Haematology, serum biochemistry and mineral profiles of Trinket cattle, an endangered feral cattle associated with the colonial history of Nicobar

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ABSTRACT

Trinket cattle is a highly endangered feral cattle of Trinket Island, linked with the colonial history of Andaman and Nicobar Islands. Danish people during their colonial time introduced these cattle in Trinket Island. Great Sumatra earthquake and Indian Ocean Tsunami in 2004 has forced these cattle to become feral in nature. Due to negligence, the cattle is at the brink of extinction and only around 150 of descendants of the cattle are reported. In the present study, the haematology, serum biochemistry and mineral profiles of Trinket cattle were evaluated. Study indicated that all the values were under the normal physiological range. These findings of this study may serve as reference values in which alterations due to metabolic, nutrient deficiency, physiological and health status can be compared for diagnostic and therapeutic purpose.

Keywords: Haematology, Mineral profiles, Nicobar, Serum biochemistry, Trinket cattle

Trinket cattle (Fig. 1), a group of feral cattle, are found in Trinket Island, a small island under Nicobar group of islands. This cattle is associated with the colonial history of Andaman and Nicobar islands. Historical documents suggest that Nicobar islands were under the control of Danish from 1756 to 1768 and during their colonization period, they introduced these cattle to Trinket island for milk purpose (Kloss 1903). At the end of Danish colonization, the aboriginal tribes used to look after the cattle. On 26th December 2004, Andaman and Nicobar Islands were hit by devastating Great Sumatra earthquake and Indian Ocean Tsunami, and Trinket Island was one of the worst affected islands. After that, the tribes deserted Trinket Island and Trinket cattle became feral in nature. These cattle population is highly endangered in nature and currently existence of only 150 cattle has been reported (De et al. 2019). In the present study, we have evaluated the haematological, serum biochemical and mineral profiles of Trinket cattle.

Importance of determining the biochemical and haematological indices of domestic livestock species have been well acknowledged and documented (Opara et al. 2006). Hematological as well as biochemical values can provide the strong valuable baseline information which inturn helps to assess the realistic evaluation of managemental practices, physiological and nutritional status of the animals, and also help to diagnose and assess the health condition or status (Radostits et al. 2006, Jezek et al. 2006, Mir et al. 2008). Metabolic disorders, nutritional deficiencies and prevalence of the diseases can be easily detected by proper analysis as well as monitoring of blood and other body fluids (Otto et al. 1992). However, this requires for the establishment of normal reference values for the particular species. Pathological values are defined as those values deviating from the normal standard reference values (Radostits et al. 2006). Evaluation, analysis and interpretation of the obtained results mainly depend on the standard reference values for different species of the animals in different regions as well as under existing environmental or climatic conditions. Since the Trinket bovine species used in the present study did not show any significant clinical signs and/or pathological symptoms, therefore they were believed as healthy animals and the result or data observed can serve as standard reference values for these animals in future in veterinary science and animal husbandry (Kaneko et al. 1997). There is paucity of literature or information for Trinket cattle on hematological and serum biochemical values in Andaman and Nicobar Islands of India. To the best of our knowledge and based on the availability of the literature, this study is to be the first report on normal hematological and serum biochemical indices in Trinket cattle in India. The present investigation describes about the composition of blood, biochemical profiles and serum mineral attributes of the relatively genetically pure germplasm of Trinket cattle of Andaman and Nicobar.
RESULTS AND DISCUSSION

Trinket cattle are highly endangered cattle breed of Nicobar. These animals after Tsunami have survived against environmental challenge which brings the greater possibility that; specific adaptive traits have evolved to survive in this island ecosystem. Metabolic, nutritional, health as well as physiological status of animal can be determined by analysis, evaluation and monitoring the blood and other bio-fluids by the use of the different clinical pathological and also with chemistry procedures (Bogin 1994, Kaneko et al. 1997). Pathologic values are defined as the values that are deviated from the standard normal references values (Kaneko et al. 1997), for that, it is required to establish the normal reference values for different haematological and biochemical indices. In the present study, the animals used were almost healthy by observation, palpation and percussion, and did not reveal any abnormal clinical signs and/or pathological conditions. Therefore, these can be considered as healthy animals and the hematological as well as the biochemical profiles of these animals can work as the standard reference values for the Trinket cattle for future use in Andaman and Nicobar Islands or having similar nutritional, climatic or environmental conditions in other countries. These established standard values will serve as reference values which will be helpful to estimate the health status of these precious germplasm of Trinket cattle in any future studies related to this bovine species. However, the final interpretation of obtained results by laboratory analysis will depend on the standard reference values of each and every species of animal in different geographical as well as the environmental conditions.

Biochemical reports to the different physiological stages are very complex as these values are influenced by many different factors like species, breed, age, sex, nutrition, physiological status such as pregnancy and lactation, illness and also the seasonal variations (Kaneko et al. 1997, Whitaker 1997). The reports of the biochemical investigations has shown the highest deviations in total serum protein, urea, sodium and potassium concentrations which inturn can be influenced by various factors like nutrition, health status, lactation stage and season (Jezek et al. 2013).

