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Studies on Serum Biochemical Values and Mineral Contents of Tissues in Qianbei-Pockmarked Goats

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Abstract: The Qianbei-Pockmarked goat is one of the best endemic species in goats in Guizhou Province. There are not data on mineral element, the normal hematological and serum biochemical values in Qianbei-Pockmarked goats in China. The serum biochemical values were defined. The contents of mineral elements in the blood, hair and liver of Qianbei-Pockmarked goats were also measured. All values are reported for the first time for Qianbei-Pockmarked goats in China.

Key words: Qianbei-Pockmarked goats, serum, minerals, biochemical values, enzymes

INTRODUCTION

The Qianbei-Pockmarked goat is one of the best endemic species in the Guizhou Province. It is vital to the production system of the South West China Karst Mountain area. Animals provide meat, wool and hides for local people. However, there are not data on mineral element, the normal hematological and serum biochemical values. This study was designed to define hematological, serum biochemical values and concentrations of mineral element in the Qianbei-Pockmarked goats. Study area is located at 27°13'15"-28°54'15"N latitude and105°35'35"-107°25'25"E longitude at an average elevation of 990 m earlier sea level. The average atmospheric temperature is 10-12°C.

MATERIALS AND METHODS

Animals: The 20 Qianbei-Pockmarked goats, 10 females and 10 males selected for the study. All the animals were healthy with no clinical signs of disease.

Sampling: All the samples were taken in May 2012. Blood samples, each of 15 mL were obtained from the jugular vein of all the Qianbei-Pockmarked goats using 1% sodium heparin as anticoagulant and stored at 4°C for hematological examination and at -20°C for analysis of mineral elements. Serum samples for biochemical values were taken without anticoagulant and were refrigerated until they arrived at the laboratory after <5 h when the serum was separated by centrifugation and stored frozen in plastic vials until the laboratory determinations could be made. Hair was taken from the neck of all the animals, washed and degreased as described by Salmela *et al.* (1981) and kept in a desiccator over silica gel until analyzed. Liver biopsies were also sampled by a trained technician using techniques previously described (Arthington and Corah, 1995). The liver samples were dried at 80°C for 48 h, ground, passed through a 0.5 mm sieve and stored in a desiccator over silica gel.

Hematological and biochemical examination: Hemoglobin (Hb), Packed Cell Volume (PCV) and Red Blood Cell (RBC) count were determined using an automated hematology analyzer (SF-3000, Sysmex-Toa Medical Electronics, Kobe, Japan). The serum content of Ceruloplasmin (Cp), Superoxide Dismutase (SOD), Glutathione Peroxidase (GSH-Px), Catalase (CAT), Lactate Dehydrogenase (LDH), Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), Alkaline Phosphatase (AKP), γ-Glutamyl Transferase (γ-GT), Creatinine (Crt), Cholesterol (Chol), Blood Urea Nitrogen (BUN), Sodium (Na), Potassium (K), Magnesium (Mg), Calcium (Ca), Inorganic Phosphorus (IP), Neutrophils, Lymphocytes, Eosinophils, Basophils, Monocytes were determined on an automatic analyser (SF-1, Shanghai Medical Apparatus and Instruments Factory, Shanghai, China) using commercial test kits (Nanjing Medicine University Biochemical Co., Nanjing, China). Quality control serum (Shanghai Biochemical Co., Shanghai) was used to validate the blood biochemistry data. Serum protein electrophoretic studies were performed on cellulose

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acetate using the EA-4 electrophoresis apparatus (Shanghai Medical Apparatus and Instruments Factory) (Shi, 1990). Serum Triiodothyronine (T_3), Thyroxine (T_4) and Parathyroid Hormone (PTH) concentrations were determined by Radioimmunoassay (RIA) on a γ-counter (γ-Autocounter, Xian 262 Factory, Shanxi, China) using commercial test kits (Tianjing Medicine Biochemical Co., Tianjing, China). Total Protein (TP), Albumin (Alb) and Globulin (Glob) were determined on an automatic analyser using commercial test kits (Nanjing Jiancheng Bio-Engineer Institute). Quality control serum (Shanghai Biochemical Co.) was used to validate the blood biochemistry data. Serum protein electrophoretic studies were performed on cellulose acetate (Shi, 1990). All the serum biochemical values were measured at room temperature.

