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RESEARCH ARTICLE

SERO-PREVALENCE AND EXPOSURE RATES OF HUMANS TO *ECHINOCOCCUS GRANULOSUS* INFECTION IN SOUTHERN LIBYA

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ABSTRACT

Human cystic hydatidosis due to *Echinococcus granulosus* larva is a serious public health problem in many parts of the world. The disease is highly endemic in Libya, previous studies concentrated on north-east, central and north-west areas of the country. This study determined sero-prevalence and exposure rates of *Echinococcus granulosus* infection in Southern Libya. This household community-based cross-sectional study was carried in Murzuk province in southern Libya during the period January 2004 to July 2005. Following informed consent, 1274 individuals from 25 villages were randomly recruited. Interviews, serologic screening and biochemical profiles were carried out. Demographic, clinical and laboratory data were collected, entered, checked and verified using the EpiInfo2004 software. Twenty nine individuals (29/1274; 2.3%) were sero-reactive, sero-prevalence rates were significantly variable among different areas [range 1.9% to 4.1%; *p=0.0006*]. Males were significantly more sero-reactive compared to females [*p=0.008*]. Individuals in the age group 7-50 years were more affected compared to other age groups (*p=0.006*). Sero-reactive individuals had serum urea, creatinine and bilirubin within reference ranges. AST, ALT and alkaline phosphatase liver enzymes were universally increased (*p=0.0000*). The exposure rate to *Echinococcus granulosus* was calculated as 6.8%. *Echinococcus granulosus* infection is prevalent in southern Libya with an exposure rate of 6.8%.

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INTRODUCTION

Echinococcus granulosus, the causative organism of cystic echinococcosis (CE) is one of the most geographically widespread pathogenic parasitic zoonosis (Shambesh, *et al.,* 1992). Human CE is known to be endemic in North Africa and has been reported in Libya, Tunisia, Algeria, Morocco and to a lesser extent in Egypt (Abada *et al.,* 1977; Larboui, *et al.,* 1979; Gebreel, *et al.,* 1983; Mlika *et al.,*1986; Bchir, *et al.,*1988; Pandey, *et al.,* 1988). In Libya, CE is one of the most important parasitic infections of humans and domestic animals. A prevalence of 8.4% has been reported in sheep as compared to 1.5% in goats, 5.4% in cattle, and 31.9% in camels (Packer *et al.,* 1985; Gusbi, *et al.,* 1987a ; Gusbi, *et al.,*1987b; el Mufti, *et al.,*1978). The main definitive host of *E. granulosus* in Libya is the domestic dog, where in rural areas up to 60% of the dogs are infected, with lower rate of infection in urban areas (Aboudaya, 1985a; Dar & Taguri, 1993). The primary treatment of Human CE in Libya is surgery (Khan *et al.,* 1990). The public health importance of this infection has been quantified mainly by retrospective reviews of hospital surgical records (Macpherson *et al.,* 1987). CE constituted 0.05 - 0.85% of all admissions in the major surgical departments in northwest and northeast areas of Libya in mid to late seventies (Aboudaya, 1985b; Bchir, *et al.,*1991; Moosa & Abdl-Hafez, 1994; Craig, *et al.,* 1996; Shambeshi *et al.,* 1999; Gutierrez *et al.,* 2003). Sero-epidemiological surveys gave variable results (3.4-10%) for *Echinococcus* sero-positivity at different areas of Libya (Gusbi, *et al.,* 1987; Abu-Hassan, *et al.,* 2002). Ultrasound-serologic CE surveys in different parts of Libya showed a prevalence rate of 1.4%. Portable ultrasound-detected CE can be serologically confirmed with reasonable accuracy (Mlika *et al.,* 1986; Qaqish, *et al.,* 2003; Bai *et al.,* 2002; Watson-Jones & Macpherson, 1988; Sotiraki *et al.,* 2003). This prospective, cross-sectional and household community-based

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study aimed to determine sero-prevalence and exposure rates of *Echinococcus granulosus* in Murzuk province, in southern Libya.