Haematological values in terms of leukocytic parameters, erythrocytic parameters and thrombocytic parameters are given in Table 1. All the haematological parameters were within the normal physiological range of cattle as depicted in Merck’s Veterinary Manual. Study on the blood composition can address the valuable information about the general health of the animal and so that, this can be utilized to evaluate the health status of the animal. Deviation of values in certain blood parameters from their normal ranges could be a very good guide to make diagnosis or for differential diagnosis of a particular disease or pathological condition (Radostits et al. 2006). Haematological profile or complete blood count (CBC) is being very essential in evaluation of the animal health status as well as the
laboratory data clinical interpretation which is a prerequisite for proper diagnosis for different patho-physiological as well as infectious disorders in the Trinket cattle (Opera et al. 2006). Moreover, the CBC is an important as well as the powerful diagnostic tool in the component of a minimum database for disease diagnosis. It can also be used to monitor or watch the response to treatment or therapy, to follow up the severity of a disease or illness or used as a starting point to formulate a list of differential diagnosis. Interpretation of the CBC can be grouped into three divisions as erythrocyte, leukocyte and platelets evaluation. Each of these divisions can be interpreted separately and individually, and integration of these divisions is very much important to get highest diagnostic yield or result (Barger 2003). Heamatological examination is also done as a routine screening procedure for assessment of general health (Gutienez De Lar et al. 1971). Blood values are also clear indicators to assess the stress and welfare of animals (Anderson et al. 1999).

Knowledge on the hematological values is very much useful to diagnose the different pathological as well as the metabolic disorders, which adversely or deleteriously affect the reproductive and productive performance of the cows (Ahmad et al. 2003). Therefore, these hematological data can help to a large extent to determine the disease course and their outcome of several viral, bacterial and parasitic diseases (Swenson 1977). Factors such as breed, sex, age, seasonal variation, pregnancy, lactation, nutritional and health status of the animal alter hematological attributes (Mirzadeh et al. 2010).

Table 2. Serum biochemical parameters of Trinket cattle

<table>
<thead>
<tr>
<th>Blood parameter (unit)</th>
<th>Value (Mean±SE)</th>
<th>Similar to the present study</th>
<th>Higher than the present study</th>
<th>Lower than the present study</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWBC (10^3/µL)</td>
<td>10.44±0.40</td>
<td>4–12</td>
<td>Sripad et al. 2014</td>
<td>Mahima et al. 2013</td>
</tr>
<tr>
<td>Neutrophil (%)</td>
<td>27.56±0.45</td>
<td>15–45</td>
<td>Bedenicki et al. 2014</td>
<td>Mahima et al. 2013</td>
</tr>
<tr>
<td>Eosinophil (%)</td>
<td>5.88±0.05</td>
<td>2–20</td>
<td>Manjappa et al. 2018</td>
<td>Bedenicki et al. 2014</td>
</tr>
<tr>
<td>Monocyte (%)</td>
<td>1.64±0.04</td>
<td>2–7</td>
<td>Sripad et al. 2014</td>
<td>Mahima et al. 2013</td>
</tr>
<tr>
<td>Lymphocyte (%)</td>
<td>63.27±0.37</td>
<td>45–75</td>
<td>Bedenicki et al. 2014</td>
<td>–</td>
</tr>
<tr>
<td>TRBC (10^6/ µL)</td>
<td>7.71±0.09</td>
<td>5–10</td>
<td>Sripad et al. 2014</td>
<td>–</td>
</tr>
<tr>
<td>HGB (g/dL)</td>
<td>12.51±0.26</td>
<td>8–15</td>
<td>Bedenicki et al. 2014</td>
<td>Mahima et al. 2013</td>
</tr>
<tr>
<td>Haematocrit (%)</td>
<td>34.19±0.35</td>
<td>24–46</td>
<td>Otto et al. 2000</td>
<td>–</td>
</tr>
<tr>
<td>MCV (fl)</td>
<td>45.97±0.52</td>
<td>40–60</td>
<td>Mahima et al. 2013</td>
<td>Mahima et al. 2013</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>16.55±0.22</td>
<td>11–17</td>
<td>Mahima et al. 2013</td>
<td>Manjappa et al. 2018</td>
</tr>
<tr>
<td>MCHC (g/dl)</td>
<td>36.19±0.13</td>
<td>30–36</td>
<td>Manjappa et al. 2018</td>
<td>Suharti et al. 2017</td>
</tr>
<tr>
<td>Platelet (10^3/µL)</td>
<td>268.00±1.52</td>
<td>100–800</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

The serum biochemical parameters of Trinket cattle are given in Table 2. Total serum protein concentration was 7.490±0.1442 g/dL (7.21 g/dL–7.69 g/dL). Concentration of serum albumin and globulin was 3.48±0.13 g/dL and 4.23±0.07 g/dL respectively. Serum concentration of glucose, urea, SGOT, SGPT and ALP was 63.59±2.58 mg/dL, 31.75±1.43 mg/dL, 88.85±2.22 IU/L, 28.70±1.11 IU/L and 101.60±2.25 IU/L respectively.
Concentration of minerals in serum of Trinket cattle is given in Table 3. Sodium and potassium concentration were 142.20±1.89 mmol/L and 5.68±0.34 mmol/L, respectively. Calcium and phosphorus concentration were 10.78±0.32 mg/dL and 6.29±0.14 mg/dL, respectively. Magnesium, iron and cobalt concentrations were 2.71±0.10 mg/dL, 1.77±0.33 mg/L and 50.10±2.30 µg/L, respectively.