Analysis of trace elements: Copper (Cu), Molybdenum (Mo), Iron (Fe), Zinc (Zn), Cobalt (Co), Manganese (Mn) and Selenium (Se) were determined by Atomic Absorption Spectrophotometry (AAS) (AA-640, Shimadzu Co., Ltd. Tokyo, Japan). Sulphur (S) was determined by nephelometry (Wen *et al*., 1983). The accuracy of the analytical values was checked by reference to certified values of elements in the National Bureau of Standards (NBS, Washington, USA) Standard Reference Material, bovine liver SRM1577a.

Statistical analyses: The data are presented as means±standard deviation. The differences were assessed by Student's t-test. Experiment data were analyzed by using a Statistical Package (SPSS Version for Windows; SPSS, Chicago, Illinois, USA).

RESULTS AND DISCUSSION

Table 1-3 summarize the hematological and biochemical values in the sera from the Qianbei-Pockmarked goats. The concentrations of mineral elements in the blood, hair and tissues are given in Table 4. The liver contained the highest concentrations of Cu, Fe, Mo, Mn, Zn, Co and Se. Serum protein concentrations in Qianbei-Pockmarked goats are given in Table 5.

Table 1: Mean hematological values in Qianbei-Pockmarked goats

Items	Males	Females	Range
RBC (10^{12} L^{-1})	12.5±3.1	13.1±2.6	6.57-14.5
Hb (g L^{-1})	112.6±25	108.8±23	79.8-157.7
PCV (%)	31.4±3.7	31.2±4.2	22.5-43.7
Neutrophils (%)	51.3±3.6	51.9±3.7	33.6-67.7
Lymphocytes (%)	31.6±6.3	31.8±6.37	20.1-37.1
Eosinophils (%)	8.22±1.27	8.32±1.98	5.9-16.2
Basophils (%)	0.53±0.17	0.55±0.15	0.33-0.89
Monocytes (%)	0.71±0.27	0.72±0.22	0.42±1.38

All hematological values are reported for the first time for Qianbei-Pockmarked goats in China. The hematological results for Qianbei-Pockmarked goats were within the reference ranges for other ruminants including cattle, sheep and camels (Abdelgadir *et al*., 1984; Arthington *et al*., 2002; Shen, 2011).

All biochemical values are reported for the first time for Qianbei-Pockmarked goats in China. Most of these values were similar to the reference values for cattle (Shi, 1990), sheep (Youde and Huaitao, 2001; Shen, 2011), yaks (Shen, 2009; Shen *et al*., 2006) and camels (Abdelgadri *et al*., 1984; Bengoumi *et al*., 1999). Essential trace elements are integral components of certain enzymes and of other biologically important compounds that have major physiological and biochemical roles. For example, Se in glutathione peroxidase, Cu and Zn in superoxide

