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Haematological and biochemical parameters altered in tuberculin reactor cattle

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Abstract

Tuberculosis is a chronic granulomatous infectious zoonotic disease prevalent in developing countries resulting high mortality and economic loss. The present study was taken up to understand the correlation between different haematological features in the typical cases of tuberculosis in dairy herds with that of comparative tuberculin positive, inconclusive and negative reactors. The study was carried out in unorganized dairy farms of peri-urban dairy farms of Guwahati city in Assam. A total of 44 milch animals were selected showing symptoms like TB in the age group of 1-8 years for the study. Single Intradermal Comparative Tuberculin Test (SICTT) was performed using bovine PPD and avian PPD. Blood samples were collected from all the tuberculin injected cows for haematological and biochemical analysis. A number of 11 positive reactors, 14 inconclusive reactors and 22 negative reactors were selected for studying the haematological and biochemical changes. In positive reactors there was significant increase in WBC, lymphocyte, THR, MPV, SGOT, SGPT and significant decrease in RBC, Hb, neutrophil, eosinophil, basophil, PCV, cholesterol, Ca²⁺ and phosphate compared to negative reactors ($P < 0.05$). Variation in the blood picture might be a parameter that can be used as indicators in the assessment of diagnosis in bovine tuberculosis in dairy farm.

Keywords: Haematology, SICTT, tuberculin, tuberculosis, Guwahati, Assam

Introduction

Tuberculosis is a disease of high zoonotic potential and has been a scourge of man and animals from time immemorial. Active animal tuberculosis outbreaks represent possible sources of infection to both animal and human populations (Ayele *et al.*, 2004; Thoen *et al.*, 2006) [1, 2]. Bovine Tuberculosis (BTB) is a chronic disease which occurs amongst farm workers of dairy farms, veterinarians, slaughter house workers and consumers (Konch *et al.*, 2017a) [3]. Aerosol exposure to *M. bovis* is considered to be the most frequent route of infection of cattle, but infection may be occurred by contaminated material (Barua *et al.*, 2016) [4]. Single intradermal comparative tuberculin test (SICTT) has usually been used to determine the prevalence of tuberculosis infection in bovine as a screening test. Haematological values are a representation of the healthy status of animal. Variation in the blood picture is a good aid in the diagnosis and prognosis of a disease and as such it has been a subject of study in several diseases of animals. Blood picture determination and serum proteins could provide valuable information related to nutrition, sex, age and physiological status of dairy cattle (Osman and Al-Busadah, 2003) [5]. In addition, they were very useful to get insight in the metabolic functions and general health conditions of cattle and to compare the standards obtained from ill animals with those normal in healthy cattle (Jezek *et al.*, 2006) [6]. A range of factors like home environment, demands for elevated productivity, densities of herds and individual susceptibility, could predispose cows to several disorders, which might affect the general health condition (Nishimori *et al.*, 2006) [7]. Blood biochemical response is of particular interest in animal welfare which reflects the different physiological situations and resulted in significant diagnostic methods to evaluate general animal health (Alberghina *et al.*, 2010) [8]. The present study was taken up to estimate different haematological and biochemical features in the typical cases of comparative tuberculin reactors in dairy herds in peri-urban areas of Guwahati city, Assam.

Materials and methods

Single intradermal comparative tuberculin test (SICTT)

A total of 47 dairy animals were selected randomly from different dairy farms located in the peri-urban areas of Guwahati city, Assam. The SICTT was carried as per Barua *et al.* (2017) [9].

Briefly, Intradermal injection with 0.1 mL PPD-bovine (1 mg/mL, 3000 IU, ID Lelystad) and 0.1 mL PPD-avian (0.5 mg/mL, ID Lelystad, 2500 IU) at sites 12 cm apart in the mid-neck region using a tuberculin syringe. Skin thicknesses were measured at both sites before the intradermal injection and after 72 hrs. Test results were interpreted according to OIE terrestrial manual [10].

Haematological and biochemical analysis

Whole blood samples (5 ml) were collected in vacutainer (with or without EDTA), for haematological and biochemical analyses respectively. For haematological study the following parameters were included: white blood cells (WBC) count, differential leukocyte count (DLC) red blood cells (RBC) count, mean corpuscular volume (MCV), hematocrit (HCT), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), hemoglobin (Hb), mean platelet volume (MPV) and packed cell volume (PCV). Biochemical parameters included determination of creatinine, blood urea nitrogen (BUN), serum glutamic-oxaloacetic transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), total protein (TP), cholesterol, Ca²⁺ and phosphate. The haematological study was conducted on automatic haemalyser MS4 and biochemical analysis was done by using of Bene Sphera (Clinical Chemistry Analyzer). The results obtained were subjected to statistical analysis by using general linear model procedure and means were compared by Dunnett's test using SAS statistical software (SAS, v2004).

Results and discussion

A total of 11 SICTT positive reactors (Figure 1) and 14 inconclusive reactors were recorded in peri-urban area of Guwahati. Twenty two (22) healthy non-reactors were subjected as control. Based on SICTT the prevalence rate of bovine TB in this area was found to be 23.40%. Previously Konch *et al.*, (2017a)^[3] recorded prevalence rate of 28% in suspected animals based on single intradermal tuberculin test.

In another study, Barua *et al.* (2017)^[9] recorded 16.58% prevalence by SICTT in Assam and Meghalaya states of North East India. The authors also reported that all the culture positive isolates were *M. bovis* species by different biochemical tests and polymerase chain reaction (Barua *et al.*, 2017; Konch *et al.*, 2017b)^[9, 11].

