



Brucellosis; still a problem in the Arab World

FASCMID & Tunisian Society of Clinical Microbiology and
Infectious Diseases

Hammamt Yasmine 23 - 26 May 2012

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Infectious Diseases Medicine

Schema

1. Bruce or not Bruce, that is the question!?
2. Epidemiology and prevalence
3. Humans and Animals, they share suffering!
4. Transmission, is it the same story?
5. Organ system infections and pregnancy, are there any new data?
6. Testing for brucella, shall we stick to what we already do?
7. Brucella Man Combat, who is the winner so far?

History of Brucellosis

The Truth About Bruce and Brucellosis

Malta fever, Gibeltar fever, Bang fever

14 June 1905

Marston 1860, first accurate clinical description.

Bang, Described infectious abortion

History of brucellosis

We read with interest Dr Wyatt's article (October 2005 *JRSM*¹) on Zammit's discovery that brucellosis was transmitted by goat milk. We would like to add the names of some other people who were involved in the research.

First, Dr Carruana-Secluna, who accompanied Zammit to Chadwick Lakes, carried out a great deal of work for Sir David Bruce—he prepared the agar plates and the culture media and cultured the causative organism from the spleen samples of fatal cases. He never received proper recognition for his work and Sir David Bruce did not allow him to be co-author on any publications. Secondly, Surgeon Captain M. Louis Hughes assisted Bruce in his studies and first named the disease 'undulant fever'. He also named the organism *Micrococcus melitensis*, although he was wrong about the source of infection, believing it to be resident in the soil and inhaled by the human. Hughes was killed in the Boer war at the age of 32.

Sir David's wife Lady Bruce was a trained microbiologist, and took an active part in her husband's research, including the exquisite illustrations to his papers.²

Finally, it is worth noting that Zammit was knighted—an honour given for his work.

Catherine Edwards

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History of Brucellosis

The Truth About Bruce and Brucellosis

14 June 1905, Zammit and Scicluna, a Maltese doctor:

- found that 5/6 goats reacted to the blood test for brucellosis
- Greatest discovery; healthy goats could be carriers of the disease
- From September 1904 – April 1905 Zammit fed goats with *Micrococcus melitensis* to infect them

H V Wyatt. J R Soc Med 2005;98:451–454

Ali S M Jawad . J R Soc Med 2006;e 9 9

Veterinary Microbiology [Vet. Microbiol.]. Vol. 90, no. 1-4, pp. 5-9. 20 Dec 2002

Journal of the royal Society of Medicine, 2006 February. Volume 99

Journal of the royal Society of Medicine, 2005;98:451–454

History of Brucellosis

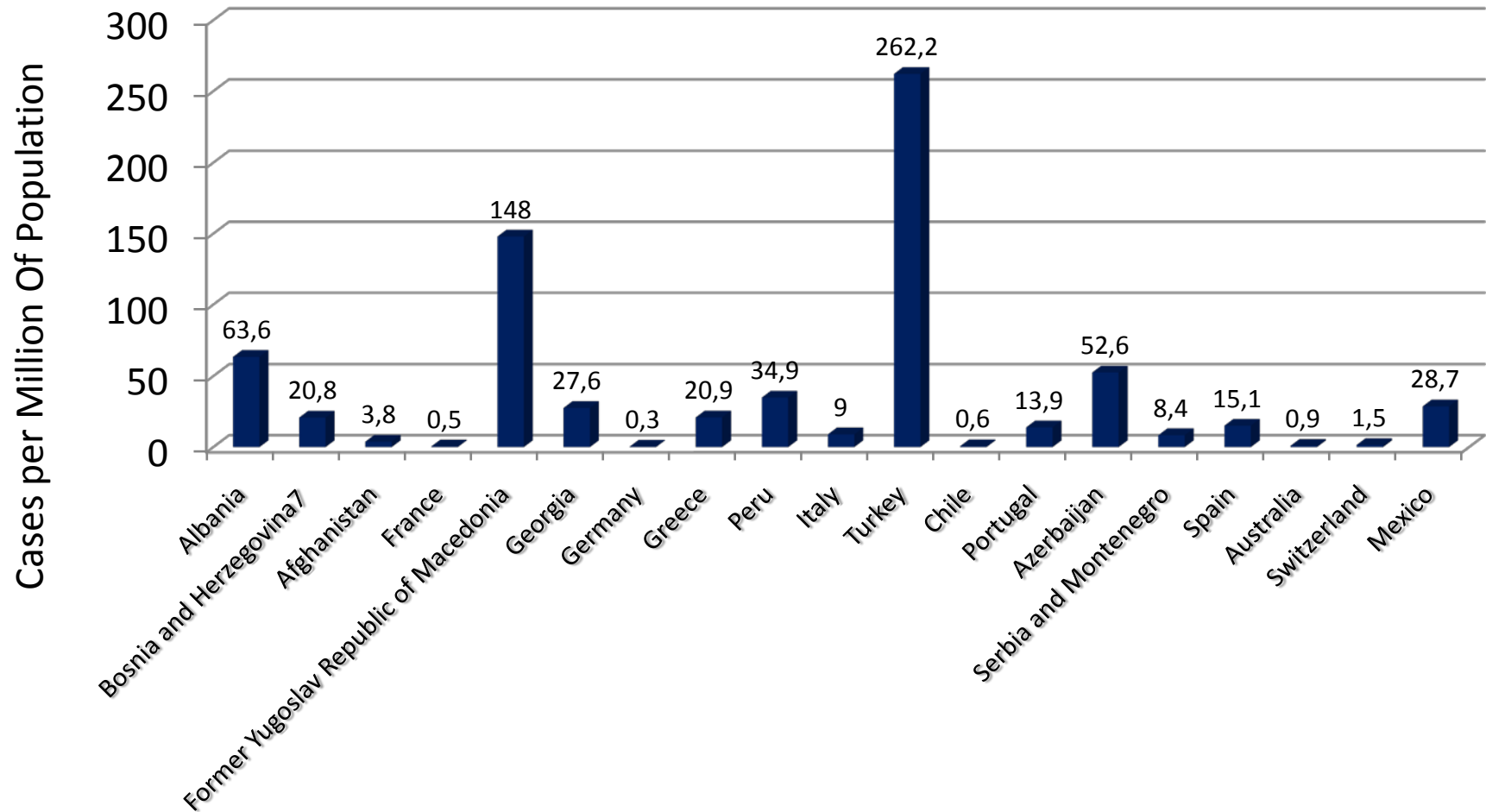
The Truth About Bruce and Brucellosis

- “After months of hard and disappointing work, Dr Zammit, a Maltese colleague, happened to examine the blood of a goat”
Bruce said !!!!!

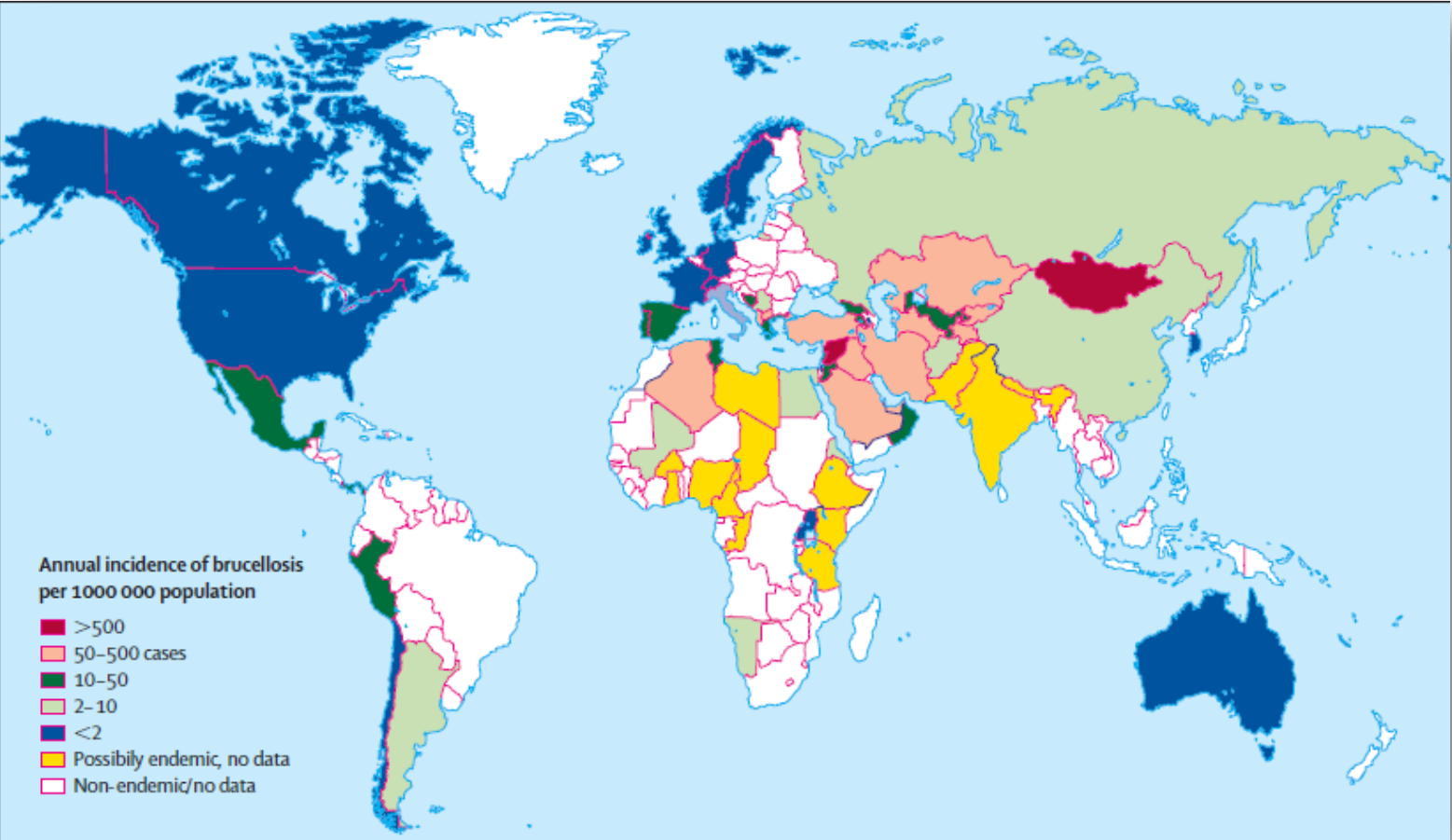
- Finally, it is worth noting that Zammit was knighted an honour given for his work

- Horrocks, a friend of Bruce undermined Zammit work as well

Some World Countries: Brucellosis Annual Cases per Million Of Population



Worldwide incidence of human brucellosis



This Provisional PDF corresponds to the article as it appeared upon acceptance. Fully formatted PDF and full text (HTML) versions will be made available soon.

