



## PLASMA PROTEIN REFERENCE VALUES IN APPARENTLY HEALTHY SUDANESE RUMINANT LOCAL BREEDS

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### ABSTRACT

The objectives of this study were to determine the reference values of total protein and albumen, in apparently healthy Sudanese ruminant local breeds, and to compare the values obtained from cattle to those of sheep and goats. The study also aimed to investigate the effect of sex difference on total protein and albumen values. To achieve these objectives, blood samples from 90 apparently healthy Sudanese local breeds were collected, of which 30 cattle (25 females, 5 males), 30 Sheep (23 females, 7 males) and 30 goats (22 females, 8 males) from central Sudan, White Nile State - Kosti area, February 2017. Total protein and Albumen samples were measured using Labtech digital

photometer, BioSystem kits were used for determination of both total protein and albumen. Sera were deeply freezed immediately after collection, for 15 day. A mean of 6.6 gm/dl of blood total protein was reported for cattle with albumen mean value of 2.8 gm/dl. For sheep, a mean value of 7.9 and 4.8 gm/dl of blood were reported for total protein and albumen respectively, while mean of 7.5 gm/dl of blood total protein and 3.4 gm/dl albumen were reported for goat. It was found that sex has no effect on both total protein and albumen

values. The study concluded that the reference protein value for Sudanese ruminant local breed did not significantly differ from the standard ones, except for cattle which were reported to be of lower values.

**KEYWORDS:** Sudanese, Reference value, protein, ruminants.

## INTRODUCTION

Serum protein is one of the most important physiological parameter indicative for health status, so it is important to know its reference value for particular tripe or breed in its normal ecosystem, as it may vary significantly from the global standards, to avoid misdiagnosis of diseases. Reference value for a particular parameter may vary significantly from the global standards due to genetic, environmental, socio-economic factors or others.<sup>[1]</sup> The main types of proteins in serum include albumin, globulin, and fibrinogen, the lower molecular weight and most abundant is albumen (2.8 to 4.5 gm/100ml).<sup>[2]</sup> Plasma globulins are  $\alpha_1$ ,  $\alpha_2$ ,  $\beta$  globulins which are synthesized in the liver and  $\gamma$  globulins which are formed in the cells of the reticuloendothelial system.<sup>[2][3]</sup> Total serum globulin concentration is about to 2.5 gm / 100 ml. Fibrinogen is the least abundant, but the largest in size, with a molecular weight of 340,000.<sup>[4]</sup> Among the general functions of plasma proteins, is their participation in nutrition as a source of protein for the tissues, when needed.<sup>[2]</sup> Osmotic pressure and water balance are an important function of plasma proteins- albumin mainly, as they exert an osmotic pressure of about 25 mm of Hg and therefore play an important role in maintaining a proper water balance between the tissues and the blood.<sup>[5][6]</sup> In kidney diseases, where there is protein loss, or during starvation condition, excessive amount of water moves to the tissues producing edema.<sup>[2]</sup> Plasma proteins has a buffering action, it helps in maintenance of the pH of the body.<sup>[4]</sup> One of the most important functions of plasma proteins is transportation, such as transportation of hormones, fatty acids, bilirubin, cholesterol, phospholipids, fat soluble vitamins (A, D, E, K), and metals.<sup>[5]</sup> Plasma proteins can function as catalytic "enzymes" e.g lipase.<sup>[6]</sup> Fibrinogen has the key role in blood coagulation, as it is converted from the soluble state to insoluble fibrin threads by thrombin. In addition gamma ( $\gamma$ ) globulins act as part of the body defense mechanism, IgA, IgM, IgG, IgE, and IgD.<sup>[4]</sup>

There are several ways to measure protein concentration, and each of them has its own advantages and disadvantage.<sup>[7]</sup> One of these ways is the Kjeldahl method which was developed in 1883 by Johann Kjeldahl.<sup>[8]</sup> Enhanced Dumas method, or methods using UV-

visible spectroscopy, in which either using the natural ability of proteins to absorb (or scatter) light in the UV-visible region of the electromagnetic spectrum, or they chemically or physically modify proteins to make them absorb (or scatter) light in this region. The basic principle behind each of these tests is similar.<sup>[8] [9]</sup> Among these methods is Biuret Method, Lowry method, Dye binding methods,<sup>[10]</sup> Turbimetric method or other Instrumental Techniques which are a wide variety of different instrumental methods for determining the total protein content.<sup>[11][12]</sup> These can be divided into three different categories according to their physicochemical principles: measurement of bulk physical properties, measurement of adsorption of radiation, and measurement of scattering of radiation. Each instrumental methods also has its own advantages and disadvantages.<sup>[8][13]</sup>

