

An epidemiological profile of brucellosis in Tabuk Province, Saudi Arabia

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مُرْتَسَم (بروفيل) وبائي لداء البروسيلات في محافظة تبوك، بالمملكة العربية السعودية
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الخلاصة: أجريت دراسة استيعابية لجميع حالات داء البروسيلات البالغ عددها 137 حالة، والتي حدثت في محافظة تبوك بالمملكة العربية السعودية في عام 1997. وقد اعتبر عيار ترصّ البروسيلات الذي يبلغ 80/1 فأكثر، أو ارتفاع عيار التراص مع سبق ظهور علامات وأعراض نموذجية، بيّنة على الإصابة بالعدوى. وقد بلغ معدل الحدوث 34 في كل 100 000، ومتوسط العمر 33.8 ± 13.9 سنة (المجال 3 - 72 عاماً) والنسبة بين المصابين والمصابات 1.8 : 1. وكانت 63.5% من الحالات من سكان الريف، بينما كان 58.4% من المصابين ممن يربون الحيوانات في بيوتهم أو في أماكن أخرى، و27% ممن يخالطون الحيوانات أثناء العمل أو يعملون في المزارع، أو من كليهما، و88.3% ممن أبلغوا عن شرب لبن نيء. وتمثلت أوسع العوامل المعدية شيوعاً في البروسيلة المالتية *Brucella melitensis* والبروسيلة المحهضة *B. abortus*، والبروسيلة الخنزيرية *B. suis*. واكتشفت الإصابة بتضخم الطحال في 25.5% وضخامة الكبد في 22.6% من الحالات.

ABSTRACT All 137 brucellosis cases occurring in Tabuk Province, Saudi Arabia in 1997 were studied retrospectively. Brucella agglutination titre of $\geq 1/80$, or rising titre plus history of typical signs and symptoms were considered evidence of infection. The incidence rate was 34/100 000, mean age 33.8 ± 13.9 years (range: 3-72 years) and male:female ratio 1.8:1. There were 63.5% of cases rurally resident, 58.4% kept animals at home or elsewhere, 27.0% worked with animals and/or on farms, and 88.3% reported a history of raw milk ingestion. The most common infecting agents were *Brucella melitensis*, *B. abortus* and *B. suis*. Splenomegaly and hepatomegaly were detected in 25.5% and 22.6% of cases respectively.

Profil épidémiologique de la brucellose dans la Province de Tabouk (Arabie saoudite)

RESUME Tous les 137 cas de brucellose qui se sont produits dans la province de Tabouk (Arabie saoudite) en 1997 ont fait l'objet d'une étude rétrospective. Un titre d'agglutination de Brucella $\geq 1/80$, ou l'élévation du titre plus des signes et des symptômes typiques dans le passé étaient considérés comme preuve de l'infection. Le taux d'incidence s'élevait à 34/100 000, l'âge moyen était de $33,8 \pm 13,9$ ans (âge compris entre 3 et 72 ans) et le rapport hommes/femmes était de 1,8:1. Il y avait 63,5 % de cas résidant en zone rurale, 58,4 % gardaient des animaux à la maison ou dans d'autres endroits, 27,0 % travaillaient avec des animaux et/ou dans des fermes, et 88,3 % signalaient une habitude de consommation de lait cru. Les agents infectieux les plus courants étaient *Brucella melitensis*, *B. abortus* et *B. suis*. Une splénomégalie et une hépatomégalie avaient été dépistées chez 25,5 % et 22,6 % des cas respectivement.

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Introduction

Brucellosis is a zoonotic disease of world-wide distribution. Although eradicated from many Western countries, it represents a major public health problem in Mediterranean Africa and Europe, in central Asia, and in Central and South America [1-6]. The global incidence of brucellosis is probably underestimated because of misdiagnosis and underreporting [7,8]. In Saudi Arabia, the disease is a major diagnostic concern and has been frequently reported among humans and animals [9,10].

In 1997, there was an unexpectedly sharp increase in the number of patients with brucellosis in the Province of Tabuk (north-western Saudi Arabia), a region of seven administrative districts: Hakl, Albedaa, Dubaa, Alwageh, Omlog, Tymaa and Tabuk (the capital), and a population of approximately 400 000 inhabitants. We retrospectively examined the epidemiological characteristics of all reported cases of brucellosis in the Province for 1997.