MATERIALS AND METHODS

Study design

This was a prospective, cross-sectional and household community-based study that was conducted in Southern Libya during the period from January 2004 to July 2005.

Study area and population

The Murzuk province has a total population of 55000 with 27324 males and 27676 females (National Census 2001). This southern province of Libya included rural and urban areas with diverse communities. The province is the widest in Southern Libya and the second wide province in Libya with rural communities, primitive lifestyle and culture. It is 140 km south-east of Sebha, has Five districts and comprising 25 villages and towns.

Methods

Following informed consent a total of 1274 individuals from 25 villages in the province were randomly recruited using a multi-stage sampling design based on areas, villages and households. Volunteers were interviewed and screened serologically with ELISA (Gold-standard) to detect anti-echinococcal antibodies. Biochemical profiles [AST, AST, ALP, bilirubin, creatinine and urea] of volunteers were examined using Reflotron Machine for Blood dry chemistry (Boehringer Mannheim, Germany). Demographic, clinical data and laboratory data were collected, entered, checked and verified using the EpiInfo2004 software

RESULTS

Data from 1274 individuals were considerable analyzable in the five areas of Murzuk province. The age range was 1-86 years with a mean ±SD of 32.00 ±15.70 years and a male: female ratio of 1:2. The mean age for males was 32.6±16.9, while that for females was 31.7±15 ($p>0.05$) (Table 1).

Table 1. Seroprevalence of anti *E. granulosus* antibodies in different age groups of the study population in Murzuk province, southern Lybia

Age (years)	Sero-reactive males	Sero-reactive Females	Total
1-10	0/28 (00%	1/55 (1.8%)	1/83 (1.2%)
11-50	7/363 (1.9%)	18/673 (2.7%)	25/1036 (2.4%)
>50	2/68 (2.9%)	1/87 (1.1%)	3/155 (1.9%)

Twenty nine volunteers were found to be sero-reactive (29/1274) using ELISA technique, giving an overall sero-prevalence of 2.3%. There was a significant difference in the sero-reactivity between the two sexes, twenty males were sero-reactive compared to 9 females ($p= 0.0000$). The sero-prevalence for the males was 2% (9/459) compared to 2.5% (20/815) in the females ($p= 0.004$) (Table 1). No significant difference in ages could be detected between sero-reactive and sero-non reactive individuals [32.4±14.37 years for sero-reactive and 32.0±15.7 for sero non-reactives; $p>0.05$). The age group 11-50 years had the highest prevalence of 2.4% compared to 1.2% and 1.9% for the age groups 1-10 years and >50 years respectively (Table 2) ($p= 0.006$).

Table 2. Sero-prevalence of anti-*Echinococcus granulosus* antibodies for the 5 areas in Murzuk province, southern Libya

Areas	Total Males	Total Females	Reactive males	Reactive females	Total
1	47	177	0 (0%)	5 (2.8%)	05 (2.2%)
2	214	367	4 (1.9%)	7 (1.9%)	11 (1.9%)
3	102	146	2 (2%)	3 (2.1%)	05 (2.0%)
4	39	61	1 (2.6%)	2 (3.3%)	03 (3.0%)
5	57	64	2 (3.5%)	3 (4.7%)	05 (4.1%)

As for the chemical profiles: AST, AST, and ALP mean levels ±SD were significantly elevated for the sero-reactive individuals at 55.7±7.6, 57.59±8.0 and 200.2±61.2 respectively. The levels were within normal ranges for sero-non reactive individuals at: 8.5±8.0, 15.8±11.7 and 164.5±59.7 respectively ($p= 0.0000$). Serum bilirubin, creatinine and urea were within normal ranges for all volunteers (Table 3).