### Local ruminants breeds at White Nile State

The samples for this study were taken from Kosti area (capital of the State) (Geographically in south side of Sudan latitude: 13.30-12 North – Longitude : 33.30/31 East, area 39,701 KM<sup>2</sup><sup>[14]</sup> . Altitude 382 m above sea level. It has a long rainy season which lasts for five months (June- October). The mean annual rainfall is 600 mm; the monthly mean temperature is 22.5 °C in winter and 34.5 °C in summer and the mean annual relative humidity is 55%.<sup>[15]</sup>

The most abundant Local breeds of cattle present in Kosti area are Kinana and Asalia (Red with different grades) (Photo 1). Goat breeds are the Nubian (Photo 2) and Mountainous (local name, Al Tagar or AlGabali) Desert (local name, AlSarawi) (Photo 3) with relatively poor growth rate while sheep local breeds are mainly Hamari and Kabbashi (Photo 4).



Photo 1: Kenana cattle breed. Source: FAO and UNEP, 1999.<sup>[16]</sup>



**Photo 2: Nubian Goat breed; Photo 3: Desert goat breed; Photo 3: Hamari sheep**  
**Source: Elniema Mustafa, 2012.<sup>[17]</sup>**

The objectives of this study were to determine the reference plasma protein values in Sudanese local ruminant breeds (cattle, sheep and goat) in Kosti area, and compare the obtained values from different species between each other and with the global standards, using the sex as a variable.

## **MATERIAL AND METHODS**

### **Sampling**

All samples in this study were taken from animals kept in White Nile State, Kosti area. Samples were taken during a field trip conducted by the students of the College of Veterinary Medicine – University of Bahri during February 2017.

All blood samples were taken from living apparently healthy animals, 30 Hamari and Kabbashi sheep local breeds (23females and 7 males), 30 Nubian & Desert goat breeds (22females and 8 males) and 30 Kinana & Asalia cattle local breeds (25 females and 5males). Blood samples from jugular vein were collected in plane tubes using disposable syringes, allowed to clot at room temperature, and then sera were taken and stored at -18 °C until they had been tested.

### **Procedure**

Determination of total protein and albumin, was done using digital photo electric colorimeter, with 8 filter model: It: 10 power rating: 230vt / - 10% (50Hz) load:50 m A sr. No: 220, Made In India.

By using biosystem kits and photo electric colorimeter, total protein and albumin concentration were measured.

## CALCULATION

The following formula was used:

$$\text{Protein} = \frac{A \text{ Sample} \times C \text{ standard}}{A. \text{ Standard}}$$

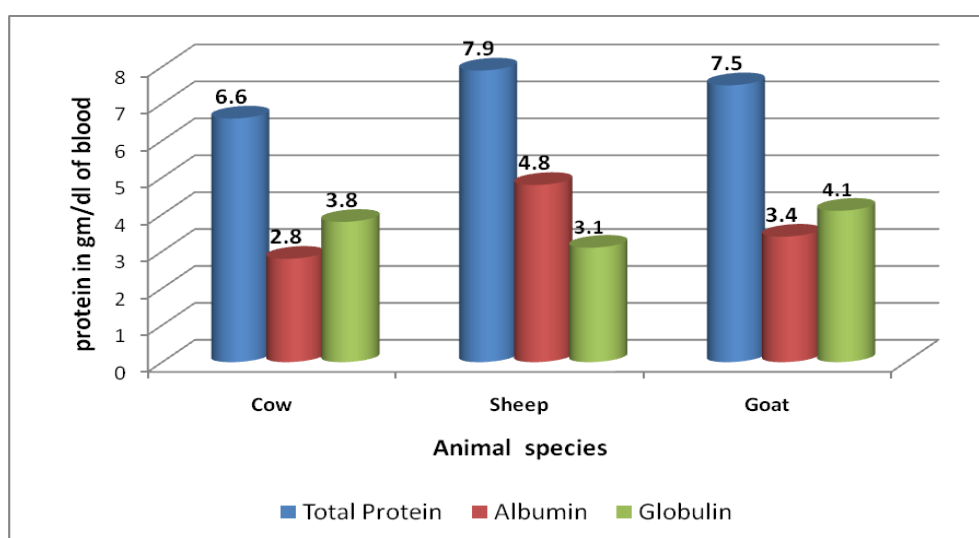
As A = absorbance of light, C = concentration

Globulin was obtained by subtraction.