The first case of *Brucella canis* in Sweden: background, case report and recommendations from a Northern European perspective

Acta Veterinaria Scandinavica 2012, **54**:18 doi:10.1186/1751-0147-54-18

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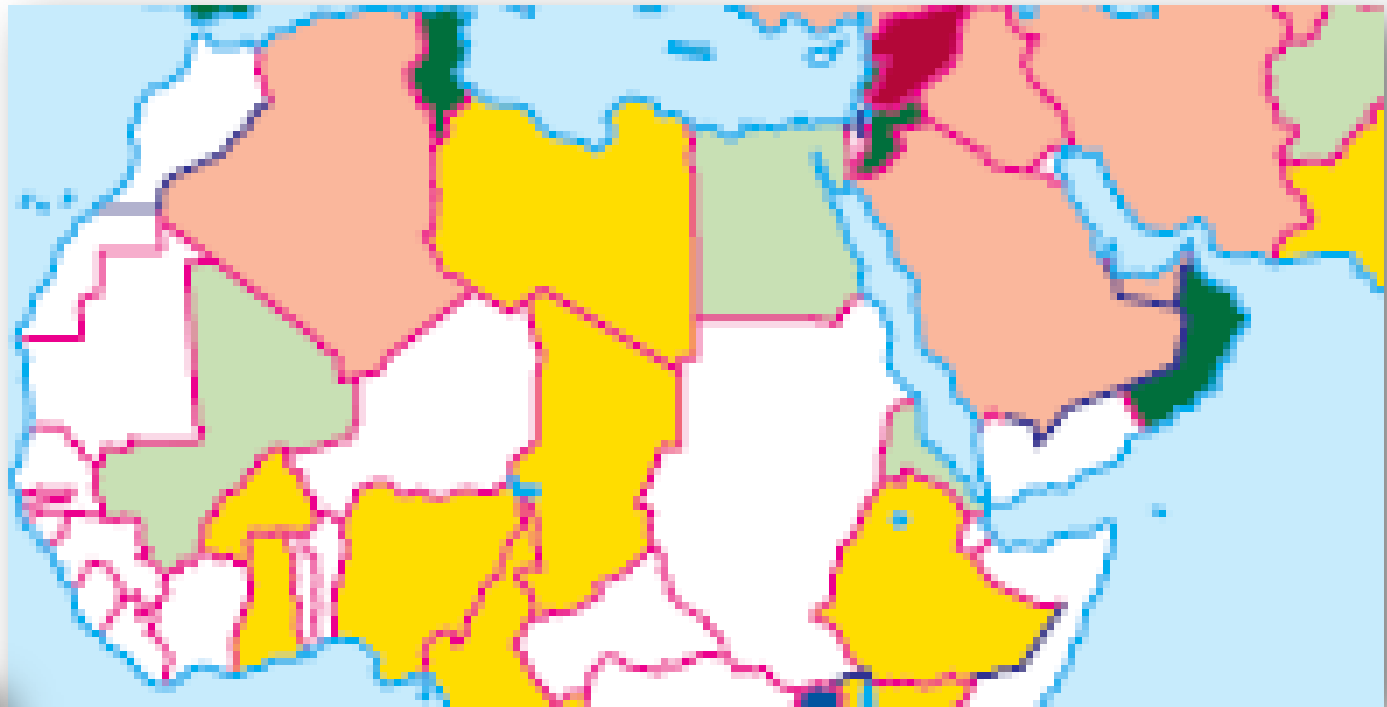
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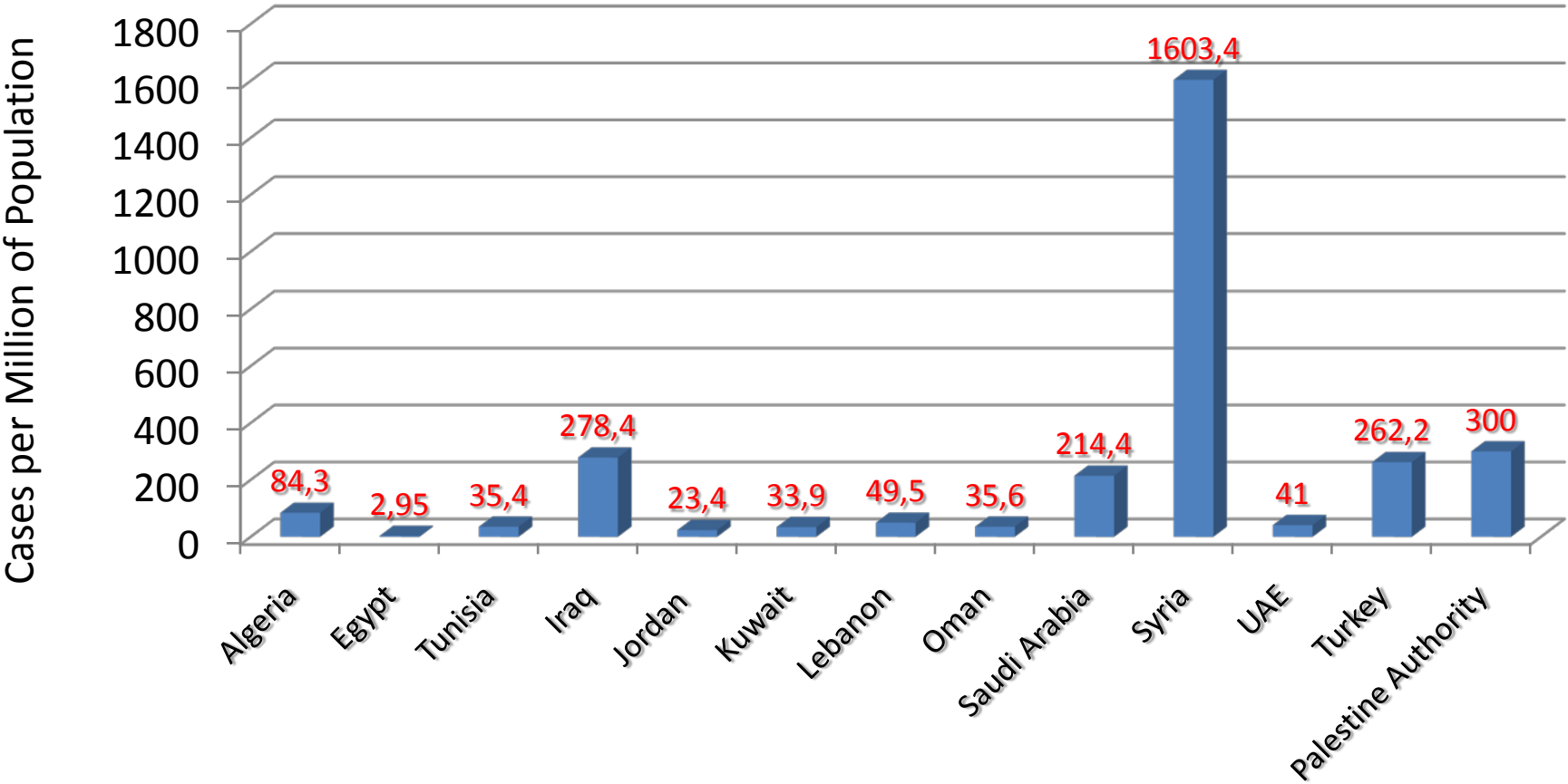
Arab World incidence of human brucellosis per million population



Annual incidence of brucellosis per 1000 000 population

- >500
- 50-500 cases
- 10-50
- 2-10
- <2
- Possibly endemic, no data
- Non-endemic/no data

Arab Countries: Brucellosis Annual Cases per Million of Population



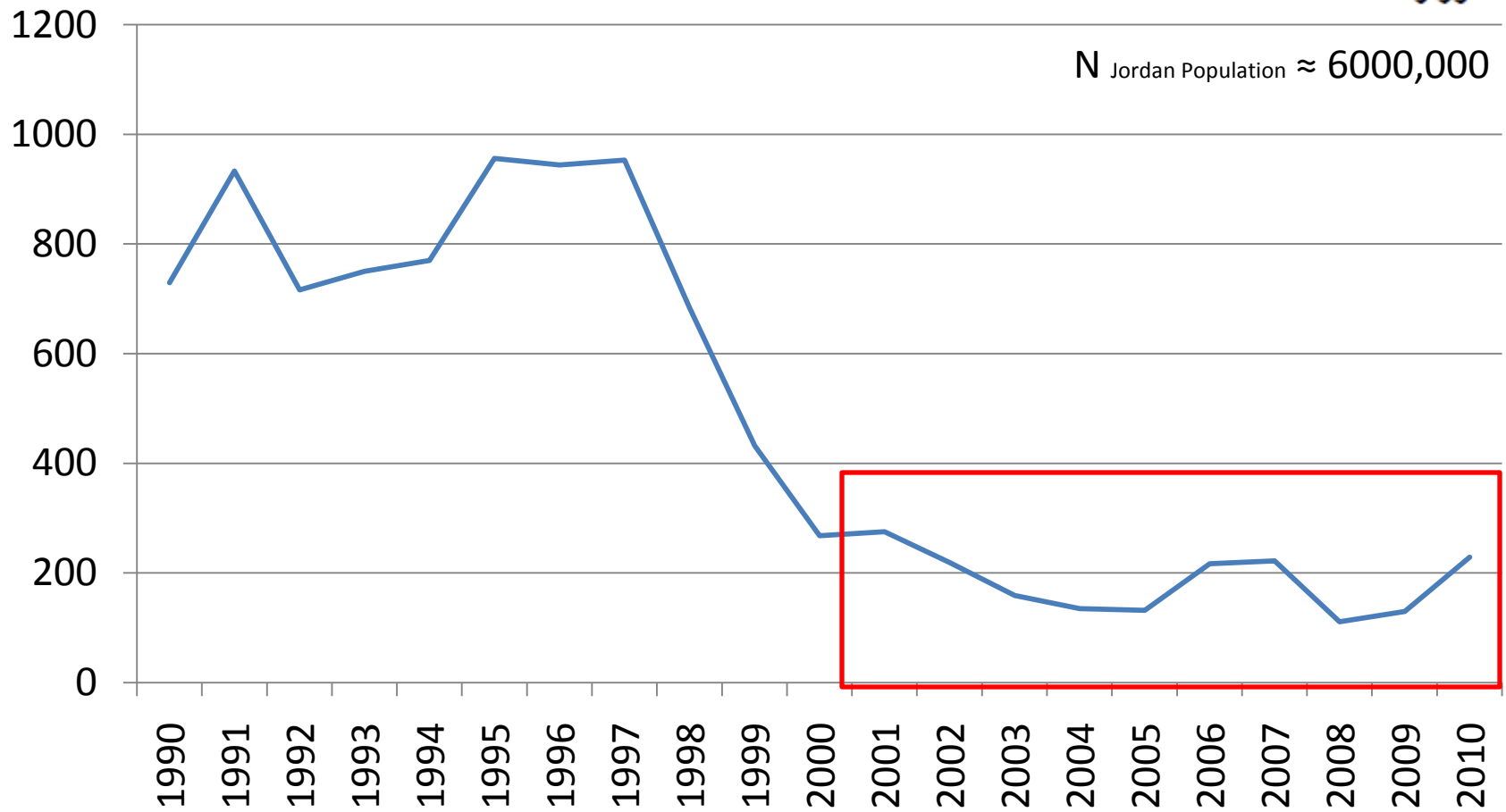
Lancet Infect Dis 2006; 6: 91-99
Veterinary Microbiology 90 (2002) 81-110