ALP is an enzyme synthesized and secreted in the liver, bone and also in placenta. It is available normally in bile fluid and growing bone in higher concentrations. It is secreted into the main blood stream at the time of injury or during the activities such as bone growth as well as pregnancy. Abnormally high concentration of ALP is observed in blood which may clearly indicate the diseased status of the liver or bone or bile duct obstruction or may be certain malignancies. And also a significant decrease of ALP activity with increased rectal temperature is in calves which have been exposed to heat (O’kelly 1973).

Basically AST transfers the amino group to α-ketoglutaric acid from aspartate to form glutamate and oxaloacetate. In bovine, ovine and caprine, the AST enzymes are present in several different tissues, mainly in liver, striated and cardiac muscle, thus it is a good bio-marker or indicator of the soft tissue damage (Otto et al. 2000). Jenkins et al. (1982) revealed the normal concentrations of this enzyme in young calves as well as the adult mature bovines. Similarly, the ALT catalyzes the two parts of the alanine cycle. It is also found in liver, plasma as well as in the various body tissues with higher level in the liver. Serum ALT concentration or serum AST level and/or their ratio (AST/ALT ratio) are normally estimated clinically as biomarkers to assess the liver health. Similarly, Piccioni et al. (2010) observed a
significant effect of days of life on SGOT levels but not on SGPT during the first week or first month of life.

Liver enzymes such as ALP, AST/SGOT and ALT/SGPT are measured in serum and commonly routinely used as biomarkers of reliable or suitable hepatic diagnostic purpose (Quintela et al. 2011, Jeong et al. 2013) in all different animal species includes sheep and goats (Tibbo et al. 2008) and cattle (Quintela et al. 2011, Noro et al. 2013). It is also observed that normal range of these liver specific enzymes is influenced by various internal as well as the external factors like age of the animals and lactation stage (Otto et al. 2000), nutrition, season and managemental practices (Quintela et al. 2011) and sex of the animals (Tibbo et al. 2008). The reference values of Trinket cattle showed higher blood levels of the enzymes ALT, AST and ALP than with other cattle, which clearly indicate that the more active muscle mass in Trinket cattle resulting from a greater as well as more active grazing and search for feed (Bogin et al. 1988).

The increased activities of AST and ALT in serum/plasma is mainly due to the leakage of these enzymes in heat stressed animals from liver cytosol into blood stream, which clearly indicates the liver damage and normal liver functions disruption (Shakoori et al. 1994). The enzyme levels of AST and ALT are dependent on the amino acid groups of alanine and glutamine which are taken up by the liver and indicate the changes in the liver metabolism which is associated with glucose synthesis (El-Maghawry et al. 2000). Blood glucose concentration is one of the biochemical profiles from which one may get body energy supply. Serum protein concentration suggests the balance between catabolism and anabolism of protein in the body and its concentration at any given time which in-turn is a function of nutritional status, hormonal balance, water balance and other parameters affecting health status (Samanta and Das 2007). Albumin is a transport protein which remains functioned in calcium, phosphorus, fat soluble vitamins, free fatty acids transport etc. Albumin indicates a long-term protein status and plasma albumin concentrations could be changed by effect of liver function, protein and energy intake, age and protein losses during some disease condition like parasitism. Plasma albumin concentrations are a indication of plasma protein levels. Physiological status or pathological status or lactation stage of the cows significantly can alter the serum levels of albumin (Otto et al. 2000). Moreover, the concentration of total protein, globulin, albumin and urea-N in blood serum are the biomarkers of the adequacy or inadequacy of nitrogen in the animal diet (Hammond 1983). In addition, serum proteins constitute a portion of the amino acid pool in the body and it is believed to be indicative of the nutritional status of the animal.

Most of the analyzed haematological, biochemical and serum mineral profiles were within normal range, which clearly indicates that, the studied Trinket bovine populations were in healthy condition. Thus, during diagnostic procedure or measurement, it is very useful to compare the values obtained from ill or sick animals with normal reference values of healthy animal (Jezek et al. 2006). The values or findings of the present study may serve as the standard reference values in which deviations due to metabolic, nutrient deficiency, physiological and health status can be compared for diagnostic, prognostic and therapeutic purpose for Trinket cattle.

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REFERENCES


