



Original Research Article

Cystic echinococcosis in humans and animals at Dhamar and Taiz governorates, Yemen

IRM Al-Shaibani¹, Fuad A. Saad², H Al-Mahdi¹

¹Department of Veterinary Parasitology, Faculty of Agriculture & Veterinary Medicine, Thamar University, Dhamar, Yemen

²Department of Microbiology, Faculty of Applied science, Thamar University, Dhamar, Yemen

*Corresponding author

A B S T R A C T

The study was carried out in Dhamar and Taiz governorates from May to October, 2013 with main objective to determine the prevalence of cystic echinococcosis (CE) in humans and animals slaughtered at slaughterhouses in both governorates. A total of 244 patients attending the outpatient and inpatient departments at public and private hospitals, a total of 257 cattle, 62 sheep, 61 goats, and 5 camels slaughtered at slaughterhouses, in both governorates were selected and examined for the presence of hydatid cysts in their visceral organs. In human, the overall prevalence CE was 2.87 percent. The higher rate of infection was recorded in liver (2.46%) compared to lung (0.14%). Significant differences ($P<0.05$) were observed between the prevalence of infection and affected organs. The higher rate of infection was recorded in Dhamar governorate (3.59 %) compared to Taiz governorate (1.90%). The higher rate of infection was recorded in age group less than 20 years old (5.0%); whereas, the lower rate was recorded in age group of 41-60 years old (1.33%). All infected patients were females (5.07%); whereas, none of males. Statistically, significant differences ($P<0.05$) were observed between the prevalence rate of CE and study area, age group, while no with sex factor. In animals, the overall prevalence of CE recorded was 22.9 percent. The higher prevalence rate was recorded in Dhamar governorate (24.31%) compared to Taiz governorate (20.95%). Out of 257cattle, 62 sheep, 61 goats and 5 camel examined, 63(24.51%), 12(19.35%), 12(19.67%), 1(20%) respectively were found infected with CE. The infection rate of CE was higher in age group animals of 9years old (78.57%);whereas, lower in age animal group of less than two years old. Of the total 138 males and 247 females examined, 22 (15.94%) males and females 66(26.72%) were found infected with EC. The higher rate of infection was recorded in lung (52.27%); whereas, the lower rate in kidney and heart (1.13%). The cysts obtained from the lungs and livers of cattle were more fertile compared to cysts obtained fromorgans of other animals' species investigated. Statistically, significant differences ($P<0.05$) were observed in prevalence rateof CE and age, sex, organ of animals, cyst-type; while, no with animal species. The results of the present study revealed that cystic echinococcosis or hydatidosis is prevalent in humans and animals in study areas which deserve serious attention fromveterinary and public health Authorities in order to reduce losses and safe health of humans and animals.

Keywords

Animals,
Cystic Echi
nococcosis,
Dhamar,
Humans,
Prevalence,
Taiz,
Yemen

Introduction

Cystic Echinococcosis (CE) or hydatidosis is one major zoonotic parasitic infection of many mammalian species. It's caused by the larval stages of the tapeworm *Echinococcus granulosus* (Regassa et al., 2010; Shahnazi et al., 2013; Wang et al., 2014). It causes considerable economic losses and public health problem worldwide (Rahimi et al., 2011). Dogs and carnivores are the definitive hosts, while a wide range of ruminants and humans act as the intermediate hosts (Eckert and Deplaze, 2004). The adult parasites are found in the small intestine of a carnivore and eggs are passed in the faeces into the environment to infect large number of mammalian intermediate hosts including ruminants, human etc (Regassa et al., 2010). Livestock acquire the infection accidentally by ingesting infective eggs which develop into larval stages in different organs of their bodies. The life cycle is complete when fertile cysts are ingested by the definitive host and develop to adult worms. (Acosta-Jamett et al., 2010).

Human is infected with CE during natural transmission of the disease from carnivores to domestic animals by unintentionally ingesting eggs of *E. granulosus* through contaminated food, water, flies and soil, or through direct contact with dogs (Pednekar et al., 2009; Moro and Schantz, 2009; Salem et al., 2011; Wang et al., 2014).

The pathogenicity of cystic echinococcosis depends on the severity of the infection and the organ in which it is situated. The infection represents a problem for public health and economy in endemic areas (Schantz et al., 1995; Hui et al., 2012). The main losses in livestock production due to CE are reduced yield and quality of meat, milk and wool; decreased hide value; reduced birth rate and fecundity; delayed

performance and growth; condemnation of organs, especially liver and lungs; costs for destruction of infected viscera and dead animals, and bans on export of animals and their products (Battelli, 2009; Sariozkan and Yalcin, 2009).