## RESULTS AND DISCUSSION

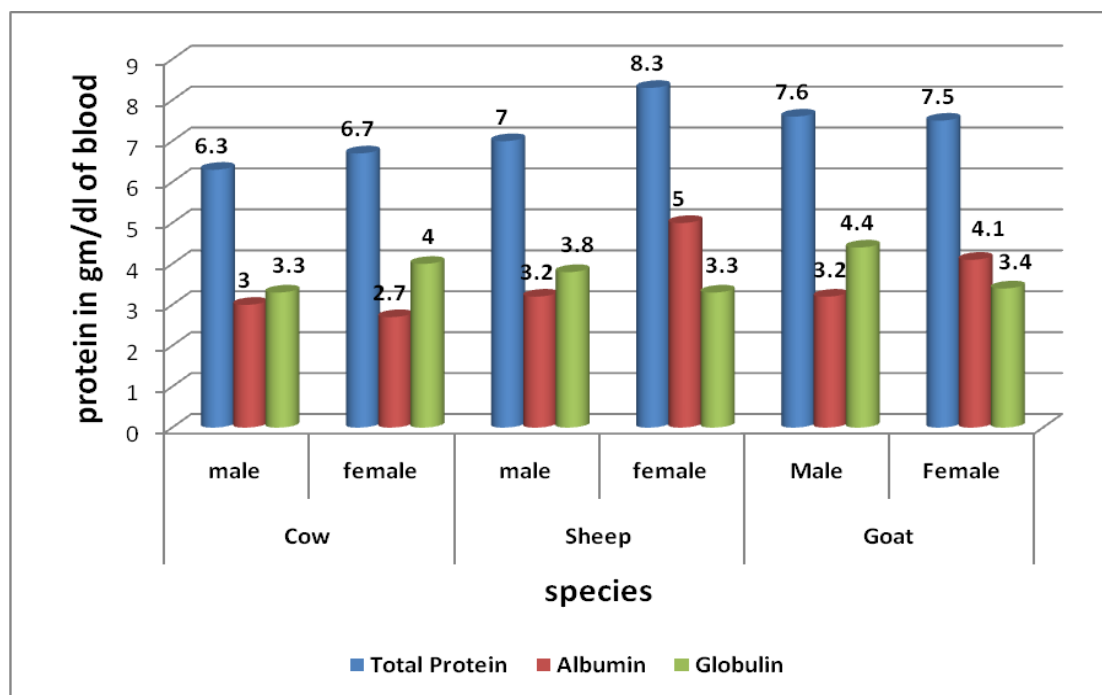
### Results

The mean of the total protein, albumin & globulin was found to be 6.6, 2.8 and 3.8 for cow, 7.9, 4.8 and 3.1 for sheep and 7.5, 3.4 and 4.1 for goat, respectively (Fig 1).



**Fig 1: The mean of total protein, albumin & globulin in cow, sheep & goat.**

The result of the effect of sex difference which was used as a variable in this study was shown in Fig (2). The mean total protein, albumin & globulin was found to be 6.3, 3.0 and 3.3 for male cow; 6.7, 2.7 and 4.0 for female cow, respectively. Male sheep accounted for 7.0, 3.2 and 3.8, respectively, while those of goat were 7.6, 3.2 and 4.4 for male and 7.5, 4.1 and 3.4 for female, respectively.



**Fig. 2: The mean total protein, albumin & globulin in cow, sheep & goat with reference to sex.**

## DISCUSSION

In this study, the mean total plasma protein in cattle was found to be 6.6 gm/dl of blood which is significantly ( $P < 0.5$ ) lower than the standard ( $7.58 \pm 0.17$  gm/dl of blood) stated by Bede Morries and Courtice (2002); and W.O Reece - Duke's Physiology of Domestic Animals.<sup>[6][18]</sup> This may be attributed to the difference in breeds or environmental factor or other factors that affect reference values stated by Hamad Iman and Musa O. A. 2006.<sup>[1]</sup> The mean total plasma protein of cattle determined in this study was considerably lower than that obtained from sheep and goats. The reference values for Sudanese local breeds of sheep and goats for plasma Total protein goes in line with standard ones that stated by Bede Morries and Courtice and W.O Reece - Duke's Physiology of Domestic Animals (2004) who reported a value of  $7.48 \pm 0.17$  and  $7.66 \pm 0.17$ , respectively.<sup>[6][18]</sup>

For plasma albumin, this study stated a mean of 2.80 gm/dl blood for cattle compared to  $3.69 \pm 0.14$  gm/dl of blood stated by Bede Morries and courtice (2002)<sup>[18]</sup> which was significantly higher ( $P < 0.5$ ). The difference in values may be attributed to breed, environmental or other factors that need to be investigated in upcoming researches. Cattle plasma albumin value for Sudanese local breeds obtained from this study was found to be lower than that obtained from sheep and goat in the same study ( $P < 0.5$ ), The difference may be attributed to breed or other



factors, the values obtained for plasma albumen in Sudanese local breed sheep and goat goes with the standard values.

## CONCLUSION

According to this study, Reference plasma protein values for Sudanese local sheep and goat breeds were found to be in line with the standard ones, while those of local cattle breeds were found to be significantly lower than the standard ones, and the other two local breeds species. Sex difference was found to be of no significance effect on both total protein and albumen values.

## RECOMMENDATIONS

Further studies covering all areas of Sudan with representative samples to create physiological parameters reference values for the Sudanese local animal breeds are needed.

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