Number of Cases of Brucellosis In Jordan over Two Decades as Published on MOH



المملكة الأردنية الهاشمية
وزارة الصحة

N Jordan Population \approx 6000,000

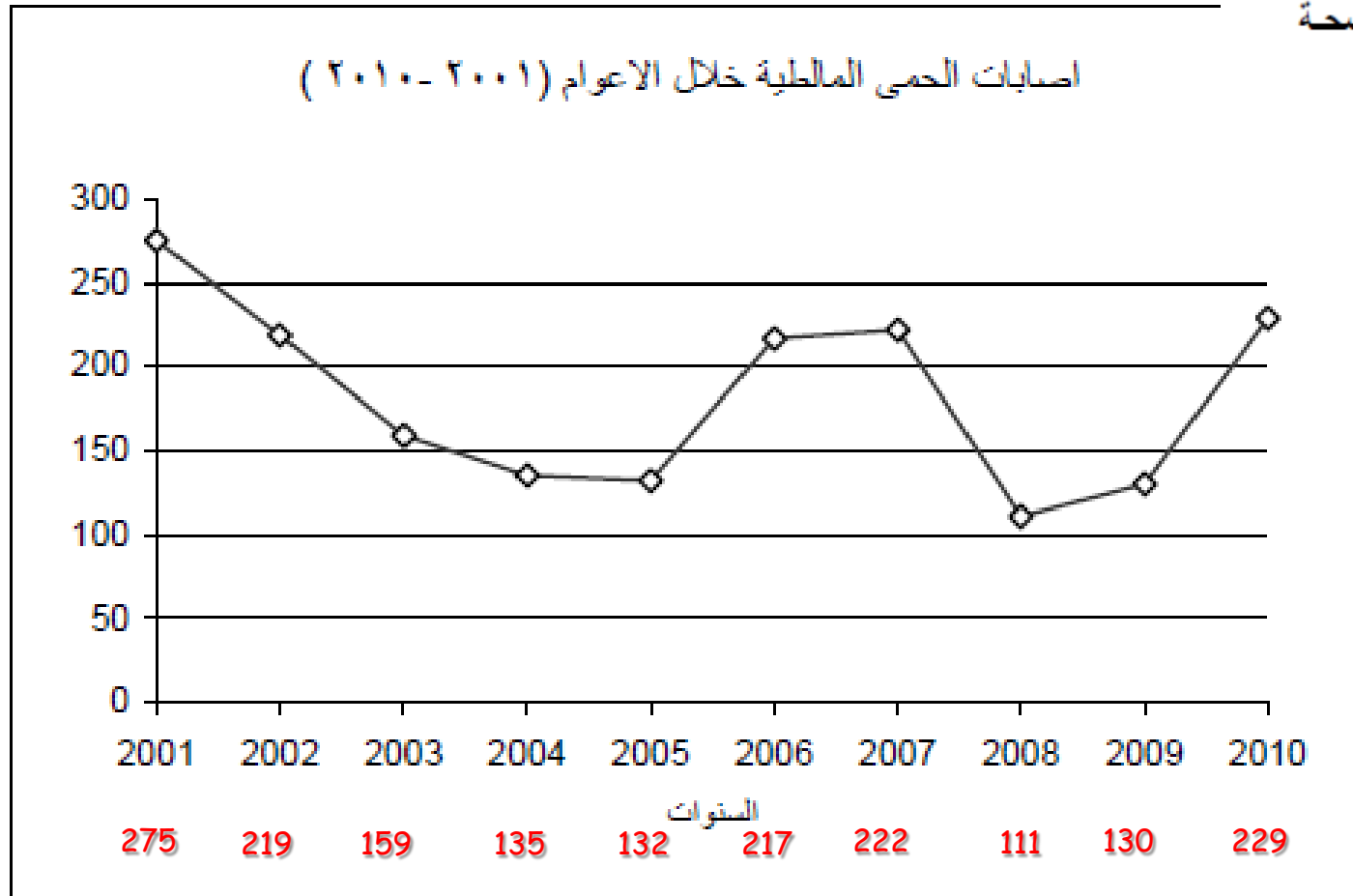


729 933 716 750 770 956 944 953 684 432 268 275 219 159 135 132 217 222 111 130 229

Brucellosis cases in Jordan for the years 2001 - 2010



المملكة الأردنية الهاشمية
وزارة الصحة



Epidemiology



Present all over the world, Primarily in animals:

- B. abortus
- B. melitensis
- B. suis
- B. ovis
- B. canis
- B. neotamae

Cattle

goat, sheep 80 - 100% of Arabia Infections

pigs

sheep, rams

dogs

rats

Annals of Saudi Medicine, Vol 19, No 5, 1999

Croat Med J. 2010; 51: 289-95. doi: 10.3325/cmj.2010.51.289

Clinical Infectious Diseases 1995;21:283-90

Korean J Vet Res(2009) 49(2) : 105~111.

J. Bacteriol. January 1965 vol. 89 no. 1 9-16

Prevalence of brucellosis in livestock in different countries

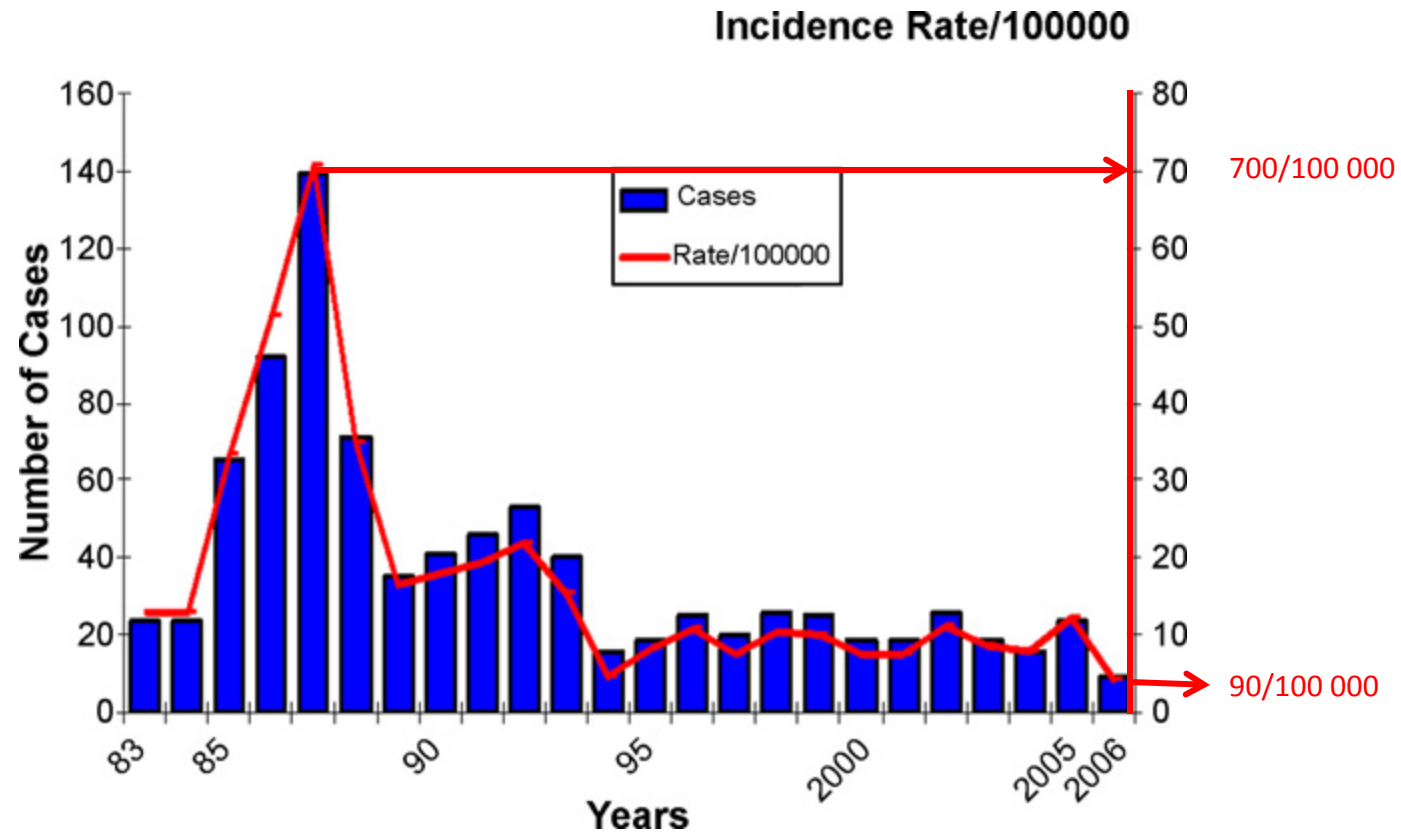
Country	Species	Prevalence (%)	<i>Brucella</i> species
Algeria	Sheep	2.18	—
	Goat	12.00	—
Egypt	Buffalo	10.00	<i>Br. abortus</i>
	Cattle	23.30	<i>Br. melitensis biovar 3</i>
	Donkey	7.30	—
	Horse	5.88	—
	Mule	71.42	—
Iraq	Sheep	15.00	<i>Br. melitensis</i>
	Cattle	3.00	<i>Br. Abortus</i>
	Camel	17.20	—
Libya	Camel	4.10	<i>Br. melitensis biovar 1.</i>
Oman	Camel	8.00	<i>Br. abortus</i>
	Cattle	3.30	—
	Sheep	1.60	—
	Goat	6.40	<i>Br. melitensis</i>
Saudi Arabia	Camel	8.00	<i>Br. melitensis biovar 2.</i>
	Cattle	18.70	—
	Sheep	6.50	—
	Goat	9.70	—
	Camel	6.95	<i>Br. abortus</i>
Sudan	Camel	0.00	—
	Cattle	5.00	—
	Sheep	1.00	—
	Goat	4.00	—
	Camel	2.00	<i>Br. abortus</i>
United Arab Emirates	Cattle	1.30	—
	Sheep	2.00	—
	Goat	3.40	—

Livestock In Egypt

- Brucellosis prevalence were estimated:

Cattle	0.79%
Buffaloes	0.13%
Sheep	1.16%
Goats	0.44%
- It is estimated that 0.2% of households livestock has one seropositive animal