There were significant differences in the sero-prevalence in the surveyed areas of Murzuk province [Area1, Area2, Area3, Area4, Area5 had sero-reactivities of 2.2%, 1.9%, 2%, 3% and 4.1% respectively] ($p= 0.04$) Table 4. The means ages and the male: female ratios were not significantly different between the different areas of Murzuk ($p>0.05$). Sero-prevalence was markedly variable between the twenty five villages of the study area and ranged from 0% to 33.3% (Table 4). The highest sero-prevalence of 33.3% was seen in the small village of Elbythan (Area 1) in Murzuk province.

An exposure rate of 6.8% was tentatively calculated from those who were sero-reactive and had abnormal chemical profile plus those with abnormal chemical profile parameters and no sero-reactivity. This exposure rate did not take into consideration that 10-20% of liver affection and around 40% of pulmonary CE that is not reflected as positive serology, making this an underestimate of the actual exposure rate.

DISCUSSION

Availability of baseline data about *E. granulosus* sero-reactivity and actual disease rates will help future control programmes by availing data that will help in the calculation of fairly accurate exposure rates. With the availability of safe and relatively cheap mass chemotherapeutic agents like Praziquantel and Albendazole future control/eradication programs can be fulfilled with ease. The present cross sectional community-based results is the first preliminary serological survey on the sero-prevalence of human cystic echinococcosis in the Murzuk province, southern Lybia. A sero-prevalnce of 2.3% confirms that southern Libya has a comparable infection rates as northern-Libya where *Echinococcus granulosus* is considered to be endemic (Shambeshi *et al.,* 1992).

Table 3. Chemical profiles of volunteers' sera categorized as sero-reactive and sero-non reactive for anti-Echinococcus antibodies

Variables	Mean ±SD Age/years	ELISA (OD)	ALP (UI)	AST (UI)	ALT (UI)	BILIRUBIN mg/dL	UREA mg/dL	CREATININE mg/dL
Positive (n= 29)	32±9	0.53±0.2	200.2±61.2	55.66±7.6	57.58±8.0	0.82±0.4	36.78±11.7	0.81±0.26
Negative (n= 1245)	31±7	0.20±0.1	164±59.7	8.45±8.1	15.75±11.7	0.78±0.4	35.90±11.6	0.82±0.24
p values		**	**	**	**	*	*	*

Continuous variables are expressed as means ±SD. *p value* ** = Significant *p value* * = not Significant

Table 4. Sero-prevalence of anti *Echinococcosis* antibodies in villages & towns in the 5 areas in Murzuk province, southern Libya

Areas	Villages	Males	Females	Total
Area1	1-Foungal	0/44	3/166	3/210
	2-Algoleb	0/1	1/6	1/7
	3-Bendlef	0/2	0/2	0/4
	4-Elbytan	0/0	1/3	1/3
Area2	1-Murzuk	2/155	5/268	7/423
	2-Edlem	1/37	1/78	2/115
	3-Heghgel	0/8	1/10	1/18
	4-Jezaw	0/15	1/10	1/26
Area3	1-Traghen	2/100	3/142	5/242
	2-Elzytona	0/2	0/4	0/6
Area4	1-Wadiutba	0/14	0/13	0/27
	2-Agar	0/8	0/12	0/20
	3-Elsbitat	0/7	1/12	1/19
	4-Marhba	1/12	2/9	3/21
	5-Mknosa	0/3	0/2	0/5
	6-Tesawa	1/12	0/17	1/29
Area5	1-Um-Elaraneb	0/11	1/16	1/27
	2-Algatron	0/12	0/9	0/11
	3-Ebder	0/3	0/0	0/3
	4-Majdol	0/3	0/7	0/10
	5-Msgoen	0/1	1/3	1/4
	6-Tarbo	0/3	0/4	0/7
	7-Tmesa	0/5	0/8	0/13
	8-Toewe	0/5	0/2	0/7
	9-Zwela	0/6	1/12	1/18

The reported prevalence rate is similar to that of countries in the area i.e. Jordan, Tuniasia and Spain, where a sero-prevalence of 2.4% was previously reported. This also points to the pan-endemicity of *Echinococcus granulosus* infection in the whole of the Mediterranean basin. With the rapid and extended movement of people between these countries, a need is clearly evident for a joint control/eradication programme for *Echinococcus granulosus* (Mlika *et al.,*1986; Khan et al., 1990; Moosa & Abdl-Hafez, 1994; Gutierrez, *et al.,* 2003).

