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Effect of housing conditions on the prevalence of bovine tuberculosis in dairy farms in Kassala State, Sudan

Ayman E.A [1]* Abbas M. Ahmed[2]* A.A. Abdelaziz[3]

1. Ministry of Livestock's, Fisheries and Rangeland, Kassala, Sudan
2. Veterinary Research Institute (VRI), Khartoum, PO Box 8067
3. Gezira University, Sudan, Wad Medani

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ABSTRACT

Four hundred and nine (409) milk producing cows , from 32 resident farms in Kassala city, Elgash area, Fato and New Halfa sugar farm, were subjected to Comparative Cervical Tuberculin Test CCTT to determine the effect of ventilation, hygiene, tick free, square available for animal head (AH), exposure to sun rays and nutritional balance factors on the prevalence of bovine tuberculosis.
Every factor had three criteria that required obtaining the highest score (3), according to the availability of one or two criteria the factor gave score (1) and score (2) respectively and scoring zero in case of absence of the three criteria. The results of this study showed that the differences between the results of CCTT in score1and score 2 for ventilation and exposure to sun rays were all significant (P = 0·000) and (P = 0·001) respectively , whereas the differences between results of CCTT in score 0,1 and 2 for hygiene , tick free , square available for animal head and nutritional balance were all insignificant .(P = 0.402 , P = 0.371 , P = 0.276 , P = 0.208) respectively .

INTRODUCTION

Bovine tuberculosis is a chronic bacterial disease of animals and humans caused by *Mycobacterium bovis* (OIE, 2009). *M. bovis* is a member of the *M. tuberculosis complex* of mycobacteria. (Ashford *et al*., 2001). Mycobacterium are actinomycetes that are aerobic, non-motile, non-spore - forming bacteria and characteristically acid – fast (Wayne and Kubica., 1986). It is usually characterized by the formation of nodular granulomas known as tubercles.

Any body tissue can be affected, but lesions are most frequently observed in the lymph nodes (particularly of the head and thorax), lungs, intestines, liver, spleen and peritoneum (OIE, 2009).

Cattle housing type and condition may

influence the transmission of the disease within the herd. Insufficient ventilation in cattle housing is a recognized risk factor in many studies (Skuce *et al.,* 2013). However, sharing of water sources and pasture increase the chances of the disease transmission to livestock (Bugwesa *et al*., 2011)

The Office International des Epizooties (OIE) classified bovine tuberculosis as a List B disease, a disease which is considered to be of socio-economic or public health importance within countries and of significance to the international trade of animals and animal products (Cousins. 2001). Bovine tuberculosis (BTB) is transmitted to man by ingestion of contaminated milk and dairy products, or by respiratory route. In Sudan, the disease was first reported in 1915 (Anon, 1915). Karib (1962) accentuated the importance of bovine tuberculosis in the early sixties in Sudan. Mustafa and Fawi (1966), El-Nasri, (1966), Mustafa (1970), Tageldin (1971) and Awad El-Kareem and Mustafa (1974), reported the importance of the disease in the Sudan.

The intradermal tuberculin test is the standard method for detection of BTB infection in cattle. It involves measuring skin thickness, injecting the purified protein derivative (PPD) into the measured area and measuring any subsequent swelling at the site of injection three days later. This test is still largely used for field testing. This is due to the high sensitivity with bovine PPD and the excellent specificity of the comparative test with bovine and avian PPD (De Kantor *et al.,* 2008).

The comparative intradermal tuberculin test is used to differentiate between animals infected with *M. bovis* and those responding to bovine tuberculin as result of exposure to other mycobacteria. In several countries, bovine tuberculin is considered to be of acceptable potency if its estimated potency guarantees per bovine dose at least 2000 IU in cattle. In cattle with diminished allergic sensitivity, a higher dose of bovine tuberculin is needed in national eradication campaigns; doses of up to 5000 IU are recommended. The volume of each injection must not exceed 0.2 ml. (OIE. 2009).

