

Research Article

Aerobic Bacteria Isolated from Condemned Camel Livers in Southern Darfur, Sudan

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Abstract: The objective of this study was to estimate the magnitude of liver condemnation due to bacterial infection and to characterize aerobic bacteria causing camel liver condemnation in Nyala city, South Darfur, Sudan. Eight hundred and ten camel livers were inspected and one hundred and three liver samples were collected in 2008-2010. Bacteriological and serological methods were used to isolate and identify aerobic bacteria causing liver infection. Results showed that the bacterial lesions were found in 36 (35%) samples out of 103 condemned inspected camel livers, the others causes were hydatid cyst 37 (35.9%), fibrosis 26 (25.2%) and calcification 4 (3.9%). Bacterial lesions consist of: abscesses 22 (61.1%), caseated nodules 13 (36.1%) and one (2.8%) congestion. Out of 36 aerobically incubated samples, 29 showed bacterial growth (80.6%) and seven cultures (19.4%) showed no growth. The isolates were identified to *Staphylococcus spp.* 11 (37.9%) which included; *Staphylococcus aureus* (*S. aureus*) 7 (63.6%), *S. haemolyticus* 3 (27.3%) and one (9.1%) *S. caseolyticus* while, *Streptococcus pyogenes* was found to be nine (31.0%) and *Corynebacterium pseudotuberculosis* (20.7%). Mixed cultures (*Staphylococcus* and *Streptococcus*) were found to be three (10.3%). Many bacteria seem to be caused camel liver condemnation and the most one is *S. aureus* therefore, camel liver need carefully inspection and awareness about consumption of raw liver must be raise

Keywords: Aerobic, bacteria, camel, liver condemnation

INTRODUCTION

Sudan is the one of the largest camel population countries in the world (Wilson, 1984) and owns about 3.6 million head of camel (Report, 2003). More than 80% of camel populations in Sudan were found in Kordofan and Darfur States (Idris, 2003). A total of 1170265 head in Southern Darfur; 158239 head in Northern Darfur and 4634 head in Western Darfur according to Ministry of Animal Resource (MAR, 2009).

Last years, camel breeders were forced to settle in South Darfur due to drought and desertification. The settlement of camel breeders around has an apparent effect on societies living around them, especially in eating habits such as the consumption of camel meat lead many people eating raw camel livers and more than 100 camel head were slaughtered in Nyala slaughterhouse per month (MAR, 2009).

Camel liver abscesses were reported by many investigators (Buxton and Fraser, 1977; Radwan *et al.*, 1989; Andrade, 1991; Al-Ani *et al.*, 1998; Teixeira *et al.*, 2001 and Hamad, 2008) and Rosa *et al.* (1989) reported that liver abscesses caused by *Fusobacterium necrophorum* and *Corynebacterium pseudotuberculosis*.

Bacteria were isolated from camel liver by many researchers, in Saudi Arabia; Radwan *et al.* (1989) isolated *Corynebacterium pseudotuberculosis*. In Jordan; Al-Ani *et al.* (1998) isolated *Actinomyces pyogenes*, *Streptococcus viridians*, *Staphylococcus aureus* and *E. coli*. In the same country, Azmi (2000) isolated *Corynebacterium spp.* and *Staphylococcus aureus*. Seleim *et al.* (2003) isolated *Pasturella multocida*. El-Dakhly *et al.* (2007) examined 165 camels of which 61 livers were infected, he isolated 11 bacterial genera and the most prevalent isolate was *Enterococcus* in addition to *Staphylococcus* and *Streptococcus*, while *Corynebacterium pyogenes*, *E. coli* and *Pseudomonas aeruginosa* reported by Altabari (2009) as the most common isolates from camel liver abscess. The most important anaerobic micro-organisms isolated from camel abscess were *Clostridium novyi*, *Clostridium perfringens* and *Fusobacterium necrophorum* reported by Makhareta (1988); Itman *et al.* (1989) and El-Naenaey (2000).

In Sudan, isolation of bacteria from camel liver was reported by Hamed (2008). In South Darfur State, *Brucella* as a zoonotic pathogen was reported in Camels by Musa *et al.* (2000) and Raga (2000) and Hassan *et al.* (2007) succeed to isolate *Streptococcus pyogenes* and *Staphylococcus aureus* from camel lung but there is

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no research conducted to study camel liver infection in study area. Therefore, this work aimed to reflect the risk of consuming raw livers by means of the isolation of aerobic bacteria from condemned camel livers.

