

## Bacterial and mycotic diseases of camels in Egypt

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### SUMMARY

THE present work is a review of bacterial and mycotic diseases reported in camels in Egypt. Tuberculosis was diagnosed as early as 1917, with an incidence of 0.3% to 4%. Besides the typical mycobacteria, mostly of the bovine type, atypical mycobacteria are also isolated frequently from tuberculous-like lesions. The incidence of brucellosis in camels varies regionally from 4% to 24%. Twenty-three *Salmonella* serovars have been isolated from mesenteric lymph nodes and faeces. An oedematous skin disease is described in which camels show oedema particularly around the elbow joints; *Corynebacterium ovis* has been isolated. Over 10 bacterial species have been isolated from skin abscesses and fistulous withers. Leptospiral antibodies have also been detected in camel sera. *Mycoplasma argini* and achleplasmas have been isolated and pathogenic strains of *Pasteurella multocida* recovered from the respiratory tract of healthy camels. Various bacteria have been isolated from cases of mastitis and from genital tract infections. From cases of ringworm *Trichophyton verrucosum* and *Trichophyton mentagrophytes* have been isolated.

### INTRODUCTION

Increasing attention is being directed towards a study of bacterial and mycotic diseases in camels. This review covers work reported in Egypt. For other reviews, see Higgins 1983; McGrane and Higgins 1984; Rutter and Mack 1963).

### TUBERCULOSIS

Camels slaughtered at Cairo abattoirs are routinely examined for tuberculosis. Mason (1917) found 4% of slaughtered camels had tuberculous lesions and organisms isolated from the affected carcasses proved to be of the bovine type. Farrag *et al.* (1953) found that 37/1931 (2%) carcasses examined showed tuberculous-like lesions; 28/37 lymph nodes examined proved to be positive by animal inoculation and of these 27 were of the bovine type and one a human type. Abdel-Aziz (1970) reported that the incidence of tuberculosis in slaughtered camels as judged by *post mortem* examination was 0.8%. Lungs and their lymph nodes were most frequently affected with 45/76 positive tuberculous cases having lesions in the bronchial lymph nodes (59%); 14 cases (18%) had generalised tuberculosis and 11 cases showed acute miliary tuberculosis (14%). The remaining cases showed lesions in the prescapular, inguinal, mediastinal or popliteal lymph nodes. Male camels had the highest incidence (78%) with older animals more frequently affected (82% of positive camels were

older than 10 years of age). In this survey, 97% of the isolates were bovine and 3% of human type (Table 1).

Elmossalami *et al.* (1970) recorded tuberculous-like lesions in 0.3% of 1809 slaughtered camels; 0.21% of carcasses were affected with typical mycobacteria, 0.05% with atypical mycobacteria and 0.05% with mixed types. Older camels were more frequently affected. *M. kansasii* and *M. smegmatis* caused caseous nodules similar to those caused by *M. bovis* or *M. tuberculosis* (Table 1).

Osman (1974) examined lymph nodes from 211 camels with tuberculous-like lesions; 91 yielded typical mycobacteria of which 85 (93%) were of the bovine type and 6 (7%) of the human type. From 96 lymph nodes, atypical mycobacteria were isolated (see Table 2).

### BRUCELLOSIS

Brucellosis was reported for the first time by Ahmed (1939) who found an incidence of 3.5% in Egyptian camels. Hamada *et al.* (1963) reported an incidence of 10% and Fayed *et al.* (1982) found 8.3% of 350 camels to be positive. Zagloul and Kamel (1985) tested 37 camels and found 8.1% reacted positively (Table 3).

### SALMONELLOSIS

Two epidemics of food poisoning in Egypt following the consumption of mutton and camel meat were

**TABLE 1: Tuberculosis in camels in Egypt**

Author	No examined	No +	%	bovine type	human type
Mason (1917)			4%	100%	-
Farrag (1953)	1931	37	2%	96.4%	3.6%
Abdel-Aziz (1970)			0.8%	97.4%	2.6%
Almossalami et al. (1970)	1809	6	0.3%		
Osman (1974)	211	91		93.4%	6.6%

**TABLE 2: Atypical mycobacteria isolated from Egyptian camels (Emossalami et al. 1970)**

<i>M. kansasii</i>	33.3%
<i>M. aquae</i>	16.7%
<i>M. aquae</i> var. <i>ureolyticum</i>	16.7%
<i>M. fortuitum</i>	16.7%
<i>M. smegmatis</i>	16.7%

reported by Sandiford *et al.* (1936). *Salmonella typhimurium* was the only microorganism isolated from the meat and from the stools of the patients. In 1944, Sandiford described 12 further outbreaks of food poisoning which he also traced to camel meat infected with *Salmonella typhimurium*.