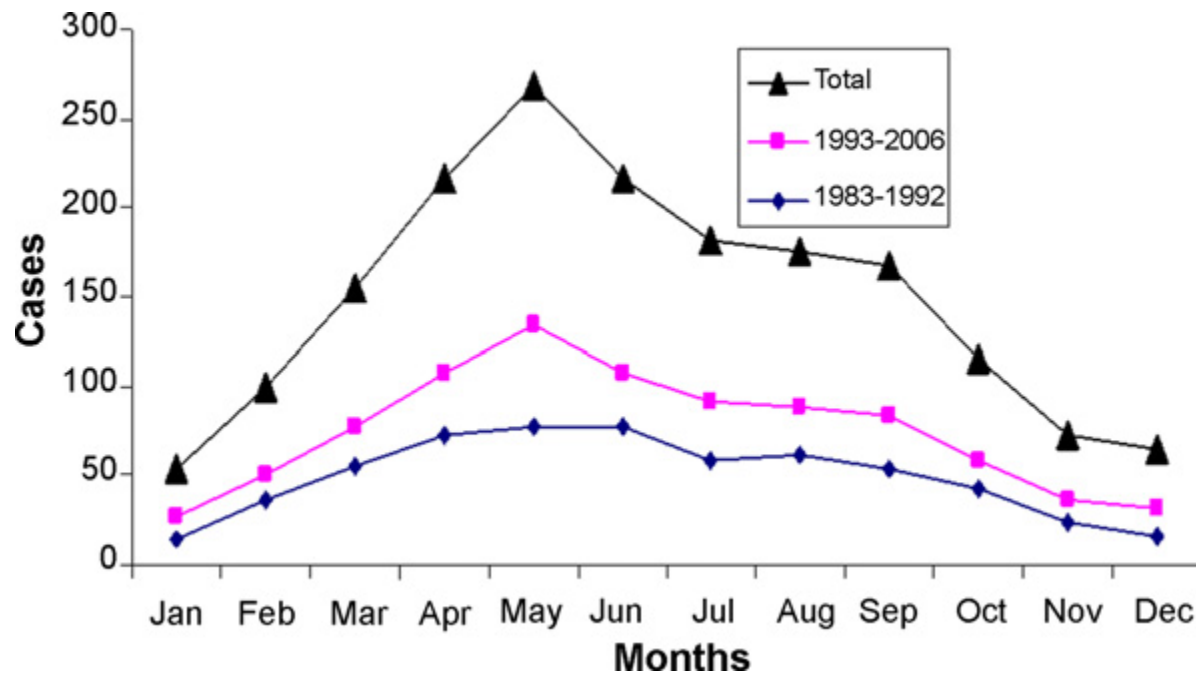
Human brucellosis cases in Saudi Aramco Health Care Population between 1983 and 2007



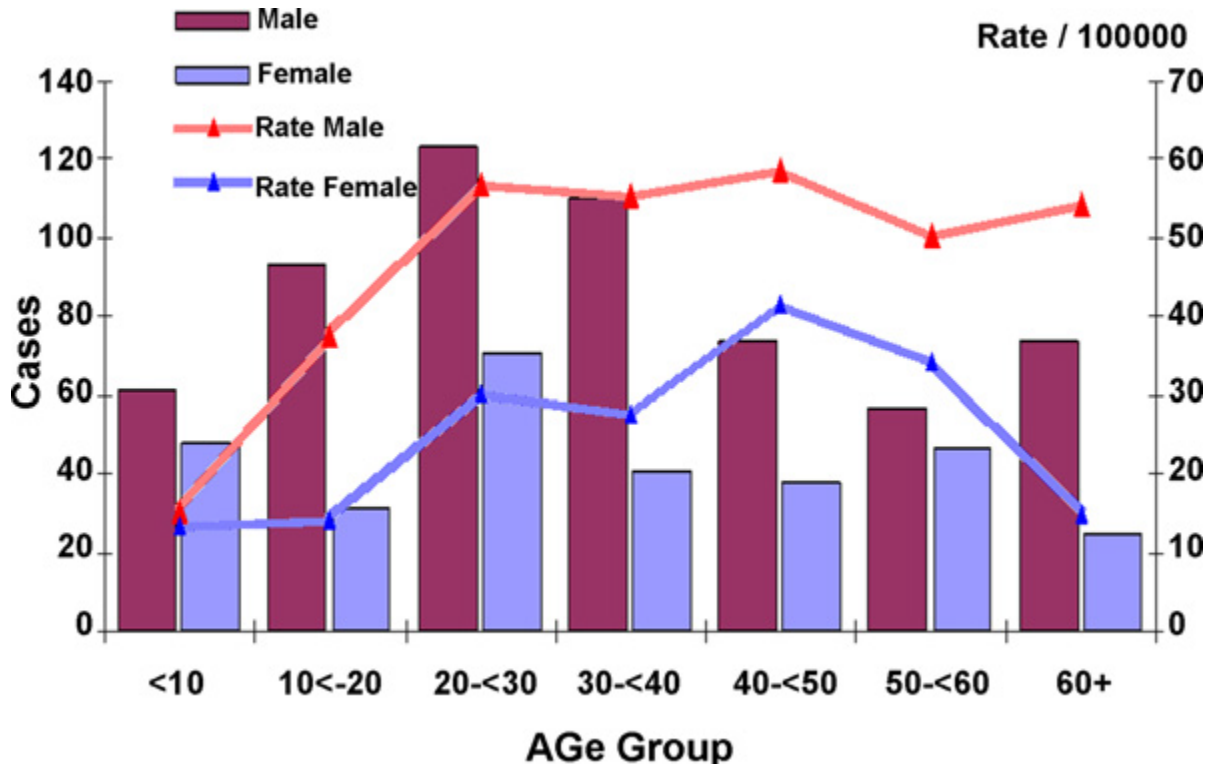
Bars: the number of new cases of per year

Line graph: the yearly rate of cases per 100,000 population

Monthly number of human brucellosis for the years 1983–2006 (Saudi Arabia)



Age and sex distribution of Human brucellosis



Bars: The number of new cases in each age group
Line graph: The rate of cases per 100,000 population in the age groups

Human brucellosis in Lebanon, Retrospective studies of cases in Lebanon

- N = 1137
- Diagnostic criteria STA \geq 1/160 with symptoms suggestive of brucellosis
- Age distribution; (> 60 years) 40%, (< 14 years) 16%
- Male to Female: 1.01
- Season: 69% in spring and summer
- Acute in 65%, sub-acute in 33%, chronic in 2%
- *Kuwait: 400 cases acute in 77%, sub-acute in 12.5%, chronic in 10.5%

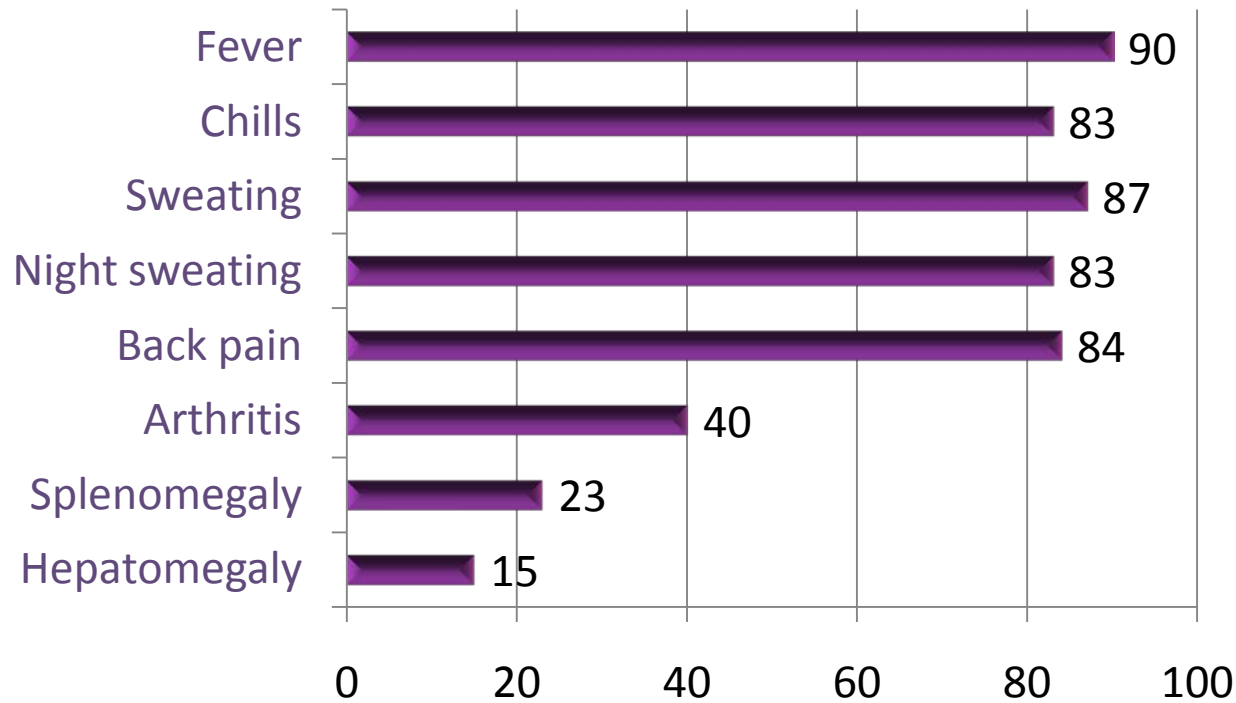
[Tohmé A et al. J Med Liban.](#) 2004 Jul-Sep;52(3):149-55.

[Tohmé A et al. Presse Med.](#) 2001 Sep 29;30(27):1339-43

*George F. Araj et al. QJM (1988) 66 (1): 39-54

Clinical Manifestations

Symptoms and Signs



Brucella Rates (%) of Symptoms and Signs in 140 Patients from Iran

Transmission



Occupation/avocation	Principal <i>Brucella</i> species
Cattle rancher	<i>B. abortus</i>
Dairy farmer	<i>B. abortus</i>
Veterinarian	<i>B. abortus</i> (<i>B. abortus</i> strain 19 and <i>B. melitensis</i> strain Rev-1 vaccines)
Abattoir worker	<i>B. suis</i>
Traveler (to areas with enzootic disease)	<i>B. melitensis</i>
Hunter (feral swine)	<i>B. suis</i>
Dog handler	<i>B. canis</i>
Laboratory worker	All <i>Brucella</i> species

