Biochemical blood parameters of Different goat breeds

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Abstract
The aim of this study was to determine the concentration of various blood parameters in different goat breeds in Sudan namely Saanen, Kalahari red, Boer, Shami, cross breed and local desert breeds in Sudan. Seventy three clinically healthy goats, aged between 2 and 4 years were included in the study. Data regarding sex, breed, age, posture, type of feed were obtained using a pre-structured questionnaire. Blood samples were obtained from the jugular vein for analysis of different blood parameters namely glucose, total protein, albumin, urea, creatinine, total cholesterol, and alkaline phosphatase (ALP). The mean glucose level was 48 mg/dl with significant difference between the study group (p<0.05). The mean concentration of cholesterol was 55.9 mg/dl, while for protein the level was 7.04 mg/dl, but there was no significant difference between the breeds. A significant difference in the mean between the breeds was found regarding albumin (mean=3.42 g/dl), globulin (mean=3.06 g/dl) and urea (mean=34.5 mg/dl), while no significant difference regarding creatinine (mean= 0.94 mg/dl) was found. The mean level of alkaline phosphatase was 104.7 IU/L with no significant difference between breeds. Cytochemical studies including glycogen and nucleoprotein was also investigated. The results obtained from this study can give a brief indication of the normal levels of blood parameters regarding the goat breeds and can be a starting point to set a standard reference limits for these animals.

Keywords: biochemical parameters, blood, goat breed, histochemical, Sudan

Introduction
Goats (Capra Hircus) are among the most domesticated animals that are usually kept for milk or meat production and can also be a source of financial income for farmers. The number of goats in Sudan is estimated to be approximately 30.649.000 head of goats (Ministry of Animal Resource and Fisheries, 2011). This number consists of Nubian, Desert and Mountain goat breeds which are local breeds with relatively poor growth rate. Several other breeds such
as Saanen, Boer, Kalahari Red, Shami have been introduced in the country. One of the important characteristics of Saanen goats is their adaptability to different climatic conditions (Ince, 2010, Pugh and Baird, 2012). Also, cross breeding between the Sudan local breeds and these other breeds have been achieved.

Different biochemical or hematological analysis of blood is important to evaluate the overall physiological status of animals. Determination of the base line values can aid in evaluation of management practices, nutritional and diagnosis of health conditions of animals. Furthermore, serum biochemical and hematological tests and determination of the various levels of blood parameters are useful in predicting health problems and diseases that can reduce animal performance and lead to economic loses such as reduced milk and wool production and might even result in mortalities (Bani et al., 2008, Kida et al., 2007). Blood profiling is capable of detecting subclinical metabolic disorders and can thus reflect the actual status of the animal (Bertoni et al., 2000, Caldeira et al., 2007).

Several factors can affect the blood parameters such as stress, nutrition, age, sex, genetics, breed, feeding level, metabolic activity of animals, diurnal and seasonal variation (Roubies et al., 2006, Piccione et al., 2010). Biochemical and hematological blood parameters show a great variation between the different breeds of goats (Azab and Abdel-Maksoud, 1999; Tambuwal et al., 2002) and thus it may be difficult to set a standard reference values for all breeds.

The main objectives of this study is to determine different blood biochemical parameters namely glucose, total protein, albumin, urea, creatinine and Alkaline phosphatase between different goat breeds raised in Sudan in order to establish a standard reference values and to study the effect of breed on blood parameters. Histochemical studies including glycogen and nucleoprotein will also be investigated.

Materials and Methods

Study area and population

Blood samples were obtained from different farms located in Khartoum State during the period from February - April 2015. The main farms sampled were the Veterinary Hospital and College of Animal Production farms –University of Bahri and some Private farms. The main breeds that were selected were Saanen, Shami, Kalahari red, Boer, cross breeds and local desert breeds. Pregnant or diseased animals were excluded. A pre -structured questionnaire was used to obtain information about age, sex, type of breed, feed and posture.

Sample collection and analysis:

Blood samples were obtained from the jugular vein for the analysis of the different blood parameters.

1) For biochemical parameters: Analysis was performed using automatic analyzer (Screen plus) with commercial kits for the detection of the different parameters.