Methods

Human brucellosis is a reportable disease in Tabuk Province. Ministry of Health regulations require cases of communicable diseases such as brucellosis to be reported regularly (weekly). All hospitals (including military hospitals), primary health care centres, private polyclinics and physicians in the Province provide information to the Preventive Medicine Department of the General Directorate of Health Affairs in Tabuk, for forwarding to the Ministry of Health. Active surveillance is used to obtain incomplete information on reported cases and to detect unreported cases.

Clinical and epidemiological information on human brucellosis cases reported during

1997 were obtained. Personal identifiers for patients were excluded from the database to assure confidentiality. Descriptive, epidemiological and clinical data for each patient were obtained, including: age, sex, nationality, area of residence, marital status, education, occupation, date of onset, date of diagnosis, serological tests, titres, *Brucella* species, symptoms and signs, history of association with animals and/or farms, and history of raw milk ingestion.

A clinical case of brucellosis was defined as any patient with febrile illness characterized by acute or insidious onset and at least two of the following symptoms: night sweats, prolonged fatigue, anorexia, weight loss, or headache; or one of the afore-mentioned symptoms plus positive response by culture or serology. Culture was considered positive if *Brucella* spp. were isolated from a clinical specimen. Serology was considered positive if there was a fourfold rise in titre between acute and convalescent serum specimens, or a single titre of $\geq 1/80$ by agglutination titre or single titre of $\geq 1/4$ by complement fixation test.

Incidence calculations were based on population data from census reports. Due to the insidious nature of brucellosis, the illness onset data were imprecise. We therefore analysed the data by date of diagnosis. Data were analysed using *STATA*, version 3.0. Frequency distributions were tabulated and relevant statistical tests used.

Results

Of the 137 patients' information sets reviewed and confirmed, 55.5% were reported from Ministry of Health hospitals and primary health care centres, 32.1% from private polyclinics, doctors and hospitals, and 12.4% from the military hospital. The

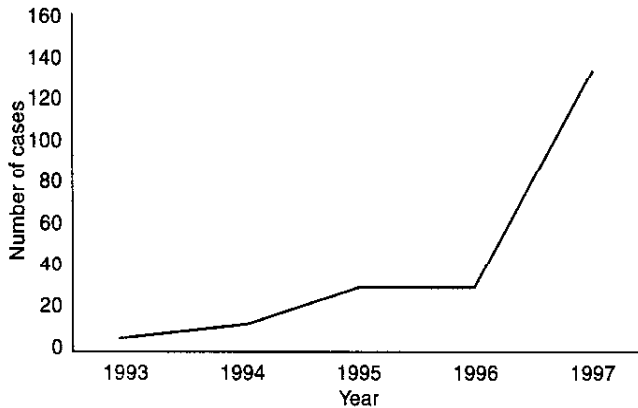


Figure 1 Brucellosis cases in Tabuk (1993-97)

incidence rate was 34/100 000. Figure 1 shows the sharp increase in the number of cases in 1997 compared to the previous 5 years in the province. The mean age was 33.8 ± 13.9 years (range: 3-72 years), with the highest frequency of cases in those aged 30-39 years (32.1%). Males were significantly more affected than females — 64.2% versus 35.8%, a male to female ratio of 1.8:1 (Table 1). The great majority of cases (86.1%) occurred in Saudi nationals and 65.7% of all affected cases were married. There was a seasonal variation of brucellosis throughout 1997, with two peaks — one in May and the other in September (Figure 2).

Socioeconomic data showed that 54.0% of cases had received no formal education; 27.0% worked with animals/on farms; 63.5% were resident in rural areas; and 78.8% were from the Tabuk area (Table 2). More than half of all cases 80 (58.4%) kept animals either at home or on a separate farm, and 121 (88.3%) reported a positive history of raw milk ingestion, either from their own animals and farms, or

Table 1 Demographic data of new brucellosis cases, Tabuk Province, Saudi Arabia, 1997

Variable	No. (n = 137)	%
<i>Age (years)^a</i>		
<10	3	2.2
10-19	16	11.7
20-29	31	22.6
30-39	44	32.1
40-49	23	16.8
50-59	14	10.2
60-69	3	2.2
≥ 70	3	2.2
<i>Sex^b</i>		
Male	88	64.2
Female	49	35.8
<i>Nationality</i>		
Saudi	118	86.1
Non-Saudi Arab	15	11
Non-Saudi, non-Arab	4	2.9

^aMean age (years) = 33.8; standard deviation = 13.9; range = 3-72; median = 32.