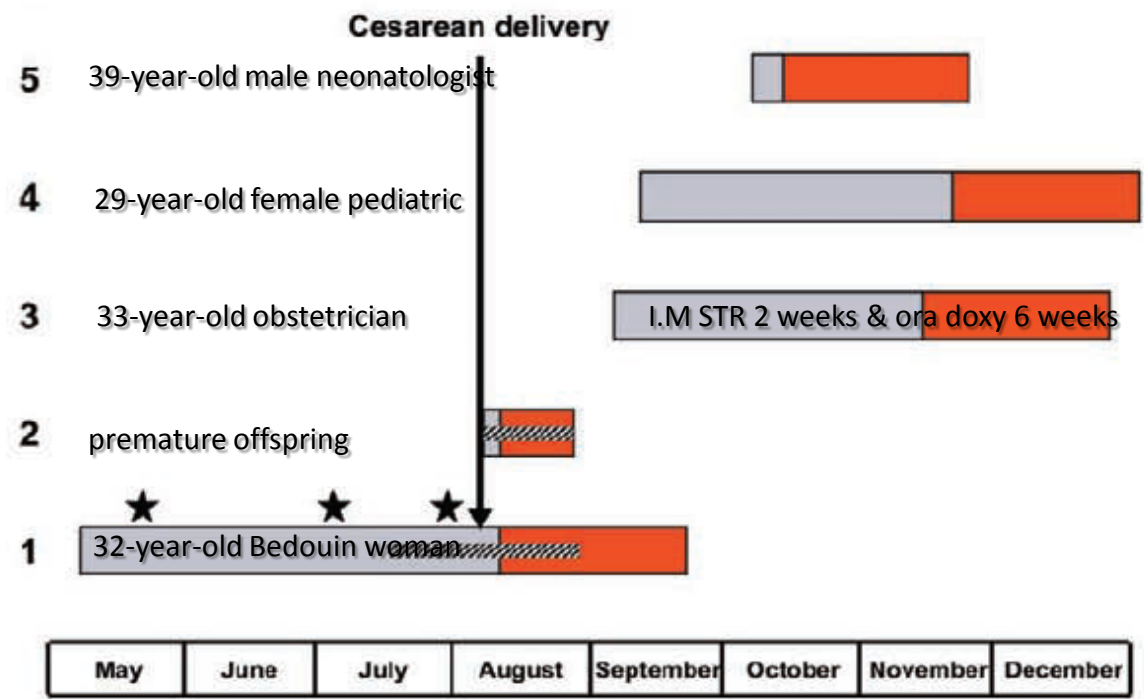
Croat Med J. 2010; 51: 289-95
Clinical Infectious Diseases 2010; 51(2):e12–e15
Clinical Infectious Diseases 2007; 45:e135–40
Clinical Infectious Diseases 1995;21:283-90
The Lancet. (337) 8732. 5 January 1991, Pages 14-15

The Many Faces of Human-to-Human Transmission of Brucellosis: Congenital Infection and Outbreak of Nosocomial Disease Related to an Unrecognized Clinical Case

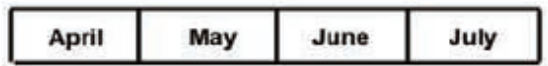
Oded Mesner,¹ Klaris Riesenber,³ Natalia Biliar,¹ Eliezer Borstein,² Leah Bouhnik,³ Nehama Peled,⁴ and Pablo Yagupsky⁴

Divisions of ¹Neonatology and ²Obstetrics and Gynecology, ³Institute of Infectious Diseases, and ⁴Clinical Microbiology Laboratory, Soroka University Medical Center, Ben-Gurion University of the Negev, Beer-Sheva, Israel

Patient



Gray bars, clinical symptoms
red bars, antimicrobial therapy
hatched bar, hospitalization period
black stars, serological tests for patient 1.



2006

2007

Sexually Transmitted Brucellosis in Humans (Occupied Palestine)

- Sexual transmission in livestock through semen and vaginal secretions is well documented
- In a two cases report; a month after husband diagnosis, wives developed symptoms and signs of brucellaosis
- Urine and semen from both husbands reveal the same *B. melitensis* biotype 1
- No other risk factors identified for both wives
- Semen commonly harbor *Brucella* spp in infected individuals.
- Vaginal secretion harbor commonly *Brucella* in infected individuals

Williams E. Chapter 2— The Mediterranean Fever Commission—its origins and achievements. In: Young EJ, Corbel MJ eds. Brucellosis— clinical and laboratory aspects. Boca Raton, FL: CRC Press, 1989:11–24.

Vandercam B, Zech F, de Cooman S, Bughin C, Gigi J, Wauters G. *Eur J Clin Microbiol Infect Dis* 1990; 9:303–304

Re-infection & Relapse

- Relapses are uncommon in properly treated patients.
- Recurrent episodes in 5%, usually milder
- Look for focal disease
- Beware of hypersensitivity reaction that mimic the disease (Sx. occur in minutes to hours)

Clinical Infectious Diseases, 1995 August; 21:283-90
The American Journal of Surgery, 1967 March.;113 (3): 422-424

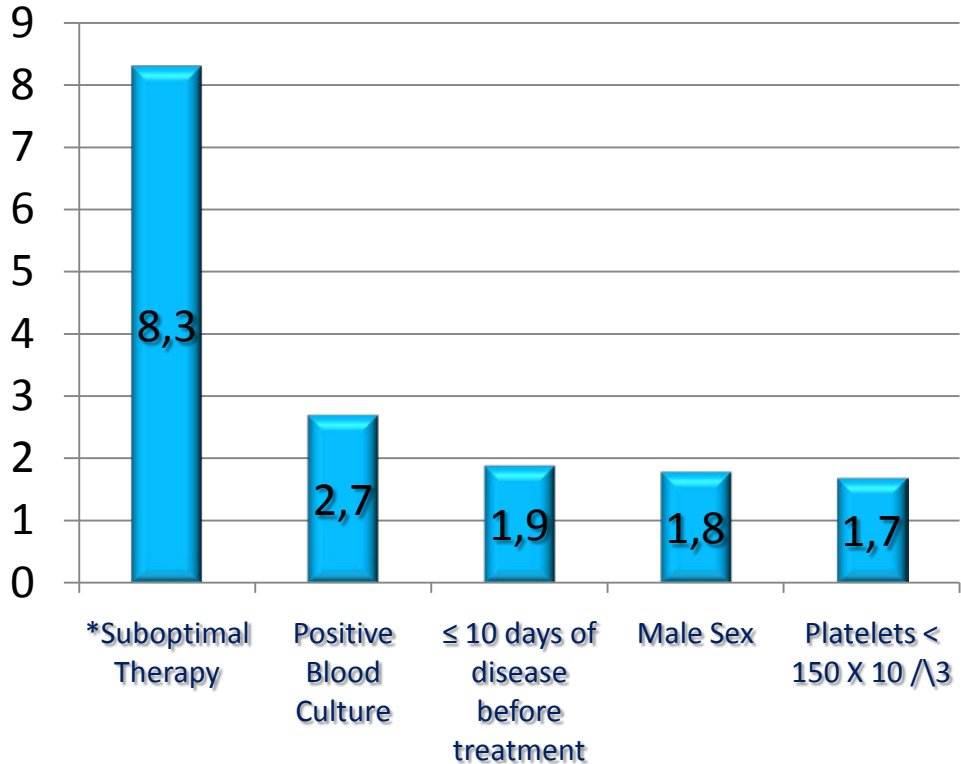
Relapse in a Spanish Study:

- N = 394
- Logistic regression analysis of risk factors associated with relapse studied in patients with brucellosis

86 patients relapsed

- Positive blood cultures 53
- Positive culture of specimen from sternum costal abscess 1
- Clinical relapse 32

OR



*TMP/SMZ. Rif/TMP. Dox/Rif (30 days)

Clinical Syndromes/Complications

Characteristics of B. Vertebral Osteomyelitis

A descriptive, retrospective, observational study of 96 patients Spain and 74 in Jordan

- Focal in 10.4% (Osteo-articular), mostly in adults age ($\mu \pm SD$; 49.5 ± 14.0 yrs)
- μ (diagnostic delay) = 12.7 weeks.
- Spinal pain, (94.8%), fever (91.7%)
- Paravertebral masses (45.8%), epidural masses (27.1%), and psoas abscesses (10.4%)
- 34-35% require additional surgical therapy
- If surgery was not needed, then FNA ($p = 0.3$) and TCB ($p = 0.4$) are comparable in sampling.
- Therapeutic failure may occur (12%)
- Attributable mortality (2.1%), severe functional sequelae (6.2%)
- No significant differences between patients treated with doxycycline-streptomycin and doxycycline-rifampicin.

Clinical Syndromes/Complications

Neurobrucellosis

- Pooled data $N_{\text{studies}} = 36$, $N_{\text{patients}} = 187$ neurobrucellosis cases were evaluated (Retrospective Study of Turkish and International database)
- Symptoms: Headache, fever, sweating, weight loss, and back pain
- Signs: Meningeal irritation, confusion, hepatomegaly, hypoesthesia, and splenomegaly
- Complications: polyneuropathy/radiculopathy, depression, paraplegia, stroke, and abscesses
- Duration of antibiotic therapy: 2-15 months (median 5 months)

§ Ann Saudi Med 2010; 30(5): 412-414

§ Genitl. Webal. Med Trop (Mars). 2000; 7(3): 309-10 (Algeria)

International Journal of Infectious Diseases (2009) 13, e339—e343 (Turkey)

*Trop Doct, October 2009: (39) 4; 233-235

**The Brazilian Journal of Infectious Diseases 2009;13(3):245

Clinical Syndromes/Complications

Neurobrucellosis

- \$Serum and CSF STA may be negative and CSF culture positive
- BC +ve in 9 patients and from CSF 11
- *Neck stiffness in 25/36 (69.4%) patients
- **Spastic Paraparesis reported from India
- Incidence: Algeria is about 4% of cases. Kuwait 7% out of 400 cases
- Mortality was 0.5%

\$ Suad Tekin-Koruk. Ann Saudi Med 2010; 30(5): 412-414
International Journal of Infectious Diseases (2009) 13, e339—e343 (Turkey)
*Trop Doct, October 2009: (39) 4; 233-235
**The Brazilian Journal of Infectious Diseases 2009;13(3):245
Guenifi W et al . Med Trop (Mars). 2010 Jun;70(3):309-10 (Algeria)
George F. Araj et al. QJM (1988) 66 (1): 39-54

Clinical Syndromes/Complications

Cardiovascular

- *Isolated Myocarditis in Tunis, and plus asymptomatic pericardial effusion in Greece
- #Isolated Acquired QT prolongation and ventricular tachycardia (Turkey)
- Endocarditis < 2%, mostly lethal.
- Out of I,E (NVE) accounts for < 1 %
- Diagnosis usually late
- Frequency of involvement; Aortic, Mitral & PVE

*Abed L. Intern Med. 2012;51(8):901-4. Epub 2012 Apr 15.