In human, the EC can cause life-threatening, illness associated with liver failure, pulmonary edema (Brehm et al., 1999), and rupture of the cyst, which may cause fatal anaphylactic shock (Regassa et al., 2010; Mandal and Mandal, 2011). In addition, the disease may negatively affect the quality of life, socioeconomic activities of infected or at risk person (Battelli, 2009).

Various studies have been reported the occurrence and prevalence of CE in humans and animals in different corners of world (Lahmar et al., 1999; Sotiraki et al., 2003; Bardonnnet et al., 2003; El Bagi et al., 2004; M'rad et al., 2005; Scala et al., 2006; Bhattacharya et al., 2008; Zanini et al., 2008; Mandal and Mandal, 2011; Rahimi et al., 2011; Manfredi et al., 2011; Azami et al., 2013; Khan et al., 2013) and some geographical zones of Yemen (Al- Alghoury et al., 2010; Muqbil et al., 2012; Al-Shibani et al., 2012), but there are no published study yet on the cystic echinococcosis of humans and animals in Dhamar and Taiz governorates. Therefore, the aim of this study was to investigate the current status of EC and its associated risk factors in humans and slaughtered animals in Dhamar and Taiz governorates, Yemen.

Materials and Methods

Study areas

The study was conducted in Dhamar and Taiz governorates, Yemen from May to October 2013 with main objective to determine the prevalence of cystic echinococcosis in humans and animals.

Geographically, Dhamar is located approximately 100 km south to Sana'a, the capital of the country. Its lies between 14° 58'N latitude, 44° 43'E longitude and at altitude of 2330 meter above sea level. The area receives average rainfall ranging from 64.2 to 68.8 mm. The mean temperature and relative humidity recorded from May to October 2013 are 16.5°C and 59.7% respectively.

Taiz far approximately 270 km South to Sana'a. Its lies between 13°.42'N latitude, 44°.55'E longitude and at an altitude of 1200 meter above sea level. The area receives average rainfall of 46.54 mm. The means temperature and relative humidity recorded from May to October 2013 are 24.8°C and 73.4.7% respectively. In general, both governorates are associated with agriculture and industrial activities.

Study subjects (Population) and size of samples

In human, 244 patients attending the outpatient and inpatient departments of surgery at public and private hospitals in both governorates were selected for study. In animals, 385 animals including cattle, sheep, goats and camels slaughtered in abattoirs of Dhamar and Taiz governorates were selected. The sample size was calculated according to Thrusfield (2007) techniques considering 40% expected prevalence and 95% confidence interval with a 5% desired absolute precision.

Study design

In human

A prospective study was carried out in Dhamar and Taiz governorates from May to October, 2013 on 244 patients attending to public and private hospitals, namely,

Dhamar General Hospital, Queen Arwa and Dara Alshifa hospitals in Dhamar governorate and Republican, Military hospitals in Taiz governorate for medical treatment and surgical operations. Complete medical history of all selected patients were collected and analyzed. Profile of each patient including age, sex, and cysts location were recorded. Records were brought to Department of Veterinary parasitology further processing and analysis.

In animals

A cross-sectional study was conducted in animals slaughtered at central abattoirs/slaughterhouses of Dhamar and Taiz governorates. Regular visits were carried out to slaughterhouses from May to October 2013. During the study period, a total of 257 cattle, 62 sheep, 61 goats, and 5 camels were selected and examined for the presence of hydatid cysts in their visceral organs according to the techniques described by Regassa et al. (2010). During inspection, carcasses and their respective organs were carefully examined.

Infected organ was kept in aseptic and clean container with properly labeled information necessary for analysis and brought to Department of Veterinary Parasitology laboratory, Faculty of Agriculture and Veterinary Medicine, Thamar University, for further processing and examination. In laboratory, the total number of hydatid cysts were counted and recorded per infected organ. The size of cysts were measured and classified as small (1-3 cm), medium (4-7 cm) and large (above 8 cm).

Cysts characterization was carried out according to the techniques described by Fikire et al. (2012) and Kumsa & Mohammedien (2012). In brief, cysts were carefully removed from organs with knife

and then transported in clean tray. Individual cyst was carefully incised and examined for protoscolices which look like white dots on the germinal epithelium; such cysts were characterized as fertile cysts. Furthermore, fertile cysts were subjected for viability test. In this, a drop of the sediment, containing the protoscolices was placed on microscopic glass slide and covered with cover slip and observed for amoeboid like peristaltic movement under microscope.