^bMale:female ratio = 1.8:1.

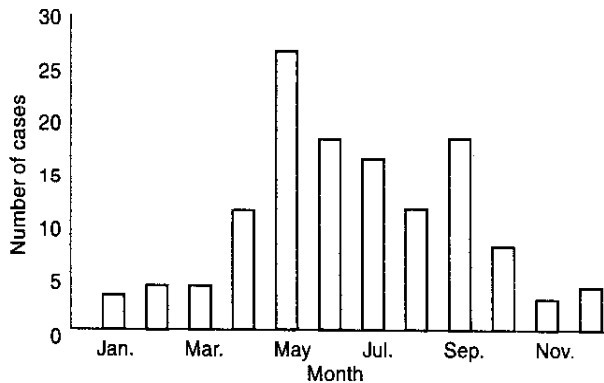


Figure 2 Brucellosis cases in Tabuk by month 1997

as a gift from their neighbours or relatives. The most frequent agglutination titre was 1/320 (in 56.9% of cases). The most common *Brucella* species isolated was *B. melitensis*, in 44.5% of cases, followed by 40.9% of cases of mixed infection of *B. abortus* and *B. melitensis* (Table 3). The predominant clinical manifestations were symptoms of fever, joint/back pain, lethargy, sweating and headache (Table 4). Splenomegaly and hepatomegaly were reported in 25.5% and 22.6% of cases respectively.

Discussion

Brucellosis is a disease with a profound public health and economic impact. Endemicity of human brucellosis in the Middle East in general and in Saudi Arabia has been reported in several previous studies. These studies have shown a close relationship between endemicity of animal infection, inappropriate eating habits and low standards of hygiene [11,12].

The present study revealed an incidence of 34/100 000 (Figure 1) in 1997, a significant increase in the number of reported

cases compared to previous years. This increased incidence could have two possible explanations. First, heavier than usual precipitation during the 1996–97 rainy season resulted in the growth of grasses in the province's desert areas. Because precipitation in neighbouring provinces was not as great as in Tabuk, shepherds and their flocks (particularly sheep, goats, camels and cattle) were attracted from nearby regions to the grassed Tabuk desert. Some of these animals were infected. Subsequently, the infection was transmitted to local healthy animals. A second reason may be due to the cessation of the national programme for the vaccination of animals against brucellosis. However, the rate obtained in our study is lower than those reported in studies previously conducted in other parts of the country. [1,4,5,9,13]. El-Sekait [14], in a study carried out in northern Saudi Arabia, reported an incidence of 1.6% (1600/100 000), compared to the present study's 34/100 000. The difference between the two rates may be related to the difference in areas examined. The El-Sekait study included the other four of the coun-

Table 2 Socioeconomic data of new brucellosis cases, Tabuk Province, Saudi Arabia, 1997

Variable	No. (n = 137)	%
<i>Level of formal education received</i>		
High	2	1.5
Moderate	61	44.5
None	74	54.0
<i>Occupation</i>		
Housewife	43	31.4
Farm and animal related*	37	27.0
Student	19	13.9
Military	19	13.9
Government employee	15	11.0
Teacher	2	1.4
Child	2	1.4
<i>Residence</i>		
Rural	87	63.5
Urban	50	36.5
<i>Area of residence</i>		
Tabuk	108	78.8
Alwageh	13	9.5
Omlog	7	5.1
Tymaa	6	4.3
Dubaa	2	1.5
Haki	1	0.7
Albedaa	0	0

*Includes farmers, agricultural workers, animal dealers, servants on farms and shepherds.

try's northern provinces (Hail, Qurriyyat, Northern Frontier and Al-Jouf).