2) For the histochemical analysis: Methyl green- pyronin method was used for investigation of nucleoprotein according to the methods described by Kass (1979) and Hayhoe and Quaglino (1988). Control sections were obtained by being incubated in a medium lacking the substrate. Glycogen was demonstrated by Periodic acid reagent (PAS) without diastase (Carleton, 1967).
Data Analysis
Data were analyzed using SPSS17.ANOVA and post-hock (The Least Significance Difference- LSD) were used to study the mean differences between the different animal groups.

Results and Discussion
A total of 74 goats were included in the study. All goats were kept in cages with free access to water. They were fed mainly on Lucerne, rhodus and concentrate. Since most of farms were concerning in production, the number of male samples was lower than the females. The mean age group of the goats was 2.7 years.

Fig. 1, 2, 3, 4, 5 ,6: Different goat breed : Shami, Kalahari Red,Boer, Saanen, local and, crossbreed goats

Goats were categorized into three main groups: Foreign breeds which included Shami, Kalahari Red, Boer, Saanen (Fig.1,2,3and 4) The second group included the local desert breed (Fig 5) and the third group was the cross breeds which was mainly between the local breeds and other breeds (Fig 6).

Serum biochemical tests are important for diagnostic purposes of different diseases which may have a negative impact on overall animal production. The concentration of the different blood parameters is shown in Table 1. The mean glucose level was 48.15 mg /dl. The lowest glucose mean level was found within the cross breeds (44mg/dl), with significant difference (p<0.05) between the cross breed one side and the foreign and local breed on the other side using the LSD test (Fig 7).
Table 1: Overall Biochemical results

<table>
<thead>
<tr>
<th>Blood parameter</th>
<th>Mean ± SD</th>
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<tbody>
<tr>
<td>Glucose mg/dl</td>
<td>48.15± 10.6</td>
</tr>
<tr>
<td>Cholesterol mg/dl</td>
<td>55.9 ±10.2</td>
</tr>
<tr>
<td>Total protein g/dl</td>
<td>7.04±0.3</td>
</tr>
<tr>
<td>Albumin g/dl</td>
<td>3.42±0.79</td>
</tr>
<tr>
<td>Globulin g/dl</td>
<td>3.62±0.09</td>
</tr>
<tr>
<td>Urea mg/dl</td>
<td>34.5±1.02</td>
</tr>
<tr>
<td>Creatinine mg/dl</td>
<td>0.94±0.2</td>
</tr>
<tr>
<td>ALP IU/l</td>
<td>104.6 ± 47</td>
</tr>
</tbody>
</table>

For Nubian goats in Sudan a higher glucose level of 70mg/dl was reported by (Abdallah et al., 2010). The level of glucose can differ between different animal species and even within breeds. Several studies reported glucose level in the range of 29-35 mg/dl for breeds raised in Nigeria (Opara et al. 2010, Njidda et al., 2013) while results reported by (Elitok, 2012) for Saanen goats raised in Turkey showed glucose levels of 31.8 g/dl for adult goats. In Kanni goats the glucose level was higher than these levels (47mg /dL) (Ramprabhu et al., 2010) and even higher levels were reported in wild goats 126.1±66.0 mg/dL (Perez et al., 2015).

Several factors can affect glucose level such as nutrition, metabolic activity of the animal, onset of puberty –as puberty probably involves more intensive energy metabolism (Azab and Abdel Maksoud, 1999, Jawasreh et al., 2010).

Regarding cholesterol level, in this study the mean level was found to be 55.9 ±10.2mg/dl and no significant difference was observed between the different breeds. In a previous study, cholesterol level was found to be 70-71mg/dl in Saanen species raised in Turkey.
The level of cholesterol can differ between different animal species, sheep for example was found to have higher cholesterol level (ranging from 81 to 98.5mg/dl) compared to goats (53 to 72 mg/dl) (Devendra et al., 2008, Jawasreh et al., 2010; Ramprabhu et al., 2010; Kiran et al., 2012).

The mean protein concentration was 7.8 ± 0.3 g/dl and no significant difference was observed between the breeds. The level of protein reported in two other goat breeds Black Bengal and Jamanapari are within this range for protein (69.9 ± 0.3 g/L and 78.5±0.89 g/L). Several other studies reported protein level in the range of 5.2 to 7.1 g/L for WAD goats (Daramola et al., 2005, Opara et al. 2010) and 4.4g/dl for Red Sokoto goats with a protein range between 6.3-8.5g/dl (Daramola et al., 2005).