The observed difference of sero-reactivity in different age groups has been previously reported in other endemic countries (Aboudaya, 1985a; Macpherson *et al.,* 1987; Bchir *et al.,* 1988; Abu-Hassan *et al.,* 2002; Qaqish *et al.,* 2003). The age-related increase in the sero-prevalence rate suggests that exposure to *Echinococcus granlosus* continues throughout life and endemicity of infection in the study area. The sero-prevalence of CE detected in this study that was significantly higher in females (2.5%) compared to males (2%) (*P= 0.0000009*) is concordant with findings from northern Libya. Although the sero-reacitivity in the north was slightly lower, the female/male difference was evident [2% for females and 1.3% for males] (Shambesh, *et al.,* 1992). This finding is also similar to findings from Tunisia where females were also at a greater risk of infection/sero-reactivity compared to males males; 4.3% and 2.5% respectively (Bchir, *et al.,* 1988). Internationally, research findings also confirmed that females are probably as twice affected compared to males. Reports from northwestern Kenya documented that females are affected more than males with a Females: Males ratios of 2 (Macpherson, *et al.,* 1987). Bai and colleagues reported from West China that females are at a significantly greater risk of infection compared to males [Female: Male is 2:1] (Bai, *et al.,* 2002). Differences in prevalence rates between the sexes is most probably attributed to different behavioral attitudes towards dogs in some parts of the world. This could also be the case in southern Libya, although no specific observations on human-dog contact have as yet been made (Watson-Jones & Macpherson, 1988).

The high prevalence rates in this study and other studies in northern Lybia and other neighboring countries reflects the high rates of transmission of the parasite. This is probably a

result of behavioral factors and common livestock rearing practices in North Africa that facilitate transmission between dogs and intermediate hosts. These sero-prevalence rates are not as high as those reported from other countries in the Mediterranean basin like Greece where a seroprevalence rate of 29% has been reported in humans (Sotikari, *et al.,* 2003). But, there is no room for complacency and efficient control programmes has to be initiated as soon as possible to stop any rise in prevalence rates in the future.

Chemical investigations of liver and kidneys parameters of the volunteers showed a significant difference in levels of ALT, AST and ALP, between sero-reactive sero-non reactive individuals. This probably indicates massive hepatic involvement by the parasite. Our findings were similar to those reported by other investigators (Dar & Taguri, *et al.,* 1993; Sigh *et al.,* 2001; Koppen *et al.,* 2003).

The difference in sero-prevalence of CE in the five sub-regions of Murzuk could be due to differences in exposure rates, differences between urban and rural communities or behavioral differences. Similar results were recently reported, where significant serological differences were detected between rural and urban areas (Acosta-Jamett, *et al.,* 2014). The marked variation in sero-reactivity between the villages of the study area has been reported before in northern Libya by (Shambesh, *et al.,* 1992). It is not known why such inter-village rates differed but it does not appear to be unique to geographical areas.

The sero-prevalence of human CE increased with age, and it seems that antibodies persist for some time after leaving the endemic area as was reported previously in immigrants from North Africa A.U.R.C Report, 1986). Le Goff claims that Moslem immigrants from North Africa are sero-reactivity because they continue to practice traditional home slaughtering of sheep is unproven (Le Goff *et al.,* 1987).

Conclusion

Sero-prevalence rate for CE in southern Libya is high. Sero-positivity increases with age confirming the endemicity of human CE in Murzuk province. A national or preferably regional control program should be seriously considered. An exposure rate of 6.8% is an underestimate of the actual exposure rate.