Trop Doct. 2009 Apr;39(2):123-4

*<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3037886/>

#Journal of Cardiology Cases, 2011 October; 4 (2): e121-e125

Clinical Syndromes/Complications

Genitourinary Epididymo-orchitis

- May present as epididymo-orchitis, prostatitis, cystitis, pyelonephritis, interstitial nephritis, exudative glomerulonephritis, renal and testicular abscess, and seminal vasculitis
- BEO in Turkey; 18.8%, Iran 11.1%. Range (2-20%), Kuwait 8.5%
- Onset was acute in (81.8%), subacute in (14.8%), and chronic in one patient (3.7%).
- Pain and scrotal swelling (100%) and fever (96.7%)
- Dysuria, haematuria, frequency or urgency (22.2%)

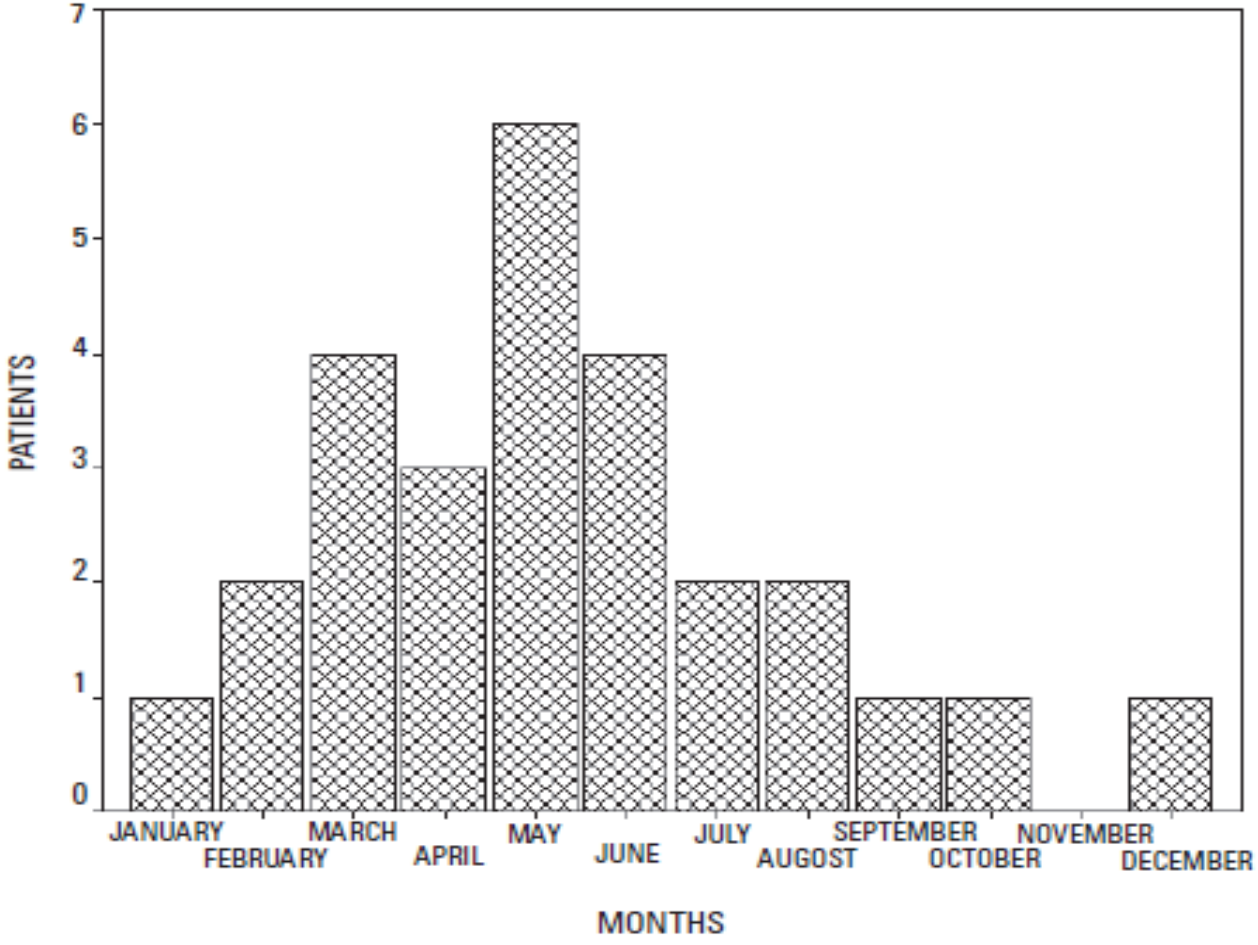
Clinical Syndromes/Complications

Specific signs and symptoms in 30 patients with *Brucella* epididymoorchitis (Iran)

Findings	Frequency	Percentage
Scrotal pain and swelling	30	100
Fever (temp $\geq 38^{\circ}\text{c}$)	29	96.7
Sweating	25	83.3
Anorexia	25	83.3
Weakness	23	76.7
Myalgia	8	26.7
Arthralgia	6	20
Back pain	6	20
Urinary frequency	6	20
Weight loss	4	13.3
Lumbosacral pain	4	13.3
Dysuria	3	10
Splenomegaly	3	10

Clinical Syndromes/Complications

Distribution of BEO by months of the year (Turkey)



Oophoritis

- In 1998 Uwaydah et al. Beirut, Lebanon, reported a Brucella-infected ovarian dermoid cyst which caused initial treatment failure in a patient with acute brucellosis. The patient defervesced abruptly after oophrectomy
- Harvard Medical School reported similar case to Marwan Uwaydah in 2007

Marwan Uwaydah et al. *Infection*, 1998 ; 26 (2);131–132
Infectious Diseases in Obstetrics and Gynecology. Volume 2007, Article ID
41473, 2 pages. doi:10.1155/2007/41473

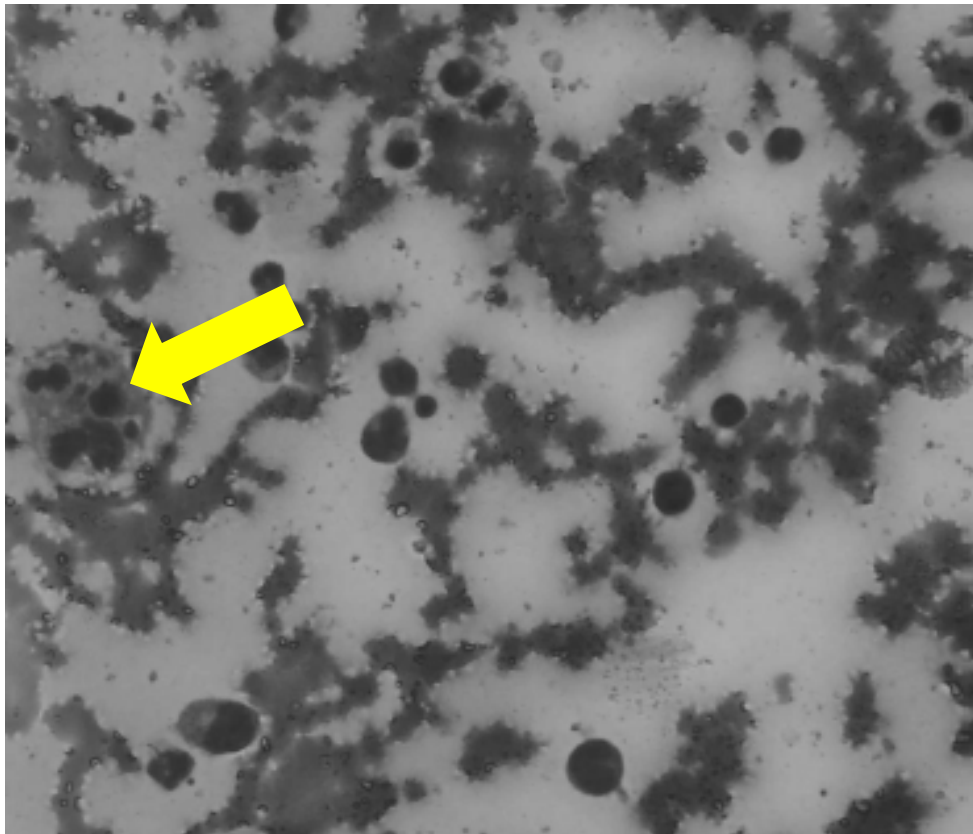
Others

- Gastrointestinal
 - GI Sx. Relatively uncommon but reported at a rate of 67% in Saudi Arabia and 20% in pediatric patients
 - Abnormal LFTs in 30 -60 %
 - Diffuse and granulomatous hepatitis.
 - Splenic calcification.
- Pulmonary (Kuwait): Cough in about 20%. Anormal CXR in about 16%
- Hematological:Anemia, leukopenia, thrombocytopenia common in adult and pediatric patients
- Cutaneous: E. nodosum, papules, rubeoliform, scarlitiniform, and eczematous rash.

Tropical Gastroenterology; 1989, 10(4):217-9
J Trop Pediatr (1992) 38 (4): 167-172
QJM (1989) 71 (1): 319-324
INFECTION 1993; 21 (1): 23-26
Annals of Saudi Medicine 1999; 19 (5)

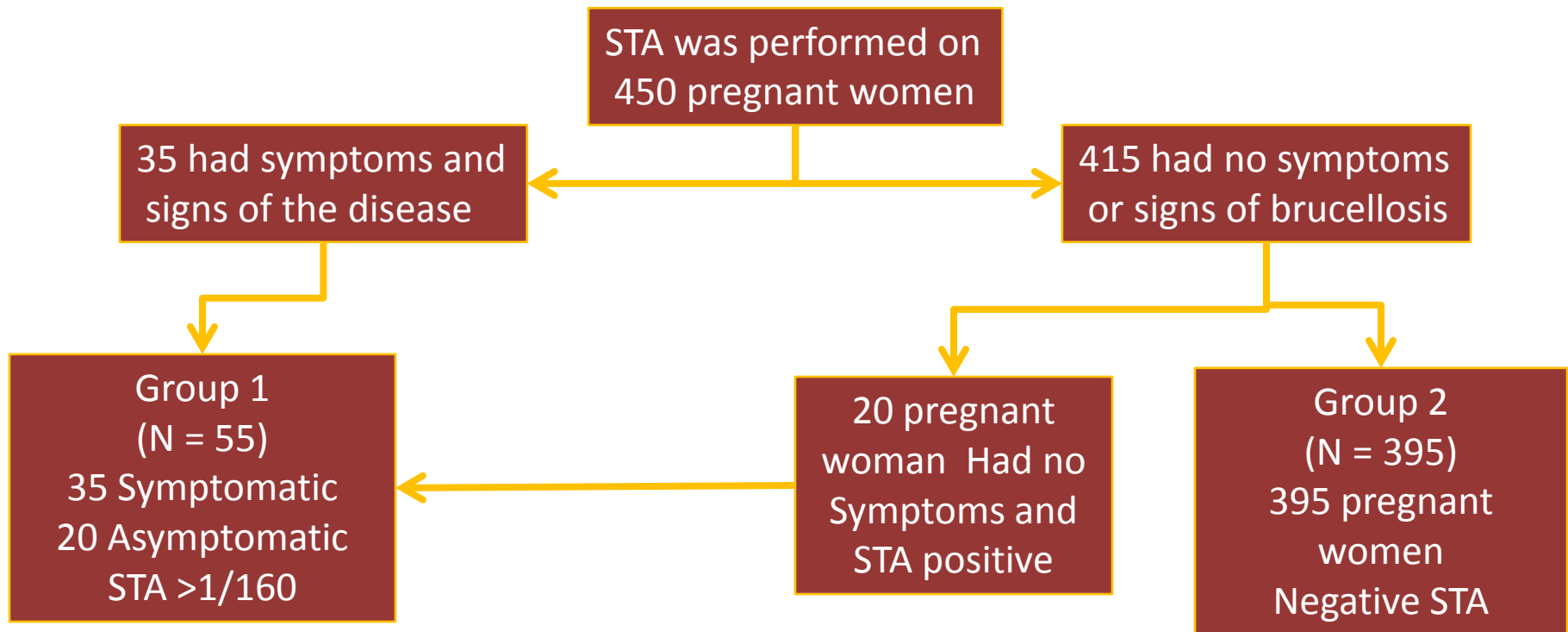
Hemophagocytic Syndrome in a Child with Brucellosis

Nivedita Mondal • R. Suresh • N. Srinivas Acharya •
Ira Praharaj • B. N. Harish • S. Mahadevan