The current study showed significant difference in WBC, MPV, SGOT, SGPT, cholesterol and phosphate level in positive and inconclusive reactors compared to negative reactors ($P<0.05$). In positive reactors there was significant increase in WBC, lymphocyte, THR, MPV, SGOT, SGPT and significant decrease in RBC, neutrophil, eosinophil, basophil, PCV, Hb, cholesterol, Ca²⁺ and phosphate compared to negative reactors ($P<0.05$). There is no significant difference in monocyte, MCV, HCT, MCH, MCHC, creatinine, BUN and TP among all groups ($P<0.05$) (Table 1).

Blood picture is an excellent guide in the detection and outcome of a disease or any disorder and it has been a focus of study in several affections in cattle (Palmer *et al.*, 2006)^[12]. Our finding is corroborated with previous reports of Javed *et al.* (2006, 2010)^[13, 14] and Shettar *et al.* (2011)^[15]. Shettar *et al.* (2011) reported increase in erythrocyte sedimentation rate, MCV, eosinophil, monocyte and decrease in total erythrocyte count and Hb in single intradermal tuberculin positive reactor cattle^[15]. In a study in buffalo, a decrease in RBC and ESR and increase in total leukocyte count, lymphocyte and neutrophils was observed in a considerable and significantly greater number of buffaloes (Javed *et al.*, 2006)^[13]. An appreciable drop in RBC count, Hb and PCV (Javed *et al.*, 2010; Rao *et al.*, 1992; Kumar *et al.*, 1994)^[14, 16, 17] and higher lymphocyte percentage has already been reported in cattle. The blood picture based on DLC, PCV, SGOT, SGPT, cholesterol, Ca²⁺ and phosphate collectively can be considered as supportive indicators of tuberculosis in cattle. Although, diagnosis should not be based on haematological and biochemical parameters exclusively, but also have to consider the results of other diagnostic procedures.

Table 1: Comparison of mean haematological and biochemical parameters in SICTT reactors

Parameters studied	Positive reactors (n=11)	Inconclusive reactors (n=14)	Negative reactors (n=22)
WBC (m/mm ³)	12.99 ± 1.177 ^a	11.35 ± 1.013 ^a	7.50 ± 0.50 ^b
RBC (m/mm ³)	4.19 ± 0.37 ^a	5.57 ± 0.41 ^b	6.37 ± 0.24 ^b
Lymphocyte (%)	78.3 ± 1.37 ^a	72.95 ± 1.011 ^b	73.32 ± 1.36 ^b
Monocyte (%)	4.55 ± 0.25 ^a	4.71 ± 0.41 ^a	4.95 ± 0.17 ^a
Neutrophil (%)	10.59 ± 1.33 ^b	13.63 ± 0.92 ^a	16.07 ± 0.70 ^a
Eosinophil (%)	5.40 ± 0.78 ^b	12.82 ± 1.10 ^a	12.80 ± 0.90 ^a
Basophil (%)	0.36 ± 0.05 ^b	0.54 ± 0.06 ^a	0.48 ± 0.04 ^a
PCV (%)	21.63 ± 1.70 ^a	26.14 ± 2.14 ^b	29.36 ± 1.36 ^b
MCV (femtoliter)	57.23 ± 7.66 ^a	63.71 ± 9.61 ^a	64.98 ± 5.23 ^a
Hct (%)	13.23 ± 1.47 ^a	12.91 ± 1.49 ^a	14.44 ± 0.70 ^a
MCH (pg)	19.28 ± 2.64 ^a	13.13 ± 2.95 ^a	18.53 ± 1.95 ^a
MCHC (g/dl)	192.88 ± 26.46 ^a	131.35 ± 29.50 ^a	185.39 ± 19.55 ^a
Hb (g/dl)	5.03 ± 0.79 ^b	7.88 ± 1.17 ^a	7.70 ± 0.65 ^a
THR (m/mm ³)	896.81 ± 80.46 ^a	633.42 ± 64.93 ^b	643.45 ± 52.97 ^b
MPV (femtoliter)	9.44 ± 0.06 ^a	9.12 ± 0.16 ^a	5.92 ± 0.27 ^b
Creatinine (mg/dl)	1.00 ± 0.04 ^a	1.04 ± 0.06 ^a	0.95 ± 0.03 ^a
BUN (mg/dl)	8.48 ± 0.39 ^a	8.4 ± 0.37 ^a	7.59 ± 0.23 ^a
SGOT (mg/dl)	79.63 ± 4.03 ^a	77.15 ± 3.75 ^a	68.54 ± 2.75 ^b
SGPT (mg/dl)	33.54 ± 2.63 ^a	30.23 ± 1.44 ^a	16.77 ± 1.51 ^b
TP (mg/dl)	8.68 ± 0.47 ^a	8.52 ± 0.53 ^a	8.4 ± 0.21 ^a
Cholesterol (mg/dl)	69.27 ± 2.46 ^b	71.38 ± 3.13 ^b	87.22 ± 2.18 ^a
Ca ²⁺ (mg/dl)	6.11 ± 0.56 ^b	8.04 ± 0.38 ^a	8.80 ± 0.18 ^a
Phosphate (mg/dl)	4.29 ± 0.24 ^b	4.97 ± 0.26 ^b	6.74 ± 0.31 ^a

Values bearing different superscripts in same row differs significantly at $P<0.05$



Fig 1: SICCT positive case in a dairy farm

Conclusion

Haematological and biochemical parameters would be very helpful indicator for diagnosis of tuberculosis. Although SICCT is found to be effective in resource poor areas where advanced diagnostic facilities are costly and mostly unavailable. Such study also aid additional information of disease severity in countries where animal test and slaughter policy along with strong abattoir vigilance is missing to confirm bovine tuberculosis.

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