A survey carried out by Floyed (1955) among domestic animals found three camels to be infected with *Salmonella saint-paul*, *S. cholera-suis* and *S. paratyphi*. Farrag and El-Afifi (1956) isolated *S. enteritidis* from 2/100 slaughtered camels and a similar low incidence was reported by Zaki (1956) who isolated *S. typhimurium* from 2/132 camels.

Hamada *et al.* (1963) recovered *S. saint-paul* and *S. glostrup* from 4/45 camel carcasses.

An extensive investigation was carried out by Kamel and Lotfi (1963) who cultured mesenteric lymph nodes and faeces collected from 915 camels slaughtered at Cairo abattoir. The 29 *Salmonella* isolates recovered were identified as *S. typhimurium*, *S. saint-paul*, *S. reading*, *S. dublin*, *S. eastbourne*, *S. enteritidis* and *S. bovis-morbificans*.

The highest incidence (44%) in the Egyptian literature was reported by El-Monla (1978) who isolated the following serovars from 22/50 apparently healthy slaughtered camels: *S. saint-paul*, *S. muenster*, *S. uganda*, *S. typhimurium*, *S. newport*, *S. reading* and *S. kottbus*. A carrier rate of 33.3% was reported by Sayed (1979). The serovars recorded by him were *S. muenster*, *S. muenchen*, *S. brandenburg*, *S. eastbourne* and *S. shubra*.

The mesenteric lymph nodes and intestinal contents of 400 slaughtered camels were examined by Refai *et al.* (1984); 9/11 serovars identified were the first recorded in camels at that time in Egypt. In addition to *S. typhimurium* and *S. eastbourne*, they reported the isolation of *S. heidelberg*, *S. newlands*, *S. chester*, *S. newport*, *S. brazzaville*, *S. goettingen*, *S.*

**TABLE 3: Brucellosis in camels (Refai 1989)**

References	Year	No tested	% of positives
Ahmed	1939	200	3.5
Zaki	1943	200	14.0-26.0%
Hamada et al.	1963	175	10.4
ElNahas	1964	200	4.0
Ayoub et al.	1978	216	24.2%
Fayed et al.	1982	300	6.6 (RBT 5.6, CFT 8.3%)
Nada	1984	780	23.1 (RBT 8.2%, CFT 13.9%)
Zagloul & Kamel	1985	37	8.1

RBT: Rose Bengal Test  
CFT: C\*\*\* Fixation Test

**TABLE 4: Salmonella serovars isolated from slaughtered camels in Egypt**

Salmonella serovars	Authors
1 <i>S. typhimurium</i>	Sandiford <i>et al.</i> (1936), Sandiford (1944), Zaki (1956), Kamel and Lotfi (1963), El-Monla (1978), Refai <i>et al.</i> (1984) and Yassien (1985)
2 <i>S. saint-paul</i>	Floyed (1955), Hamada <i>et al.</i> (1963), Kamel and Lotfi (1963) El-Monla (1978) and Yassien (1985)
3 <i>S. reading</i>	Kamel and Lotfi (1963), El-Monla (1978)
4 <i>S. brandenburg</i>	Sayed (1979)
5 <i>S. shubra</i>	Sayed (1979)
6 <i>S. heidelberg</i>	Refai <i>et al.</i> (1984)
7 <i>S. chester</i>	Refai <i>et al.</i> (1984)
8 <i>S. cholera-suis</i>	Floyed (1955)
9 <i>S. paratyphi-C</i>	Floyed (1955)
10 <i>S. brazzaville</i>	Refai <i>et al.</i> (1984)
11 <i>S. bovis-mrobrificans</i>	Kamel and Lotfi (1963)
12 <i>S. glostrup</i>	Hamada <i>et al.</i> (1963)
13 <i>S. newport</i>	El-Monla (1978), Refai <i>et al.</i> (1984), Yassien (1985)
14 <i>S. muenchen</i>	El-Monla (1978), Sayed (1979)
15 <i>S. kottbus</i>	El-Monla (1978)
16 <i>S. enteritidis</i>	Farrag and El-Afifi (1956), Kamel and Lotfi (1963), Yassien (1985)
17 <i>S. dublin</i>	Kamel and Lotfi (1963)
18 <i>S. eastbourne</i>	Kamel and Lotfi (1963), Sayed (1979), Refai <i>et al.</i> (1984)
19 <i>S. goettingen</i>	Refai <i>et al.</i> (1984)
20 <i>S. israel</i>	Refai <i>et al.</i> (1984)
21 <i>S. newlands</i>	Refai <i>et al.</i> (1984)
22 <i>S. newbrunswick</i>	Refai <i>et al.</i> (1984)
23 <i>S. lokstedt</i>	Refai <i>et al.</i> (1984)

*lokstedt*, *S. israel* and *S. newbrunswick*.