MATERIALS AND METHODS

Study area: This study was carried out in Nyala city, the capital of South Darfur State, during the period from August, 2008 to August, 2010.

Collection of samples: A total of 810 camel livers were inspected at Nyala slap and 103 samples of condemned camel livers were collected. Samples such as abscesses, caseated nodules and congestion were investigated at Nyala Veterinary Research Laboratory for bacterial isolation. The isolates were identified using bacteriological method. Other lesions including; hydatid cyst, fibrosis and calcification were diagnosed at slaughterhouse.

Isolation of the organisms: Samples (abscess, caseated nodules and congestion) were streaked onto blood agar plates then incubated aerobically at 37°C. Growth was examined after 24-48 h then sub-cultured and checked for purity under the microscope by examining smears stained by Gram and ZeihNeelson stains.

Identification of isolates: Isolated organisms were further identified according to the criteria outlined by Barrow and Feltham (2003) which include; morphology, Gram reaction, ZeihNeelson stain, cultural characteristics, motility test and biochemical reaction then confirmed by the commercial Kits (KB004 and KB005 biochemical tests).

Biochemical kits: Kits in this study used as a confirmatory test, it contains different biochemical tests as colorimetric identification system. Kit KB004 was used to differentiate the species of the genus *Staphylococcus spp.* and Kit KB005 used for *Streptococcus spp.* The tests are based on the principle of PH change and substrate utilization. During incubation, tested organisms which grown on nutrient agar medium, made metabolic change which indicated by a colour change in the media, immediately or after addition of reagent.

Statistical analysis: Statistical Package for Social Scenes (SPSS) was used to analyze data.

RESULTS

Type of condemnation: A total number of 810 camel livers were inspected, 103 (12.7%) were condemned, of

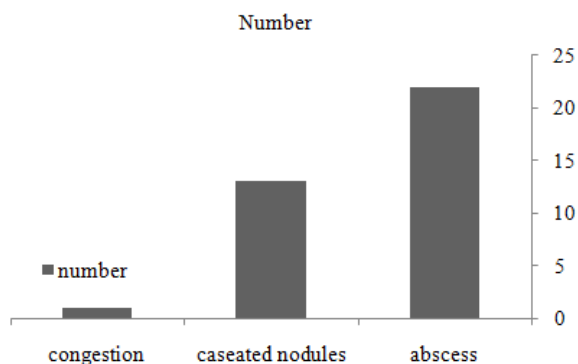


Fig. 1: Bacterial lesions cause camel liver condemnation at Nyala slap



Fig. 2: Abscess in camel liver



Fig. 3: Abscess contained caseated material

which 36 (35.0%) were due to bacterial infection. Out of the 36 obtained bacterial infection, abscess represented 22 (61.1%), caseated nodules 13 (36.1%) and one (2.8%) congestion (Fig. 1 to 3).

Microscopic examination: A total of 36 smear of bacterial-like infection samples, stained by Gram stain and Zeih-Neelson stain. They showed Gram positive reaction with different shapes and apparent non-acid fast organism.

Bacterial isolation: Out of the 36 cultured samples, 29 samples showed bacterial growth (80.6%) seven (19.4) samples showed no growth. In the former 11(37.9%), 9(31.0%) and 6(20.7%) samples were found to be *Staphylococcus spp.*, *Streptococcus pyogenes* and *Corynebactrium pseudotuberculosis* respectively. Mixed (*Staphylococcus aureus*+*Streptococcus pyogenes*)

Table 1: Biochemical reactions used for the identification of the isolates to the species level

Test	<i>S. aureus</i>	<i>S. haemolyticus</i>	<i>S. caseolyticus</i>	<i>Strept. pyogenes</i>	<i>Coryne. pseudotuberculosis</i>
Catalase	+ve	+ve	+ve	-ve	+ve
Oxidase	-ve	-ve	+ve	-ve	-ve
Coagulase	Slide+ve Tube+ve	-ve	-ve	nt	nt
VP	+ve	+ve	-ve	-ve	-ve
Urease	+ve	-ve	-ve	nt	nt
Sucrose	+ve	+ve	nt	+ve	-ve
Arginine hydrolysis	+ve	+ve	nt	+ve	+ve
Lactose	nt	nt	nt	+ve	-ve
Hippurate	nt	nt	nt	-ve	nt
Asculin	nt	nt	nt	-ve	nt