A drop of 0.1% aqueous eosin solution was added to equal volume of protoscolices of hydatid fluid on a microscopic slide with the principle that protoscolices should completely or partially exclude the dye while the dead once take it up. Moreover, non-fertile cysts were further classified as sterile or calcified. Sterile hydatid cysts were characterized as their content. Whereas typical calcified cysts produce a gritty sound feeling up on incision by their smooth inner lining usually with slightly turbid fluid (Parija, 2004; Regassa et al., 2010).

Statistical analysis

Data obtained from human study, postmortem examination and laboratory findings of animals were entered into Ms Excel and analyzed using SPSS version 17. Prevalence of CE was calculated by dividing the number of CE animals with the total number of animals examined.

Chi-square test was applied to determine the associations between the various potential risk factors like age, sex, month variation (season), cyst viability and the prevalence of hydatid cyst in the examined animals. A statistically significant association among variables was considered to exist if P value was less than 0.05.

Result and Discussion

Human study

In human study, the overall prevalence of cystic echinococcosis in humans was 2.87 percent (7/244) at different public and private hospitals of Dhamar and Taiz governorates. The higher rate of infection was recorded in liver (2.46%) whereas; the lower in lung (0.41%). No infections were detected on other organs of subjects investigated. No significant differences ($P < 0.05$) were observed in prevalence of infection between the affected organs (Table 1).

The governorates (regions), age and sex are considered as risk factors for occurrence of EC in humans in this study as shown in the Table 2. Accordingly, the higher rate of infection was recorded in Dhamar governorate (3.59 %); while the lower in Taiz governorate (1.90%). There were significant differences ($P < 0.05$) in prevalence rates of infection between two governorates. The higher rate of infection was recorded in age group of less than 20 years old (5.0%); whereas, the lower rate in age group of 41-60 years old (1.33%). All infected patients were females (5.07%); while, none patient male was found. Statistically, significant differences ($P < 0.05$) were observed between prevalence rate and age group of patients, whereas no with sex as presented in Table 2.

Cystic echinococcosis in animals

In animal, a total of 385 animals slaughtered at different slaughterhouses of Dhamar and Taiz governorates were examined, 88 (22.9%) animals were found infected with CE either in single or in mixed infections.

The governorate (region), animal species, age sex and month variation are considered as potential risk factors for the occurrence of EC in animals (Table3). Accordingly, the prevalence rate recorded in Dhamar was higher (24.31%) than rate recorded in Taiz governorate (20.95%).The prevalence of CE in different species of species animals were 24.51%, 19.35%, 19. 67% and 20.0% in cattle, sheep, goats and camels respectively as depicted in Tables 3. Age data revealed that prevalence rate of CE was high in animals group of 9 years old (78.57%) and low (3.77%) in animals group of less than two years old. Significant differences ($p<0.05$) were observed in prevalence among different animals age groups. In the term of sex, higher prevalence rate was observed in female animals (26.72%); whereas, the lower rate (15.94%) in male animals. There was significant difference ($P<0.05$) between prevalence and animal's sex. The prevalence rate of cystic echinococcosis was high in the month of August (26.93 %); whereas, low in the month of July (14.71%). Statistically significant differences were not observed among different months of study and prevalence rate.

The overall distribution of cysts in different organs of animals slaughtered at slaughterhouses of Dhamar and Taiz governorates is presented in Table 4. As shown, the higher number of cysts and percentage were recorded in lung (52.27%); whereas, the lower (1.13%) in kidney and heart. There were significant differences ($P<0.05$) in prevalence rate and distribution of hydatid cysts in different organs in different animal species examined.

Systematic measurements of the cysts in different affected organs are presented in Table 5. The results revealed that the higher number of small (32.9%), medium (15.2%)

and large (6.8%) cysts were found in lungs and livers of infected animal, while the low number of was recorded in heart and kidney (0.52%). The variation in size of cysts in different organs was significantly different ($P<0.05$).

The fertility and sterility rates of cysts in different organs of slaughtered animals at slaughterhouses of Dhamar and Taiz governorates are shown in Table 6. The cysts obtained from the lungs and livers of cattle were more fertile compared to cysts obtained from other animals' species. Similarly, high number of calcified cysts (3.14%) was observed in livers recovered from cattle and the low number (0.17%) in liver of goats; whereas, nofrom organs of camels. The relation between cyst-type, affected organ, and animal species were significant differences ($P<0.05$).