Seasonal variation of cases is explained according to the geographical nature, as well as customs and traditions in Tabuk. Grass growth in the spring, due to the rainy season, results in more animals being attracted to the area, and thus, an increase in milk and meat production, with a consequent increase in untreated milk and raw animal liver consumption and of new cases of disease peaking in the month of May. In summer, large numbers of urban Saudis

Table 3 Distribution of new brucellosis cases by brucella agglutination titre and *Brucella* spp., Tabuk Province, Saudi Arabia, 1997

Variable	No. (n = 137)	%
<i>Brucella titre</i>		
1/80	2	1.5
1/160	18	13.1
1/320	78	56.9
1/640	23	16.8
1/1280	16	11.7
<i>Brucella spp.</i>		
<i>B. abortus</i>	19	13.9
<i>B. melitensis</i>	61	44.5
<i>B. suis</i>	1	0.7
Combined <i>B. abortus</i> and <i>B. melitensis</i>	56	40.9

habitually return to their original families in the desert and rural areas to spend the vacation. On their return to the towns and cities (August/September) they traditionally bring large quantities of untreated milk to distribute as gifts to their neighbours, relatives and friends, leading to an increase in consumption of untreated milk by more consumers, and a September peak in new brucellosis cases.

The finding of this study that the most affected group was those aged 30–39 years, (mean age 33.8 ± 13.9 years) is consistent with many other studies [1,4,5,9,14]. The study also showed a higher rate of infection among males than females, a finding also consistent with many earlier studies [4,5,9,15,16], although some studies have reported an equal frequency between sexes [1,14,17,18,19]. Infection was most common among Saudis who consumed the greatest quantities of untreated milk and raw liver and spleen.

Table 4 Comparison of clinical features of brucellosis in studies conducted in Saudi Arabia

Clinical picture	Al-Sekait [15]	Al-Mofleh [1]	Present study
<i>Symptom</i>			
Fever	78.0	15.5	90.0
Back/joint pain	27.0	43.7	84.7
Lethargy	12.0	32.3	81.0
Sweating	25.0	–	78.8
Headache	31.0	0.0	77.4
Anorexia	27.0	–	45.3
Weight loss	14.0	–	43.1
Chills	23.0	7.7	38.7
<i>Sign</i>			
Splenomegaly	12.0	0.0	25.5
Hepatomegaly	8.0	8.5	22.6

Values given are the percentage of the total in the study.

The study also found patients were more likely to be from lower socioeconomic strata, a finding which accords with the results of several previous studies [5,14,15,17]. The Tabuk area was more severely affected due to its greater population concentration and consumption of milk and animals.

Consumption of untreated milk (from goats, sheep, camels or cattle) represented the most common source of infection in this study. The most frequent *Brucella* species isolated was *B. melitensis* (44.5%), due to the preponderance of goats and sheep in Tabuk, a finding consistent with many other studies [14,15,20,21]. The relatively increased frequency of infection by *B. abortus*, either alone or with *B. melitensis*, may be due to the trend to increased consumption of untreated, infected camel's milk, and the habit of eating raw or insufficiently cooked cow's liver and spleen.

The comparatively higher percentage of brucellosis cases reported from general hospitals and primary health care centres is

explained by their wide distribution and high patient volume. The variation in the frequency of symptoms and signs between this study and other studies is probably due to the difference in the methods of selection and in the activity and stages of disease. Patients in this study were reported from among those presenting with disease at health care facilities, whereas those of other studies were detected during field surveys [1,4,14,15,20–25].

Brucellosis is increasing in the north-western region of Saudi Arabia. Coordinated, comprehensive and organized efforts between the ministries of health, agriculture, municipal and rural affairs are required to prevent and control the disease.