Table 2: Serum biochemical values in Qianbei-Pockmarked goats

Items	Males	Females	Range
SOD (μmol L^{-1})	18.3±2.3	18.1±2.1	13.6-23.1
CAT (μmol L^{-1})	23.3±2.8	23.1±2.3	21.1-29.7
GSH-Px (μmol L^{-1})	27.5±2.9	27.6±3.7	20.3-35.1
Cp (mg L^{-1})	51.3±11.7	52.7±12.1	27.2-71.7
LDH (μmol L^{-1})	4.61±0.33	4.62±0.56	2.62-5.17
AKP (IU L^{-1})	216±22	218±21	161-253
AST (IU L^{-1})	31.7±9.9	31.8±8.9	20.6-41.3
ALT (IU L^{-1})	11.7±4.7	11.7±4.9	7.6-15.7
γ-GT (IU L^{-1})	16.3±3.5	16.8±3.5	13.2-25.3
BUN (mmol L^{-1})	5.28±1.37	5.12±2.58	3.76-8.81
Crt (μmol L^{-1})	327±37	326±37	222-431
Chol (mmol L^{-1})	2.61±0.36	2.76±0.37	1.53-3.21
K (mmol L^{-1})	4.33±0.37	4.28±0.53	2.71-6.11
Na (mmol L^{-1})	123±36	121±37	67-198
Ca (mmol L^{-1})	2.27±0.27	2.26±0.28	1.31-3.23
IP (mmol L^{-1})	1.75±0.37	1.78±0.23	0.93-2.36
Mg (mmol L^{-1})	0.97±0.27	0.93±0.21	0.17-1.73

Table 3: Concentration of parathyroid hormone, triiodothronone and thyroxine in serum

Items	Males	Females	Range
PTH (ng L^{-1})	113.2±25.3	115.7±31.8	65.7-131.1
T_3 (nmol L^{-1})	1.73±0.37	1.69±0.36	1.57-2.17
T_4 (nmol L^{-1})	51.7±11.1	51.9±11.2	35.7-62.7

Table 4: Concentrations of mineral element in blood, hair and liver of Qianbei-Pockmarked goats

Elements	Liver	Blood	Wool
Se (ppm)	1.22±0.71	0.073±0.023	0.29±0.05
Fe (ppm)	2187±137	361±23	258±25
Zn (ppm)	217±21	17.8±3.7	119±15
Cu (ppm)	102±22	0.84±0.16	5.77±1.57
Mn (ppm)	6.11±0.81	0.51±0.17	5.39±1.26
Mo (ppm)	4.27±2.17	0.61±0.12	0.48±0.13
Co (ppm)	1.37±0.37	0.83±0.26	1.22±0.23
S (mmol L^{-1})	67±17	32.3±7.3	213±27

Table 5: Serum protein concentrations in Qianbei-Pockmarked goats

Items	Males	Females
Total protein (g L^{-1})	64.7±6.7	66.3±5.7
Albumin (g L^{-1})	46.3±5.8	47.6±8.3
α-globulin (g L^{-1})	3.8±0.7	3.7±0.8
β-globulin (g L^{-1})	4.8±1.3	4.7±1.3
γ-globulin (g L^{-1})	9.8±2.8	10.3±2.7
A/G	2.51±0.11	2.55±1.2

dismutase, Fe in hemoglobin and Co in vitamin B_{12}. It is well known that dromedaries have some physiological peculiarities in trace element metabolism due to their adaptation to poor feeding resources (Faye and Bengoumi, 1994). Researchers think that the Qianbei-Pockmarked goats have some physiological peculiarities in trace element metabolism maybe due to geographic (altitude, latitude, climate) and dietary factor (Gengelbach *et al*., 1997). The reference values for the concentrations of mineral elements in the liver and hair of Qianbei-Pockmarked goats were the first such reports in China. The concentrations of Co, Zn, Mn, S and Mo in the liver and hair were within the reference ranges for camels (Faye and Bengoumi, 1994; Faye *et al*., 1992), cattle (Georgievaskii *et al*., 1982) and sheep (Shen, 2011). The hematological and serum biochemical values and mineral contents in the tissues of domestic animals may vary according to geographic (altitude, latitude, climate) and dietary factors. Too little information is available to permit conclusions on the effects of these factors on Qianbei-Pockmarked goats in China. Further studies will also be needed to the effects of diet, regional differences, season of year and the reproductive and physiological status of the animal.

CONCLUSION

Most contents of mineral elements and serum biochemical values were similar to those of cattle, sheep, goats and camels. The liver contained the highest concentrations of copper and iron. The concentrations of cobalt, zinc, manganese and molybdenum in hair were within the reference range for other ruminants. The mean iron, copper and selenium concentrations in the liver were significantly lower than those in sheep.

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