In human

The results of this study revealed that cystic echinococcosis is common prevalent in humans at Dhamar and Taiz governorate. These results are in agreement with findings of Al Hureibi et al. (1992), Azazy et al. (2000), Alghoury, et al. (2010), Tantawy (2010), Al-Shibani et al. (2012) who carried out studies in humans echinococcosis in Yemen and other workers in different regions of the world (Acosta-JamettMan et al., 2010;Rahimi et al., 2011;Manfredi et al., 2011; Mandal and Mandal, 2011;Khan et al., 2013; Singhet al., 2013). In this study, the overall prevalence of echinococcosis in humans in both governorates was 2.9 per cent. These results are partially in accordance with findings of some above workers who reported the prevalence rate ranged from 2.3 to 8.5 percent, and it's lower than findings of Alghoury, et al. (2010), Saida and Nouraddin (2011), Al-Shibani et al.(2012), Singh et al. (2013),

who reported the prevalence rate from 15.43 – 55.03 percent. The differences in the prevalence rate recorded in this study and above workers may be attributed to socio-economic, cultural status, standard medical services and size of the samples. The patients who admitted either in government or private hospitals for surgical operation due to EC during same period of study were more in Dhamar governorate comparing to Taiz governorate. This could be attributed to health and education level, availability and population of dogs in studied area, size of the samples examined and contamination of environment with eggs of *E.grangulosus*.

The results in this study revealed that, all the infected patients with cystic echinococcosis were females (5.07%); whereas, none of male. These results are in agreement with findings of Alghoury, et al. (2010), Al-Shibani et al. (2012) who reported that females are more prone to infection compared to males. Traditionally in Yemen; the females are more associated to animals either in the home or in field. This association may be increased the risk of infection and transmission of diseases to them.

In the present study, the higher infection rate of EC was recorded in age group of less than 20 years old. The results of this study are in consistent with findings of Saida and Nouradin (2011) who studies the epidemiology of echinococcosis in humans and animals in Iraq. The higher infection rate in age group less than 20 years may due to that young are exposed to infection when they play with dogs or contact with soil or contaminated sand with faeces of infected dogs. In addition, McManus et al.(2003) and Al-Shibani et al. (2012) suggested that human cystic echinococcosis may be occur in the subjects/patients in between 1-75 years of age, but high prevalence rate

recorded in age groups from 20-40 years old.

In animal

The results of present study revealed that CE is prevalent in animals in study areas of Dhamar and Taiz governorates. This is in line with earlier studies carried out in different countries of the world including Yemen (Azlaf and Dakkak, 2006 in Morocco; Christodouloupoulos et al., 2008 in Greece; Kebede et al., 2009 in Ethiopia; Acosta-Jamett et al., 2010 in Chile; Mohamadin and Abdelgadir, 2011 in Sudan; Manfredi et al., 2011 in Italy; Kouidri et al., 2012 in Algeria; Muqbil eat al., 2012 in Yemen; Khan et al., 2013 in India; Azami et al., 2013 in Iran; Qingling et al., 2014 in China; Hayajneh et al., 2014 in Saudi Arabia). The overall prevalence rate of CE in animals at Dhamar and Taiz governorates` slaughterhouses was 22.9 % which is higher (22.90%) than that reported from other geographical zones of the country (Baswaid, 2007 in Hadhramout; Muqbil et al., 2012 in Aden), they reported the prevalence rate as 5.45% and 2.9% respectively. The current findings indicative of a high prevalence and comparable to some of these reports from different parts of the country. The occurrence of such a high prevalence in the current study might be due to increasing inflow of livestock from high epidemic with CE areas to Dhamar and Taiz markets. Similarly, several studies have also carried out on CE in different countries of world and reported different rate of infections for example; In Turkey, Umur (2003); Esatagil and Tuzer (2007), In Ethiopia, Regassa et al. (2010); In Sudan, Mohmadin and abdelgadir (2011); In Ethiopia, Fikire et al. (2012); in Iran, Azami et al. (2013); In libya, Kassem et al. (2013) reported the prevalence rate ranging between 2.5- 52.69 %. The higher prevalence rate of CE reported by above

workers may be attributed to size of samples, difference in strains of *E. granulosus* that exist in different geographical situations, difference in culture and social activities, dog population in the region, animal species, status condition of public health and Veterinary services and variation in agro-ecology zones.