+ve = Positive -ve = Negative nt = not tested

Table 2: The biochemical tests (Kits) used to confirm the identification of *Staphylococcus* and *Streptococcus* species

Test	<i>Strep. pyogenes</i>	<i>S. aureus</i>	<i>S. hemolyticus</i>	<i>S. caeolyticus</i>
Vogesproskauer's	-ve	+ve	+ve	-ve
Alkaline phosphatase	nt	+ve	-ve	-ve
ONPG	-ve	-ve	-ve	-ve
Urease	nt	+ve	-ve	-ve
Arginine	+ve	+ve	+ve	+ve
Mannitol	-ve	+ve	+ve	-ve
Sucrose	+ve	+ve	+ve	+ve
Lactose	nt	+ve	+ve	+ve
Arabinose	-ve	-ve	-ve	-ve
Raffinose	-ve	-ve	-ve	nt
Malose	nt	+ve	+ve	+ve
Esculine hydrolysis	+ve	nt	nt	nt
PYR	+ve	nt	nt	nt
Glucose	+ve	nt	nt	nt
Ribose	-ve	nt	nt	nt
Sorbitol	-ve	nt	nt	nt

bacteria were observed in three (10.3%) cultures. Within this genus *Staphylococcus*, 7(63.6%) were *Staphylococcus aureus* (*S. aureus*), 3 (27.3%) were *S. haemolyticus* and 1 (9.1%) was *S. caseolyticus* (Table 1).

Biochemical kits: The results of biochemical tests (kits) for *Staphylococcus* and *Streptococcus* spp. showed in Table 2.

DISCUSSION

Some investigators reported different liver condemnation rates due to bacterial infection mainly hepatic abscesses in other ruminants. Rosa *et al.*, (1989) reported 2.5% in goat in Northeast Brazil while Ahmedullah *et al.* (2007) found 3.8% in the same species in Bangladesh. Mellau *et al.*, (2007) reported 18829 (16.3%), 10515(17.1%) and 7011(18.5%) livers of cattle, sheep and goats respectively were condemned due to different diseases included hepatic abscesses. In Western Nigeria, Cadmus and Adesokam (2009) reported liver condemnation rate due to abscess was 1.1% in cattle, 1.0% in sheep and 1.5% in goats and Hamad (2008) in East Sudan reported 97 camel abscesses from lung, liver and lymphnodes, but information about camel liver infection is rare or may be absent especially in the area of study and this work seems to be the first one of its kind. In this study, the

total condemnation rate of camel liver was 103(12.7%) and 36(35%) due to bacterial infection; abscess represented 22(61.1%) as the most bacterial lesions. This finding is in agreed with Al-Ani *et al.* (1998) in Jordan and Radwan *et al.* (1989) in Saudi Arabia. In this study caseated nodules represented 13(36.1) of the total bacterial lesions. Such observation is believed to be reported for the first time as bacterial lesion which caused condemnation of camel liver. However caseated nodules were reported in other organs of camel such as the lung (Hassan *et al.*, 2007).

In this study *Staphylococcus* spp. were found to be the most predominant isolates 11(37.93%) from camel liver and this result agreed with the results obtained by Azmi (2000) in Jordan and by Hamad (2008) in Sudan who found *Staphylococcus* spp. represented the highest isolation rate from camel liver. However the result disagreed with Seleim *et al.* (2003); El-Dakhly *et al.* (2007) who reported *Pasturellamultocida*, *Enterococcus* spp. and *Salmonellaspp.* respectively as the most prevalent isolates from camel liver. In this study, also *Streptococcus pyogenes* was isolated from the same organ and found to be 9(13.0%) and this result agreed with the findings reported in camel liver by Al-Ani *et al.* (1998) and El-Dakhly *et al.* (2007). In the same study, *Corynebacterium* spp. seems to be isolated for the first time in Sudan from camel liver and constituted 6(20.7%), this in line with Radwan *et al.* (1989) and Rosa *et al.* (1989) who isolated the same bacterial species from camel liver. Different bacterial

species isolates may be due to different camel living places and in an area of study camel sometimes shared other animal species in water and grazing.

In the present study some blood agar plates resulted in no growth and this agreed with the results obtained by Chardrdan *et al.* (2006) and Hamad (2008). This study concluded in, camel liver condemnation caused by different bacterial species and the predominant one is *Staphylococcus spp.*, it was therefore, recommended that camel liver needs carefully inspection and more researches in addition to raise of awareness about consuming raw liver or meat.

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