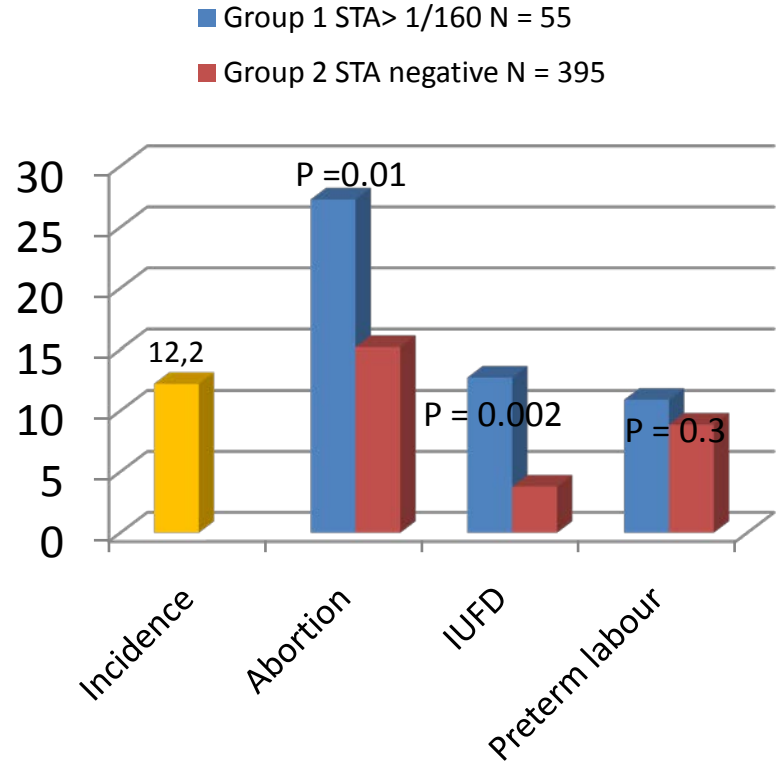
The Effects of Maternal Brucellosis on Pregnancy Outcome

- Prospective study: Taif, S.A. and Mansoura University Hospital
- Primary Measure: Outcome of pregnancies complicated by Brucella infection.
- August 2005 - December 2007
- The incidence was 12.2 % (55/450) among pregnant women

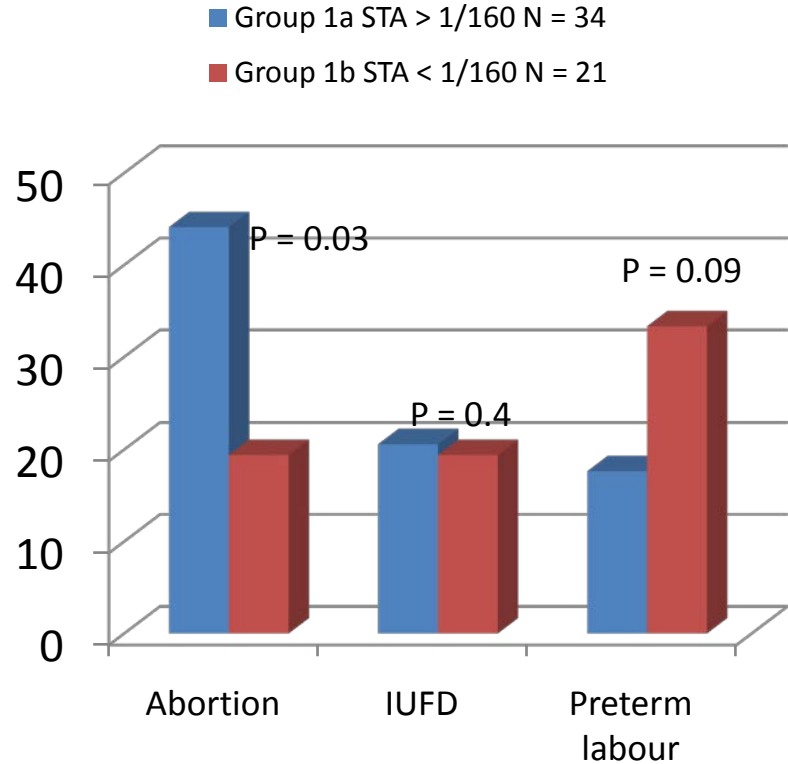


Outcome of Pregnancies Complicated by Brucella Infection based on STA positivity and level (Saudi/Egypt)

Percentage of abortion, IUFD and preterm labour of the two studied groups




The relation of the tested parameters based on brucella titer




Occurrence of spontaneous abortion and intrauterine death, according to trimester of pregnancy, in 92 women with acute brucellosis in Saudi Arabia

Trimester of pregnancy	No. of patients	No. (%) of spontaneous abortions
First	23	12 (52)
Second	44	28 (64)
Third	25	2 (8) ^a
Total	92	42 (46) ^a

($P < 0.0001$)



($P < 0.001$)



^a These were or included intrauterine fetal deaths

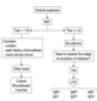
Laboratory Diagnosis

1. Rose bengal test (RBT)
2. SAT (STA)
3. Coombs test brucella (non-agglutinating antibodies)
4. Counter immune electrophoresis proteins test
5. ELISA
6. Immune capture brucella
7. fluorescence polarization assay
8. Lateral flow immunochromatography assay (IgM , IgG)
9. Blood culture

S-LPS (or PS)

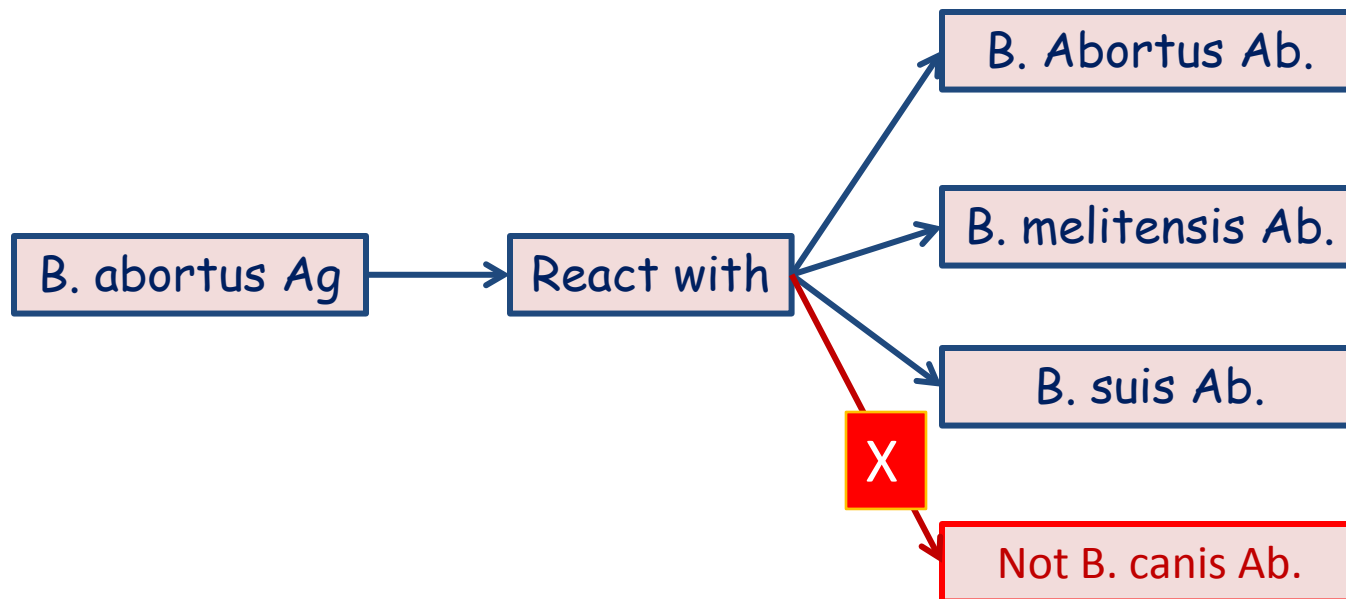
RBT versus (Serum agglutination, Coombs, competitive ELISA, Brucellacapt, lateral flow immunochromatography for IgM and IgG detection and immunoprecipitation with Brucella proteins) *

- Studied patients:
 - 208 sera were tested from **patients** with brucellosis proved by **bacteriological isolation**
 - 20 **contacts** with no brucellosis
 - 1559 sera of persons with **no recent contact** or brucellosis symptoms
- Using modified RBT titre $> \frac{1}{4}$ none of contacts or Rev 1 was positive
- *Other tests **failed to discriminate** contacts or Rev 1 injected individuals
- RBT $> \frac{1}{4}$ does not need confirmation by other* (usually more expensive, sophisticated and time consuming) tests
- RBT is as good as sophisticated tests and recommended as the first test



STA (SAT)

- Positive; IgG \geq 1/160 or four fold increase in titer



Titer of 1/160 may persist for up to 1.5 yrs.

Clin Vaccine Immunol March 2002; 9(2): 366-369

Z. Memesh et al. Diagnostic Microbiology and Infectious Disease 44 (2002) 129-132

JCM, June 1980, p. 691-693

2-ME STA

For initial diagnosis and follow up

- The 2ME disrupts disulfide bonds, making IgM inactive and permitting only brucella agglutination by IgG
- 2ME test is evidence of an active infection and the need for antibiotic therapy

Number of patients by titers and by time after onset of brucellosis

	Months	First week	6	9	12	18
$\geq 1/160$	STA	53/53 (100%)	75	62	55	44
	2-ME	24 (45%)	22	12	8	4

- Not sensitive at the outset of illness

ELISA

Comparison of SAT and ELISA IgG/IgM tests in patients with positive Brucella blood cultures

	SAT		ELISA					
	Positive (titre ≥ 320)	Negative (titre < 320)	IgG		IgM		IgG+IgM	
			Positive IgG	Negative IgG	Positive IgM	Negative IgM	Positive IgG or IgM	Negative IgG and IgM
Positive blood cultures (n = 68)	65	3	31	37	53	14	62	4
Controls (n = 70)	0	70	2	68	0	70	2	68
Sensitivity	65/68 = 95.6%		31/68	45.6%	53/67 = 79.1%		62/66 = 94.1%	
Specificity	70/70 = 100%		68/70	97.1%	70/70 = 100%		68/70 = 97.1%	
Positive predictive value	100%		45.2%		100%		63.01%	
Negative predictive value	99.7%		97.1%		98.9%		99.6%	

Note: Predictive value calculation assumes seroprevalence of active Brucellosis in Saudi Arabia is 5%.

ELISA and CNS Brucellosis

Sera from patients in different stages of brucellosis as well as sera and CSF from patients with CNS brucellosis and controls, were tested by ELISA for Brucella-specific IgG, IgM and IgA.

Test		IgG	IgM	IgA
ELISA Serum	Acute n = 296	97	100	98
	Subacute n = 44	100	86	100
	Chronic n = 40	100	33	100
ELISA CSF	n = 45	100	20	85
STA (MDA) and RBT	Acute	98		
	Subacute	84		
	Chronic	61		
CSF	STA(MDA)	25		
	RBT	22		
B. Melitensis (SA) and Culture		Significantly lower positive results		
ELISA was negative in the CSF specimens from patients with brucellosis without CNS involvement (n = 66), or meningitis other than Brucella (n = 62), and no meningitis (n = 144).				