Yassien (1985) recovered *S. typhimurium*, *S. enteritidis*, *S. newport*, *S. saintpaul* and *S. san-diago* from the carcasses of apparently healthy camels.

The spectrum of salmonella serovars isolated from camels in Egypt is summarised in Table 4.

#### PASTEURELLOSIS

Fayed (1973) isolated *Pasteurella multocida* from 6/100 nasopharyngeal swabs collected from apparently healthy camels. All isolates proved to be pathogenic to mice and rabbits. Two camels which were intranasally infected with these isolates

developed clinical signs 48 hours post infection, however they recovered after 5 days.

#### YERSINIA ENTEROCOLITICA

Hamdy *et al.* (1989) isolated *Yersinia enterocolitica* from 8% meat surfaces, 4% liver samples, 12% mesenteric lymph nodes and 2% faeces collected from slaughtered camels in Egypt.

#### OEDEMATOUS SKIN DISEASE

Caprano (1934) described a disease of camels in Egypt characterised by lymphadenitis with external

**TABLE 5: Bacteria isolated from skin abscesses in Egyptian camels**

<i>Staphylococcus aureus</i>
<i>Corynebacterium pyogenes</i>
<i>Corynebacterium pseudotuberculosis</i>
<i>Streptococcus pyogenes</i>
<i>Escherichia coli</i>
<i>Klebsiella</i> spp.
<i>Proteus vulgaris</i>
<i>Proteus mirabilis</i>
<i>Pseudomonas aeruginosa</i>
<i>Clostridium perfringens</i>
<i>Fusobacterium necrophorum</i>

glandular and visceral lesions resembling pseudotuberculosis of sheep with the isolation of *Corynebacterium* spp. Ismail *et al.* (1985) observed oedematous skin disease in 21 camels in 6 villages in Sharkia Governorate, where the disease was also recorded in cattle and buffaloes.

Oedema was evident particularly around the elbow joints of the forelimb, the chest and regional lymph nodes. In some cases there was ulceration and oozing of bloody exudate. *Corynebacterium ovis* was isolated in pure cultures from closed lesions. From open lesions, *C. ovis* was also found but associated with *Staphylococcus aureus*.

#### SKIN ABSCESSSES

A variety of bacteria was isolated by Ismail *et al.* (1990) from closed abscesses on the thoracic regions, shoulder, abdomen, head and limbs of one humped camels (Table 5).

#### FISTULUS WITHERS

El-Seedy *et al.* (1990) described fistulus withers in 93 working camels. Eighty-seven samples were bacteriologically positive with *Staphylococcus aureus*, *Corynebacterium pyogenes*, *C. ovis* and *Escherichia coli* predominant. *Proteus vulgaris* and *Klebsiella* spp were also isolated sporadically. Among the strict anaerobic organisms recovered from cases of fistulus withers were *Clostridium perfringens* and *Fusobacterium necrophorum*.

#### MASITIS

Mostafa *et al.* (1987) examined 55 raw milk samples using field mastitis tests and bacteriological examination. Twenty-three samples showed strong reactions with the field test and yielded *Cl. perfringens*, coagulase positive *Staphylococcus aureus* and *E. coli*.

Karmy (1990) examined 32 camels suffering from mastitis and isolated *Staphylococcus aureus* from 11

cases, *Streptococcus agalactia* from 5 cases, *E. coli* from 6 cases, *Pasteurella haemolytica* from 6 cases and *Corynebacterium pyogenes* from 4 cases.

#### GENITAL TRACT INFECTIONS

A review of the available literature revealed that Zaki and Mousa (1965) noted the presence of a variety of bacteria in the cervical canal, amniotic fluids and fallopian tubes of Egyptian she-camels. Awad *et al.* (1978) examined 48 uteri (20 normal and 28 with endometritis); *Corynebacterium pyogenes*, *Pasteurella multocida* and *Klebsiella* spp were isolated only from cases of endometritis whereas *Staphylococcus aureus* and haemolytic streptococci were isolated from normal and diseased uteri with a significantly higher incidence in cases of endometritis.