The objectives of this work was to see the effect of housing conditions (ventilation, hygiene, tick free, square available for animal head (AH), exposure to sun rays and nutritional balance) on the prevalence of bovine tuberculosis.

MATERIALS and METHODS

Study area:

Kassala State lies between Latitudes 14°15′ and 17°15′ N and Longitudes 34°30′ and 37°E′ in eastern Sudan; it borders Eritrea and Ethiopia. The total animal population in this state according to the Administration of Animal Resources (2006) is 3800553, animal species as follows: 631957 cattle, 1457643 sheep, 1122073 goats and 588880 camel.

Number of tested animals:

The total number of cows investigated in this study was 409 dairy cows from resident farms in Kassala city, Elgash area, Fato and New Halfa sugar farm.

Classification of farms:

Every factor had three criteria's that required to obtain the highest score (3), according to the availability of one or two criteria's the factor gave score (1) and score (2) respectively and scoring zero in case of absence of the three criteria , for ventilation the criteria were cowshed open in the direction of the air passage , there are no building or walls that block the passage of air and the height is more than 3 meters , for exposure to sun rays the required criteria were, Two –thirds of the cowshed is exposed to sunrays throughout the day , free

movement for cows in all parts of the shed and the sun rays has the ability to reach all parts of the shed through different time of the day . For tick free factor the animal body is free from tick infestation, there is a regular program to combat ticks and cowshed built with metal materials. For hygiene, the needed criteria's were; the ground is clean, dry and can be cleaned, the cleanliness every 1 to 7 days and no food leftover on the ground. The criteria for nutritional balance were balanced diet containing all necessary elements (protein, carbohydrates, essential minerals, vitamins ….etc), daily green fodder supply and mineral block. For square for animal heads factor the criteria's were ; space available for animal head (AH) is 5 meters or above, sufficient and well-distributed eating and drinking equipments and isolation or restriction of bulls from females especially the fierce ones.

According to that, no farm had score 0 for ventilation , exposure to sun rays ,square available for animal heads and nutritional balance whereas 15(3.7%) cows had score 0 for hygiene and tick free , 57(13.9%) cows had score 1 , 352(86.0%) cows had score 2 for ventilation , 120(29.3%) cows had score 1 , 289(70.7%) had score 2 for exposure to sun rays , 291(71.1%) cows had score 1 , 118(28.9%) cows had score 2 for square available for animal heads , 25 (6.1%) cows had score 1 , 384(93.9) cows had score 2 for nutritional balance , 291(71.1%) cows had score 1 , 103(25.2%) had score 2 for hygiene , 311(76.1%) cows had score 1 , 839(20.3%) had score 2 for tick free .

Comparative cervical tuberculin test (CCTT)

Test procedure

Bovine and avian purified protein derivatives, PPD (Symbiotic, France) were used as injected antigens in this test. Each ml of the bovine and avian PPD contains 20000 IU.

The procedure was carried out as described in the OIE Terrestrial Manual (2009). Briefly, the injection sites on the mid-neck were clipped and cleaned. A fold of skin within each clipped area was measured with a caliper and the site was marked prior to injection. Then, a short needle, bevel edge outwards and graduated syringe charged with tuberculin, was inserted obliquely into the deeper layers of the skin. The dose of 2000 IU of bovine and avian tuberculin was then injected. A correct injection was confirmed by palpating a small pea-like swelling at each site of injection. The distance between the two injections was approximately 12–15 cm. The skin-fold thickness of each injection site was re-measured 72 hours after injection.

Test interpretation

As used in European Union (EU) countries, the reaction is usually considered to be positive if the increase in skin thickness at the bovine site of injection is more than 4 mm greater than the reaction shown at the site of the avian injection. The reaction is considered to be inconclusive if the increase in skin thickness at the bovine site of injection is from 1 to 4 mm greater than the avian reaction. The reaction is considered to be negative if the increase in skin thickness at the bovine site of injection is less than or equal to the increase in the skin reaction at the avian site of injection.