REFERENCES

A.U.R.C., A.R.C., A.C.A.P.E.M., Chipponi J, Huguier M. 1986. Surgically treated hydatid cysts of the liver in France. Epidemiology, diagnostic and therapeutic procedures. Study of 306 cases. *Gastroenterol Clin Biol.,* 10: 419–23.

Abada M, Galli I, Bousallah A, Lehmann G. 1977. Kystes hydatiques du cerveau problems diagnostiques et therapeutiques a propos de 100 case. *Neuro-Chir.,* 23: 195–204.

Aboudaya MA, 1985a. Prevalence of human hydatidosis in Tripoli region of Libya. *Int J Zoonoses.,* 12:304-7.

Aboudaya MA. 1985b. Prevalence of Echinococcus *granulosus among* domestic animals in Libya. *Trop Anim Health Prod.,* 17: 169–170.

Abu-Hasan N**,** Daragmeh, M, Adwan, K, Al-Qaoud, K & Abdel-Hafez SK. 2002. Human cystic echinococcosis in the West Bank of Palestine: surgical incidence and seroepidemiological study. *Parasitol Res.,* 88:107-12.

Acosta-Jamett G, Weitzel T, Boufana B, Adones C, Bahamonde A, Abarca K, Craig PS, Reiter-Owona I. 2014. Prevalence and risk factors for echinococcal infection in a rural area of northern Chile: a household-based cross-sectional study. *PLoS Negl Trop Dis* 8:e3090. doi: 10.1371/journal.pntd.0003090. eCollection 2014.

Bai Y, Cheng N, Jiang C, Wang, Q. & Cao D. 2002. Survey on cystic echinococcosis in Tibetans , West China. *Acta Trop.,* 82:381-5.

Bchir A, Hamdi A, Jemni L, Dazza MC, Allegue M, BrahamMS, Prazuck T, Achour H, Gaudebout C, Rousset JJ, Jemmali M. 1988. Serological screening for hydatidosis in households of surgical cases in central Tunisia. *Ann Trop Med Parasitol.,* 82*:* 271–273.

Bchir A, Larouze B, Soltani M, Hamdi A, Bouhaouala H, Ducic S, Bouden L, Ganouni A, Achour A, Gandebout C, Rousset JJ, Jem-Mali M. 1991. Echotomographic and serological population -based study of hydatidosis in Central Tunisia. *Acta Trop.,* 49: 149–153.

Craig PS, Rogan MT, Allan JC. 1996. Detection, screening and community epidemiology of taeniid cestode zoonoses: cystic echinococcosis, alveolar echinococcosis and neuro cysticercosis. *Adv Parasitol.,* 38: 196–250.

Dar FK, Taguri S. 1993. Human hydatid disease in eastern Libya*. Trans R Soc Trop Med Hyg.,* 72: 313–314.

el Mufti M, Kamag A, Ibrahim H, Taktuk S, Swaisi I, Zaidan A, Sameen A, Shimbish F, Bouzghaiba W, Hassi S. 1978.Albendazole therapy of hydatid disease: 2-year follow-up of 40 cases. *Ann Trop Med Parasitol.,* 87: 241–246.

Gebreel AO, Gilles HM, Prescott JE. 1983. Studies on the sero-epidemiology of endemic diseases in Libya. I. Echinococcosis in Libya. *Ann Trop Med Parasitol.,* 77: 391–393.

Gusbi AM, Awan MA, Beesley WN. 1987a. Echinococcosis in Libya. II. Prevalence of hydatidosis (*Echinococcus granulosus*) in sheep*. Ann Trop Med Parasitol.,* 81: 35–41.

Gusbi MA, Awan MAQ, Beesley WN. 1987b. Echinococcosis in Libya. I. Prevalence of *Echinococcus granulosus* in dogs with particular reference to the role of the dog in Libyan society. *Ann Trop Med Parasitol.,* 81: 29–34.

Gusbi MA. 1988. Results of a questionnaire on offal disposal issued. *Med Parasitol* 82: 635–636.