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References

1. Al-Mofleh I et al. Brucellosis in Saudi Arabia: epidemiology in the central region. *Annals of Saudi medicine*, 1996, 16:349–52.
2. Matyas Z, Fujikura T. Brucellosis as a world problem. *Developments in biological standardization*, 1984, 56:3–20 .
3. *Joint FAO/WHO Expert Committee on Brucellosis WHO. Sixth report*. Geneva, World Health Organization, 1986 (WHO Technical Report Series, No. 740).
4. Madkour M et al. Brucellosis in Saudi Arabia. *Saudi medical journal*, 1985, 6:324–32.
5. Mousa A et al. The nature of human brucellosis in Kuwait: study of 379 cases. *Reviews of infectious diseases*, 1988, 10:211–7.
6. *A guide to the diagnosis, treatment and prevention of human brucellosis*. Geneva, World Health organization, 1981:8–41.
7. Wise RI. Brucellosis in the United States. Past, present and future. *Journal of the American Medical Association*, 1980, 244:2318–22.
8. Young EJ. Human brucellosis. *Reviews of infectious diseases*, 1983, 5:821–42.
9. Kiel FW, Khan MY. Brucellosis in Saudi Arabia. *Social science and medicine*, 1989, 29:999–1001.
10. Khan MY. Brucellosis: observations on 100 patients. *Annals of Saudi medicine*, 1986, 6(suppl.):S19–23.
11. Roux J. Epidémiologie et prévention de la brucellose. [Epidemiology and prevention of brucellosis.] *Bulletin of the World Health Organization*, 1979, 57: 179–94.
12. Christie AB. *Infectious diseases, epidemiology and clinical practice*, 3rd ed. London, Churchill Livingstone, 1980: 824–47.
13. Radwan AI et al. Incidence of brucellosis in domestic livestock in Saudi Arabia. *Tropical animal health and production*, 1983, 15:139–43.
14. Al-Sekait MA. Epidemiology of brucellosis in northern Saudi Arabia. *Saudi medical journal*, 1992, 13:296–9.
15. Al-Freihi, HM et al. Brucellosis in Saudi Arabia: diverse manifestations of an important cause of pyrexial illness. *Annals of Saudi medicine*, 1986, 6:95–9.
16. Arribas JL et al. La brucelosis en un hospital terciario. Estudio epidemiológico retrospectivo de 166 casos. [Brucellosis at a tertiary hospital. Retrospective epidemiologic study of 166 cases]. *Revista clínica española*, 1989, 185:60–4.
17. Dajani YE, Masoud AA, Barakat HF. Epidemiology and diagnosis of human Brucellosis in Jordan. *Journal of tropical medicine and hygiene*, 1989, 92:209–14.
18. Bilal NE et al. Brucellosis in the Asir region of Saudi Arabia. *Saudi medical journal*, 1991, 12:37–41.
19. Al-Balla SR. Epidemiology of human brucellosis in southern Saudi Arabia. *Journal of tropical medicine and hygiene*, 1995, 98:185–9.
20. Kiel FW, Khan MY. Brucellosis among hospital employees in Saudi Arabia. *Infection control and hospital epidemiology: the official journal of the Society of Hospital Epidemiologists of America*, 1993, 14:268–72.
21. Mohamed AES et al. Alimentary tract presentations of brucellosis. *Annals of Saudi medicine*, 1986, 6:27–31.

22. Gotuzzo E et al. Articular involvement in human brucellosis: a retrospective analysis of 304 cases. *Seminars in arthritis and rheumatism*, 1982, 12:245-55.
23. Luzzi GA et al. Brucellosis: imported and laboratory-acquired cases, and an overview of treatment trials. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1993, 87:138-41.
24. Al-Sekait MA. Prevalence of brucellosis among abattoir workers in Saudi Arabia. *Journal of the Royal Society of Health*, 1993, 113:230-3.
25. Chomel BB et al. Changing trends in the epidemiology of human brucellosis in California from 1973 to 1992: a shift toward foodborne transmission. *Journal of infectious diseases*, 1994, 170:1216-23.

Human brucellosis is a major public health problem in the Region; more than 45 000 cases are reported annually. Weaknesses in control of the disease among animal populations, persistent local habits in consumption of raw milk and milk products, high mobility of the animal population and thus the contamination of the environment and intensive urbanization of human and animal populations are the major reasons for the high prevalence. The Regional Office assists national programmes in strengthening surveillance and control capabilities against zoonoses through provision of technical advice, support for training courses and provision of supplies and equipment for laboratory diagnoses of such diseases.

Source: The work of the WHO in the Eastern Mediterranean Region. Annual Report of the Regional Director. 1 January-31 December 2001. Page 158.