The mean concentration of albumin and globulin were 3.42±0.79 mg/dl and 3.62±0.09 mg/dl, respectively. Regarding albumin a significant difference was observed between all goat breeds while for globulin a significant difference was found between the foreign and the two other breeds. The level of albumin is similar to what is reported by (Abdalla et al., 2010) where the albumin level for Nubian goats was 3.27 g/dl but lower than that reported by (Hassan Shaikat, et al., 2013) where albumin levels was 4.3g/dL and 4.7 g/dL for Black Bengal and Jamanapari breeds respectively, but lower levels were reported by (Opara et al., 2010) where albumin levels was 2.8 g/dl and 2.4g/dl for globulin.

The mean level of urea concentration was 34.8±0.97 mg/dl. Significant difference was found between all the breeds studied except between foreign and cross breeds. The levels obtained in this study (34.8±0.97 mg/dl) are higher than the previous results of (Abdalla et al., 2010) which was 28mg/dl. According to (Hassan Shaikat, et al ,2013) urea levels were 23.9 mg/dl and 35.9mg/dl for Black Bengal and Jamanapari breeds with significant difference between them. Several studies reported a range of 32-38 mg/dl for urea level (Opara et al., 2010; Elitok,2012). High levels of urea usually indicate excessive tissue protein catabolism associated with protein deficiency (Oduye and Adadevoh, 1976). Low levels of urea usually indicate the digestive capacity of the animals regarding its efficiency in nitrogen utilization, urea cycling and nitrogen conservation (Daramola et al., 2005).

For creatinine the mean concentration was 0.94±0.2mg/dl. A significant difference was found between cross and local breeds only. Lower levels of creatinine in the range of 0.6mg/dl t 0.84mg/dl were reported by (Abdalla, et al., 2010; Opara et al., 2010, and Elitok,2012). The level of the enzyme alkaline phosphatase was also studied. This enzyme catalyzes the hydrolysis of phosphate esters in different molecules such as proteins and nucleotides The mean concentration reported in this study was 104.7±49 IU/l. The highest level was found within the foreign breeds, but with no significant difference between the breeds. The levels ranged from 49 IU/ to 239 IU/l. These results are similar to what was reported by (Elitok ,2012) for adult Saanen goats in Turkey (103-105 IU/l). Lower level of 63.2 ± 6.9 IU/l was observed for west African dwarf goats in Nigeria (63.2 ± 6.9 IU/l) (Opara et al., 2010). Several factors can affect the level of this enzyme among them is pregnancy, blood pH, disease and age (Kelly, 1974, Tambuwal et al., 2002).

Alkaline phosphatase (ALP) is an enzyme produced by the liver and along with other enzymes such as aspartate aminotransferases (AST), glutamyl transferase (GGT), and alanine aminotransferase (ALT), can be used as an indicative of liver diseases and can also be a predictive of the health status of goats (F. Rumosa et al ,2012). Usually the information obtained from liver enzymes- in combination with other investigations such as blood minerals, faecal egg counts, the physical examination and, coupled with medical history, provides an excellent basis for estimation of severity of diseases and treatment of goats (Tibbo et al., 2008).
Histochemical investigation of glycogen and nucleoproteins was also done. Distribution of glycogen in blood cells is usually variable. Positive reactions were localized in the cell cytoplasm. The erythrocytes do not normally show detectable amount of glycogen. Eosinophils showed a very distinctive appearance in glycogen preparation (Fig.8). Neutrophil contained very large amounts of glycogen, usually in the form of moderately fine granules (Fig.9). The glycogen granules can show some variation in size and arrangement, being sometimes relatively few and coarse, and other times numerous and fine (Nawal and Osman, 2006). Lymphocytes had much smaller glycogen content than granulocytes, but glycogen positive granules can often be demonstrated in the cytoplasm (Fig.10). Glycogen has also been investigated in cortical and medullary cells of goats (Ashok et al., 2011) and it showed a positive reaction for glycogen in young fetuses, but the intensity can be affected by some factors such as pregnancy.

A positive reaction for RNA and DNA was detected in neutrophils, RNA was red in colour and DNA was green (Fig.11). Lymphocyte stained deeply with pyronin (Fig. 12) and also monocytes. Similar observation was also reported by (Nawal and Osman, 2006)

**Conclusion**

The results obtained from this study showed a significant difference between the blood parameters of different goat breeds. The data obtained can serve as reference limits to be used when data regarding changes during disease, nutrient deficiency or other health affecting parameters is needed to obtain.

**References**