Gutierrez MP, Ramirez, I, Zarzosa Mdel P, Fernandez, JM, Duenas AL, Mantecon MA, Almaraz, A, Rodriguez-Recio MJ, Marcos H, Alonso P, Bartos MA, Orduna A,

Khan AH, Elsageyer MM, Kidwai SA. 1990. Sero-epidemiological study of human hydatid disease in Libya using finger prick blood samples. *Ann Trop Med Parasitol.,* 84: 537–539.

Koppen S, Wejda, B, Dormann A, Seesko H, Huchzerrmeyer H, Junghanss T. 2003. [Anaphylactic shock caused by rupture of an echinococcal cyst in a 25-year-old asylum seeker from Georgia] *Dtsch Med Wochenschr,*128:663-6.

Larbaoui D, Alloula R. 1979. Etude pidmiologique de l'hydatidose en Algrie. Resultats de deux enquetes retrospectives portant sur 10 ans. *Tunis Med* 57: 318–326.

Le Goff L, Marty P, Gari-Toussant M, Dumon H, Fichoux YL, 1987. L'hydatidose humaine dans les Alpes Maritimes. *BullSoc Fran Parasitol.,* 5: 219–222.

Macpherson CN, Romig,T Zeyhle E, Rees PH, Were JB. 1987. Portable ultrasound scanner versus serology in screening for hydatid cysts in a nomadic population. *Lancet,* 1259–261.

Mlika N, Larouze B, Gaudebout C, Braham B, Allegue M, Dazza M C, Dridi M, Gharbi S, Gaumer B, Bchir A, Roussett JJ, Delattre M, Jemmali M. 1986. Echotomographic and serologic Screening for hydatidosis in a Tunisian village. *Am J Trop Med hyg Hyg* 35: 815–817.

Moosa RA, & Abdl-Hafez, SK. 1994. Sero-diagnosis and epidemiology of human uniloucular haydatidosis in Jordan. *Parasitol Res.,* 80:664-7.

Packer DE, Ali TM. 1985. *Echinococcus granulosus* in dogs in Libya. *Ann Trop Med Parasitol.,* 80: 137–139.

Pandey VS, Ouhelli H, Moumen A. 1988. Epidemiology of hydatidosis/echinococcosis in Quarzazate, the pre-Saharian region of Morocco. *Ann Trop Med Parasitol.,* 82: 461–470.

Qaqish AM, Nasrieh MA, AlQaoud, KM, Craig, PS & Abdel-Hafez SK. 2003. The sero-prevaelances of cystic echinococcosis, and the associated risk factors, in rural-agricultural, Bedouin and semi-bedouin communities in Jordan. *Ann Trop Med parasitol*., 97:511-20.

Rodriguez–Torres A. 2003. [seroprevalence of infection due to *echinnococcus granulosus* in the population of Castilla and Leon (Spain)]. *Enferm Infecc Microbiol Clinic,* 21: 563-7.

Shambesh M K, Macpherson CNL, Beesley WN, Gusbi A. 1992. Prevalence of human hydatid disease in northwestern Libya: a cross-sectional ultrasound study. *Ann Trop Med Parasitol.,* 86:381–386.

Shambesh, MA Craig PS, Macpherson CN, Rogan M T, Gusbi, AM, Echtuish EF. 1999. An extensive ultrasound and serologic study to investigate the prevalence of human cystic echinococcosis in Northern Libya. *Am J Trop Med Hyg.,* 60:462-468.

Singh M, Rathore SS, & Singh A. 2001. Uncommon clinical presentation in a case of hydatid cyst of liver. *J Ind Acad Clin Med.,* 2: 93-95.

Sotiraki S, Himonas C, Korkoliakou P. 2003 hydatiodosis-echinococciosis in Greece. *Acta Trop.,* 85:197-201.

Watson-Jones DL, Macpherson CN. 1988. Hydatid disease in the Turkana district of Kenya. VI. Man:dog contact and its role in the transmission and control of hydatidosis amongst the Turkana. *Ann Trop Med Parasitol.,* 82: 343–356.

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