In the present study, infection of CE was slightly higher in animals at governorate of Dhamar (24.31%) compared to Taiz (20.95%). The difference in prevalence rate of CE in livestock between two governorates may be due to farming practices, stocking rate, and climatic conditions.

Animal species, age, sex, and month variation (season) were considered as potential risk factors for the occurrence of CE in animals at slaughterhouses of Dhamar and Taiz governorates. Accordingly, the higher prevalence rate was recorded in cattle (22.91%). These results are higher than prevalence rate recorded by Mohamadin et al. (2010) in Sudan (2.8%), Muqbil et al. (2012) in Aden (0.5%), Yemen, Shahnazi et al. (2013) in Iran (1.27%), Saida et al. (2013) in Iraq (7.77%); while, it's lower than rate recorded by Regassa et al. (2010) in Ethiopia (52.69%). The contrary in prevalence rate recorded in cattle in this study and other studies may be due the breed of animals, geographical areas and management practice. In the hand, the low prevalence rate was recorded in goats compared to all animals species subjected to investigation. These results are in agreement with findings of kumsa & Mohammedzien (2012) and Saida et al. (2013) who recorded low prevalence rate in goats compared to other animal species investigated. This could be attributed to the fact that goats feed mainly by browsing, while cattle and sheep who graze close to the root of on pastures that may be contaminated eggs of *E.*

granulosus that may increase the risk of infection.

Significant variations were observed in the prevalence rate of CE among age groups of animals in the current study. The higher rate of infection was recorded in animals above 6 years old; whereas the lower rate in young animal groups. The results of this study are in line with findings of Kassem et al. (2013) in Libya; kumsa and Mohammedzein (2012) in Ethiopia, who observed that older animals are more susceptible to CE compared to younger animals. The higher infection rate recorded in old animal groups could be attributed to that aged animal have longer exposure time to eggs of *E. granulosus* compared to young. Moreover, Khan et al. (2013) cited that there is positive correlation between infection rate of the disease and age of the animal.

Data on sex wise observations revealed that the prevalence of CE was high in females compared to males. The results of this study are in consistent with findings of Muqbil et al. (2012); Kassem et al. (2013). The higher rate of infection in female animals slaughtered in slaughterhouses /abattoirs of Dhamar and Taiz governorates may be attributed to females are more susceptible to the infection of *E. granulosus* due to hormonal factor as suggested by Daryani et al. (2007) and Ibrahim (2010).

The results of this study showed that CE infection was prevalent throughout the study period. However, the level of infection was not significant among the months during the period of study. The higher rate of infection was recorded in August; whereas the lower rate in July. These results are in agreement with findings of Mohamadin and Adelqadir, (2011) who reported that there was no significant difference in infection rate of CE among different months of the study. The

higher rate of infection recorded in month of August may be attributed to environmental factors which are suitable for life cycle and development survival of causative agent.

In this study, results revealed that hydatid cysts occurred most commonly in the lung (52.27%) and followed by liver (42.04%). This might be due to the fact that animals are slaughtered at older age, during which period the liver capillaries are dilated and most oncospheres pass directly to the lungs; additionally, it is possible for the hexacanth embryo to enter the lymphatic circulation and could be carried via the thoracic duct to the heart and lungs in such a way that the lung may be infected before or instead of liver (Arene, 1985).

A total of 573 cysts from different affected organs were collected, counted, and subjected to characterization. The higher numbers of small, medium and large sized cysts were found in lungs than liver; whereas, the kidney and hearth harbored low number of small sized cyst. The reason for higher percentage of large, medium and large cysts in the lung and liver is may be due to soft consistency of the lung and liver, while the lower proportion of small cysts in kidney may indicate late infection of the animals and due to immunological response of the host which might preclude expansion of cyst size (Torgerson et al., 2002).

Information on the prevalence rate of fertility and sterility of cysts in affected organs of various domestic herbivores provide reliable indicators of the importance of each type of animals as a potential source of infection to dogs. The variation in infertility, sterility and calcified of cysts depending on geographical situation, kind of infected hosts and organs and strain of parasite(Saeed et al. 2000; Gemmel et al., 2002; Azami et al.,2013). The results of this study oninfertility and sterility could be explained in the views of above workers.

