen J, He Y, Deng Y, Chen J, Fang W, et al. Clinical Features, Radiological
 Characteristics, and Outcomes of Patients With Intracranial Alveolar Echinococcosis: A

- 604 Case Series From Tibetan Areas of Sichuan Province, China. Front Neurol 605 2021;11:537565.
- 27. Wu XL, Dang ZC, Li L, Zhang M, Feng YL, Duan MX. Compliance of echinococcosis
 patients taking albendazole and analysis of its influencing factors. Bull Dis Control
 Prev,2011;26(01):59-61+81. (In Chinese).
- 28. Zhai XM. Clinical Effect of Albendazole Emulsion on Hepatic Cystic Echinococcosis.
 Chin Gen Prac 2018;S2:111-112. (In Chinese).
- 611 29. Wang LY, Qin M, Gavotte L, Wu WP, Cheng X, Lei JX, et al. Societal drivers of human
 612 echinococcosis in China. Parasit Vectors 2022;15(1):385.
- 30. Li T, Ito A, Pengcuo R, et al. Post-treatment follow-up study of abdominal cystic
 echinococcosis in tibetan communities of northwest Sichuan Province, China. PLoS
 Negl Trop Dis, 2011,5(10):e1364.
- 31. Salinas J L, Vildozola G H, Astuvilca J, et al. Long-term albendazole effectiveness for
 hepatic cystic echinococcosis. Am J Trop Med Hyg, 2011,85(6):1075-1079.