Hegazi *et al.* (1979) studied the bacteriology and histopathology of endometritis. From cases of acute catarrhal endometritis they isolated *Escherichia coli*, *Klebsiella* spp, *Corynebacterium pyogenes* and *Staphylococcus aureus*. *Corynebacterium pyogenes* was the main case of acute suppurative endometritis, while in chronic cases, *Streptococcus pyogenes* was the main isolate.

Ali *et al.* (1987) isolated *Escherichia coli*, micrococci, *Corynebacterium pyogenes*, *Citrobacter*, *Staphylococcus aureus* and *Pasteurella multocida* from cases of endometritis. From cases of pyometra they isolated *Streptococcus pyogenes* and *Proteus* species.

Hassan (1990) examined the genital organs of 127 camels slaughtered at Cairo abattoir (83 non-gravid and 20 gravid, as well as 24 with pathological changes). He isolated *Streptococcus pyogenes* and *Corynebacterium pyogenes* from cases of pyometra, *Corynebacterium pyogenes* from a case of early embryonic death, *Corynebacterium pyogenes* from abscesses of the uterine wall and *Staphylococcus aureus*, *Corynebacterium pyogenes*, *Corynebacterium ovis*, *Escherichia coli*, *Streptococcus pyogenes*, *Klebsiella* spp and *Pseudomonas aeruginosa* from cases of endometritis. He noted that virtually the same microorganisms were also isolated from apparently healthy genitalia but with lower frequency.

#### LIVER ABSCESSSES

Itman and his colleagues (1989) were the first in Egypt to report on a study of liver abscesses in the camel. From 100 camel livers showing necrosis and abscesses they isolated *Clostridium novyi* from 6 cases and *Clostridium perfringens* from 9 cases. However, the same bacteria were also isolated from apparently healthy livers.

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**TABLE 6: Mycoplasma isolated from Egyptian camels (Sabry and Ahmed 1989)**

Identified species	Recovery sites	References
1 <i>M. arginini</i>	- Nose, lungs and oropharynx	Fayad and Sabry (1979); Ahmed (1984), Sabry and Ahmed (1986)
2 <i>A. granularum</i>	- Conjunctiva, lymph nodes and - Female genitalia	Fayad and Sabry (1979), Ahmed (1984), Sabry and Ahmed (1986)
3 <i>A. laidlawii</i>	- Conjunctiva - Respiratory tract - Female genitalia - Rectum, urinary bladder.	Fayad and Sabry (1979), Ahmed (1984), Sabry and Ahmed (1986) Sabry and Ahmed (1986)
4 <i>A. oculi</i>	- Conjunctiva, nose - Vagina	Fayad and Sabry (1979), Ahmed (1984)

### MYCOPLASMOSIS

Investigations of camel mycoplasmas in Egypt have been reported by several authors (Al-Zeftawi 1973; Ahmed 1984; Gad 1975; Sabry and Ahmed 1975; Sabry *et al.* 1976; Fayad and Sabry 1979 and Ahmed 1984) and the data are summarised in Table 7. A systematic study of the mycoplasma flora of dromedary camels was carried out by Sabry and Ahmed (1986). The serotyping of 308 isolates recovered from 849 specimens revealed the identification of *Mycoplasma argini* (11.4%), *Acholeplasma laidlawii* (75.8%), *A. oculi* (2.1%), *A. granularum* (3.1%) and unidentified species (7.6%). These isolates were recovered from the respiratory, digestive and female urogenital tracts. From these data the only possibility which needs further verification for disease association of mycoplasmas in camels is the frequent isolation of *M. arginini* from pneumonic lungs and their associated mediastinal lymph nodes. Sabry and Ahmed (1989) have reviewed mycoplasmas isolated from different animals in Egypt.

### LEPTOSPIROSIS

Only two publications could be traced in the available literature concerning leptospirosis in the Egyptian camel. Maronpot and Barsoum (1972) detected leptospira antibodies in titres of 1:128 and more in 34 out of 50 camel sera. Hatem (1976) reported an incidence of 9.2% in 88 camel sera with significant antibody titres. The sera were positive to *L. pyrogenes*, *L. tarassovi*, *L. bataviae* or *L. butembo*.

### MYCOTIC DISEASES

The only work done on mycotic infections of the camel in Egypt is that of Torky (personal communication) who isolated *Trichophyton*

*verrucosum* and *T. mentagrophytes* from cases of ringworm.

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