It could be concluded that CEis prevalent in humans and animals at Dhamar and Taiz governorates. The risk factor of age influenced significantly in the prevalence of CE in animals and humans. This information could be provided baseline for developing epidemiologically control strategies for controlling *Echinococcus granulosus* parasites, the causative agent of CE. Further studies on CE infections are needed to be conducted in other geographical areas of the country. Promotion and improving the medical health service and animal management among the farms of small farmers. Control and Eradication of the stray dogs by the optimal sanitary methods is recommended.

Table.1 The frequency and distribution of cystic echinococcosis in human in different organs at Dhamar and Taiz governorates

Organ	No. of individuals examined	No. of individuals infected	Prevalence %	P value	χ^2
Liver	244	6	2.46	0.350	0.875
Lung	244	1	0.41		

Table.2 Risk factors influencing distribution of cystic echinococcosis in human in Dhamar and Taiz governorates

Risk factor	No. of patients examined	No. of patients infected	Prevalence %	P value	X ²
Region					
Dhamar governorate	139	5	3.59	.000	259.044
Taiz governorate	105	2	1.90		
Age				000	19.102
20<	40	2	5.00		
21-40	116	4	3.44		
41-60	75	1	1.33		
>61	13	0	0.00		
Sex				.660	13.179
Male	106	0	0.00		
Female	138	7	5.07		

Table.3 Risk factors influencing distribution of cystic echinococcosis prevalence in animals at Dhamar and Taiz governorates

Risk factor	No. of animals examined	No.of animal infected	Prevalence %	P value	X ²
Governorate (region)				.437	.603
Dhamar	218	53	24.31		
Taiz	167	35	20.95		
Animal species				.752	1.205
Cattle	257	63	24.51		
Sheep	62	12	19.35		
Goats	61	12	19.67		
camel	5	1	20.00		
Age				.000	221.817
2 <	106	4	3.77		
3-5	133	24	18.05		
6-8	132	49	37.12		
>9	14	11	78.57		
Sex				.016	5.833
Male	138	22	15.94		
Female	247	66	26.72		
Month Variation (Season)				.614	3.563
May	65	17	26.15		
June	89	20	22.47		
July	68	10	14.71		
August	72	19	26.39		
September	72	17	23.61		
October	19	5	26.32		

Table.4 Distribution of cystic echinococcosis in different organs of animal species at Dhamar and Taiz governorate

Animal species	No. of affected organs					P	X ²
	Lung	Liver	Kideny	Heart	Liver & Lung		
Cattle	34(38.63%)	26(29.54%)	1(1.13%)	0	2(2.27%)	0.000	121.817
Sheep	7(7.95%)	4(4.55%)	0	1(1.13%)	0		
Goats	5((6.82%)	6(6.82%)	0	0	1(1.13%)		
Camels	0	1(1.13%)	0	0	0		
Total	46(52.27%)	37(42.06%)	1(1.13%)	1(1.13%)	3(3.41%)		

Table.5 Cyst size and count in relation to organ in slaughtered animals in slaughter houses of Dhamar and Taiz governorates

Organ	Small	Medium	Large	Total	P value
Lung	189(32.9%)	87(15.2%)	39(6.8%)	315(54.97%)	0.000
Liver	153(26.8%)	67(11.8%)	30 (5.2%)	251(43.80%)	
Kidney	5(0.87%)	00	00	5(0.87%)	
Heart	3(0.52%)	00	00	3(0.52%)	
Total	350	154	69	573	

Table.6 Fertility and sterility of hydatid cyst found in infected organs of animals slaughtered at slaughterhouses of Dhamar and Taiz governorates

Animal species & organs	Fertile		Sterile		Calcified		P value
	No. of cysts	%	No. of cysts	No. of cysts	No. cyst	%	
cattle							0.000
Lung	108	18.84	122	21.29	00	00	
Liver	41	7.16	151	26.35	18	3.14	
Kidney	00	00	5	0.87	00	00	
heart	00	00	00	00	00	00	
Sheep							
Lung	35	6.10	12	2.09	00	00	
Liver	10	1.74	4	0.69	2	0.34	
Kidney	00	00	00	00	00	00	
heart	00	00	3	0.53	00	00	
Goat							
Lung	31	5.41	00	00	00	00	
Liver	21	3.66	00	00	1	0.17	
Kidney	00	00	00	00	00	00	
heart	00	00	00	00	00	00	
Camel							
Lung	00.	00	00	00	00	00	
Liver	00	00	9	1.57	00	00	
Kidney	00	00	00	00	00	00	
heart	00	00	00	00	00	00	
Total	246	42.93	306	53.40	21	3.66	

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