Thus, ELISA is the test of choice in the diagnosis of patients with brucellosis, especially those with chronic or CNS infection

Treatment

- Single agent treatment carries 10 – 40 % chance of relapse
- WHO, 1981 regimen
 - Tetracycline 2 gm/day for 6 weeks
 - Streptomycin 1 gm / day for 3 weeks.
- WHO 1986, and current regimen
 - Doxycycline 200 mg/day For 6 weeks
 - Rifampicin 600 – 900 mg/day For 6 weeks
- Ciprofloxacin; quick response but monotherapy has high rate of relapse (KFSH-Saudi Arabia)

Treatment

- Pregnancy: Rifampicin ± TMP-SMX
- Children:
 - More than 8 years:
 - Doxy 100 mg BID for 6 weeks + (Gentamicin iv 2-3 wks OR Streptomycin 1 gm IM QD for 2-3 wks)
 - Doxy + Rifampicin 600-900 mg/day for 6 wks
 - TMP-SMX DS p.o QID for 6 wks + Gentamicin for 2 wks.
 - Less than 8 years: TMP-SMX 5 mg/kg p.o. BID + Gentamicin for 2 wks.
 - TMP-SMX + rifampicin OR doxycycline + rifampicin (Turkey)

Pediatrics International, 2009 February; 51(1): pages 114–119, Ziad Mamesh et al. CID 2001; 32:1172–7
NEJM352: 2325, 2005, Rev. of infec. Disease 1983;5 : 821-41, Antimic. Agents. Chemo. 1986;29:182-183),CID 1995;21:283-90

Efficacy and Tolerability of Antibiotic Combinations in Neurobrucellosis: Results of the Istanbul Study

- Retrospective study, Adult patients (N = 215), 28 hospitals from 4 different countries
- **Ceftriaxone does not accumulate in phagocytes**, should it be added to Brucella treatment ?
 - Protocol ONE = ceftriaxone, rifampin, and doxycycline (4.40 ± 2.47 months)
 - protocol TWO = TMP-SMX, rifampin, and doxycycline (6.52 ± 4.15 months)
 - Protocol THREE = the patients started with P1 and transferred to P2 when ceftriaxone was stopped
- Ceftriaxone-based treatment period was shorter ($P = 0.002$), efficacy was found to be better ($P = 0.017$) and less relapse plus failure ($P = 0.020$)
- Seemingly, ceftriaxone-based regimens are more successful and require shorter therapy than the oral treatment protocol.

Endocarditis

- Medical therapy
- Valve replacement and medical treatment
- Antimicrobial therapy: (Tetra, Strep, & TMP-SMX) OR
(Rifampicin, TMP-SMX for 6 – 9 months)

Combating Brucellosis in Human

Education and Changing the deeply rooted habits:

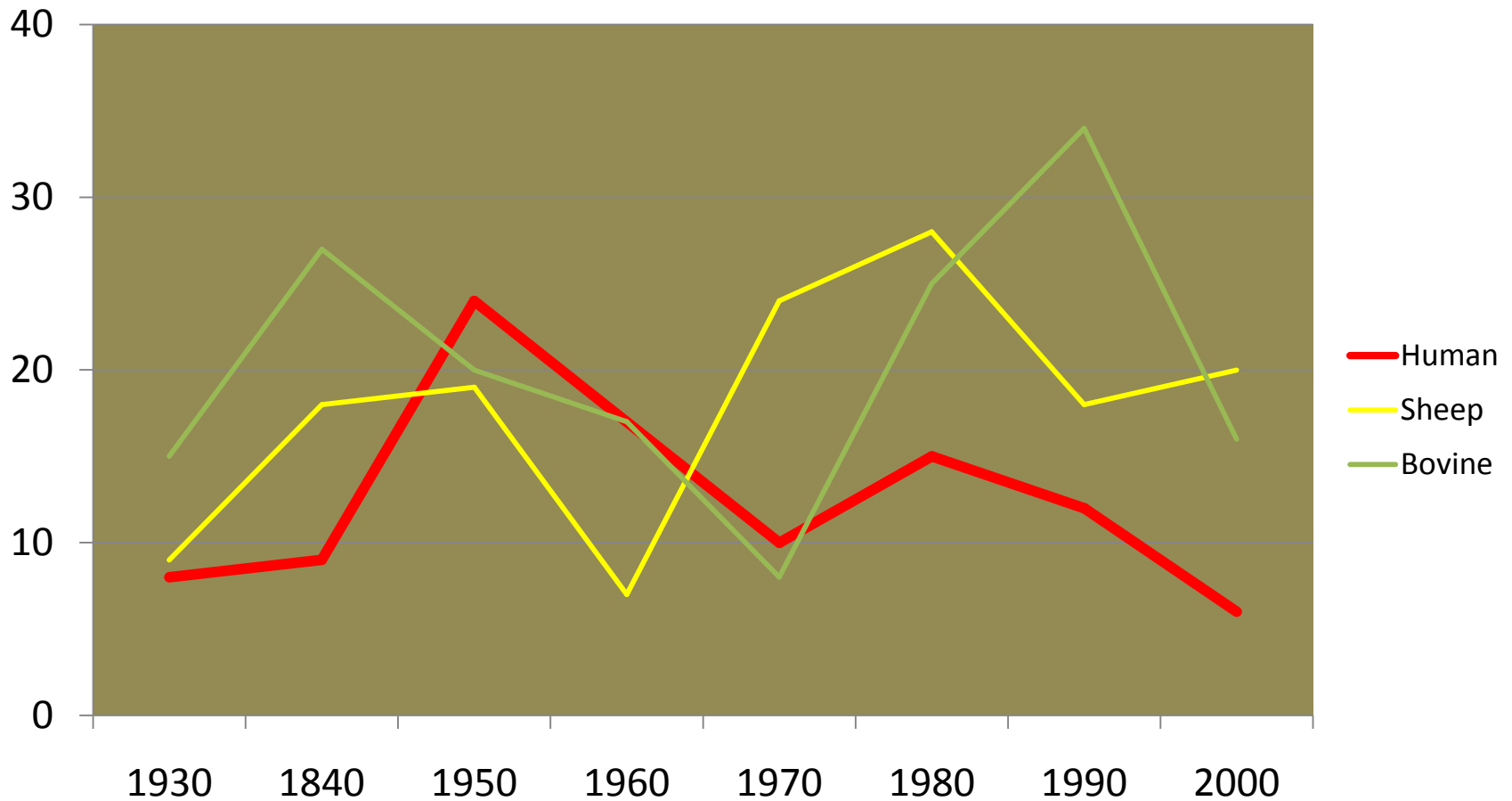
- Milk and its products
- Domestic farm animals slaughtering education
- Abattoir workers
- Farmers handling animals
- Laboratory personnel

Combating Brucellosis in Animals

Jordan (MOA) since 2003

- Logistics to prevent animal diseases (away from Urban areas, water, highways ... etc)
- Veterinarian services is a must in any animal barn
- Areas for infected animal isolation
- Areas to burn dead animals
- Barns for animals feed
- Screening of imported animals

Trends of Seroprevalence of Human and Animal Brucellosis in Turkey, 1930s-2000s

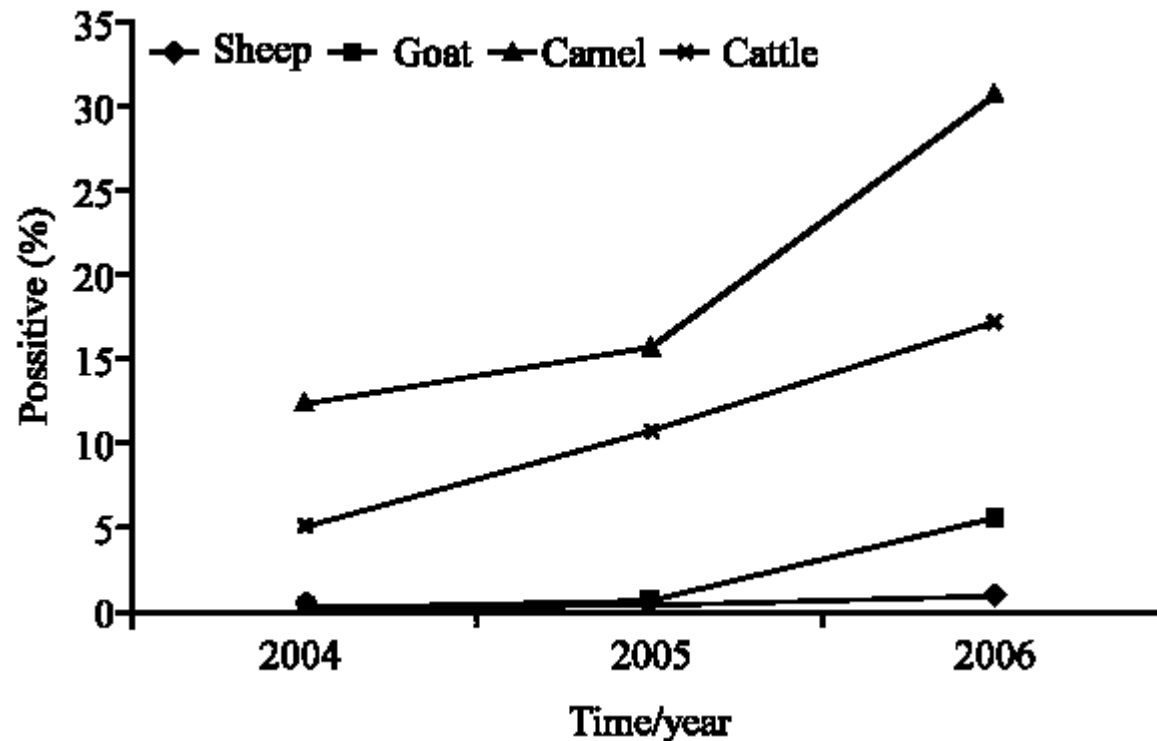


Survey of Brucellosis among Sheep, Goats, Camels and Cattle in Kassala Area, Eastern Sudan

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Abstract: This study is conducted to estimate the prevalence of brucellosis in different animals species in Kassala area, eastern Sudan during 2004 up to 2006. The study aimed to provide a documented information on the prevalence of the disease with a view to assisting veterinary authorities in diseases control policies and planning research priorities in the region. The serum samples were collected from sheep, goat, camels and cattle, then tested in by Rose Bengal Plate test. The study showed that the prevalence of brucellosis is increased during the last years among different animal species.

Percentage of Animals Tested Positive Between 2004 - 2006



Animals sera were tested by RBST

To Wrap Up

- In many Arab countries brucella is still occurring at an unacceptable rates
- Guidelines for laboratory diagnosis are needed
- Efforts to combat brucellosis is not enough on the official scale
- Outreach people; educate them about their animals themselves
- Treatment regimens should not be perplexed
- Educating physicians about brucellosis and about treatment and follow up
- Ministries of Health and Agriculture should work closely on this zoonotic infection