RESULTS

Comparative Cervical Tuberculin Test (CCTT)

Out of 409 cows subjected to this test, 8 (1.95 %) showed positive reaction. (Table1). The results of this study showed that the differences between the results of CCTT in score 1 and score 2 for ventilation and exposure to sun rays were all significant (P = 0·000) and (P = 0·001) respectively , whereas the differences between results of

CCTT in score 0,1 and 2 for hygiene , tick free , square available for animal head and nutritional balance were all insignificant. (P = 0.402 , P = 0.371 , P = 0.276 , P = 0.208) respectively

Table1: Comparative cervical tuberculin test (CCTT) results according to housing conditions score in milk producing farms, Kassala State

Variables	CCTT			
	Score	No. Examined	Positive	%
Ventilation	0	0	0	0
	1	57	5	8.8
	2	352	3	0.8
	Grand Total	409	8	1.95
Exposure to sun rays	0	0	0	0
	1	120	7	5.8
	2	289	1	0.3
	Grand Total	409	8	1.95
Tick Free	0	15	1	6.7
	1	311	6	1.9
	2	83	1	1.2
	Grand Total	409	8	1.95
Hygiene	0	15	1	6.7
	1	291	5	1.7
	2	103	2	1.9
	Grand Total	409	8	1.95
Square for AH	0	0	0	0
	1	291	7	2.4
	2	118	1	0.8
	Grand Total	409	8	1.95
Nutritional Balance	0	0	0	0
	1	25	2	8
	2	384	6	0.8
	Grand Total	409	8	1.95

DISCUSSION

Bovine tuberculosis constitutes a public health problem, affecting people that have close contact with infected cattle (Proano-Perez *et al*, 2006). Though uncommon, human tuberculosis due to *M. bovis* is still a public health problem concern to both medical and veterinary professions and there is need to maintain careful surveillance. The comparative intradermal tuberculin test (CCTT) is used to differentiate between animals infected with *M. bovis* and those responding to bovine tuberculin as a result of exposure to other mycobacteria.

When CCTT results were analyzed according to the ventilation, it was found that, the highest prevalence was in farms that had a score 1 for ventilation (8.8%) and the lowest prevalence (0.8%) was in farms with score 2 and the difference between two scores had a significance level (0.000) which may indicate the role of ventilation in prevalence rate of the disease. Neill *et al.*,

(2001). reported that infected cattle are the main source of infection and the bacteria are usually excreted in the exhaled air. It has been stated that cattle may excrete bacteria from the infection of a lung lesion. According to Goodchild, Clifton- Hadley (2001), cattle to cattle transmission plays a part in the entry of infection into herds through contagious spread, closeness of contact and ventilation. Ayele *et al.,* (2004) and Radostits *et al.,* (2000) also reported that dairy cows (mainly of exotic breeds) kept under intensive farming systems, where there is close contact between the animals, are capable of favouring the spread of *M. bovis*. This would make extensive farming systems safer than zero grazing and more effective in preventing transmission of bovine tuberculosis.

However, exposure to sun rays was effective against the organism, where the proportion of CCTT reactors was 0.3% in farms that scored 2, whereas the proportion was 5.8% in farms with score 1 and the difference between two scores had a significance level (0.001). These findings were in line with the study of Hirsch and Zee. (1999), who stated that, *M .bovis* resists drying but are killed by sunlight, ultraviolet radiation and pasteurization . Furthermore, John *et al* ., (2004), reported that the environmental survival of *M. bovis* is greatly reduced by the exposure to sunlight .On other hand, the results of CCTT for nutritional balances , tick free ,square available for animal heads and hygiene, showed that the differences between scores were statistically insignificant , these finding may indicate that the most important factors that affect the prevalence of BTB particularly in farms with closed system are the ventilation and exposure to sun rays.

It is concluded from this study that ventilation and exposure to sun light had a significant effect on the prevalence of bovine tuberculosis whereas hygiene, tick free, square available and nutritional balance factors had no significant effect.

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