

Evaluation of clinical, hematological and biochemical parameters in goats with subclinical and clinical pregnancy toxemia in Libya

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ABSTRACT: This study was aimed to evaluate the clinical, hematological and biochemical parameters in goats with clinical and subclinical pregnancy toxemia. A total of 63 pregnant goats were included in this study. On the basis of clinical examination and assessment of β -hydroxy butyric acid concentration (BHBA) does were classified into three groups. group A: Consist of 20 healthy pregnant goats, used as control. Group B: consist of 28 does with subclinical pregnancy toxemia (SCPT). Group C: consist of 15 does with clinical pregnancy toxemia (CPT). For each case, history, age, breed, number of fetus, results of clinical examination and hematobiochemical findings were recorded and analyzed. Clinical examination in clinical pregnancy toxemic goats revealed anorexia, depression, dullness, dyspnea, weakness, dropped head, lateral recumbency, acetone smell from the mouth, grinding of teeth and neurologic signs. Hemato biochemical analysis revealed a significant increase of PCV%, BHBA, ALT, AST, urea and creatinine in clinical pregnancy toxemic goats, while there was significant decrease of serum glucose, total protein, albumin, globulin, sodium, potassium and calcium. Does with subclinical pregnancy toxemia showed significantly lower serum glucose, total protein and calcium, whereas a marked increase in PCV%, urea and BHBA. The results revealed that the caprine pregnancy toxemia have severe impacts on several clinical and biochemical parameters. In order to prevent the economic loss due to pregnancy toxemia, measuring blood metabolites can be potentially useful tool for routine monitoring of subclinical pregnancy toxemia in late pregnant goats.

Keywords: Goats, hemato-biochemical, Libya, parameters, pregnancy toxemia.

INTRODUCTION

Sheep and goats are economically important livestock, play an important socioeconomic role for small and large farmers in Libya (El-Sebaie, 1995). Libyan has 2.5 million heads of goats (AOAD, 2009). Most of them concentrated in the mountainous region of Al jabal AL-akhdar in the east or Nafusa in the west part of Libya (Akraim, 2012). Libyan local goat (mahali) represents more than 90% of goat population (El-Sebaie, 1995). Shami goat breeds (Cyprus Damascus breed) were imported for crossing with local goats in order to improve their productivity (El-Sebaie, 1995; Hermas et al., 2010).

Pregnancy toxemia is a metabolic disease of goats and sheep, which occurs in the last stage of gestation. The late

period of pregnancy in dose and ewes take 4 to 6 weeks before parturition (AOAD, 2009; Kulcsar et al., 2006; Schlumbohm and Harmeyer, 2004; Schlumbohm and Harmeyer, 2008). This period is the most important period for observing possible incidence of pregnancy toxemia (Abdelaal et al., 2013; Kulcsar et al., 2006). The most important factor for the incidence of the disease is the transient anorexia which might occur due to transport of animals, environmental changes and offering unaccustomed ration (AOAD, 2009; Hefnawy et al., 2011). The development of pregnancy toxemia depends on the balance between fetal demand for energy and the maternal food supply (AOAD, 2009; Dalrymple, 2004;

Hefnawy et al., 2010). The clinical findings in does suffering from pregnancy toxemia shows anorexia, recumbency, grindings of teeth, sweetish fruity odor from breath (Abdelaal et al., 2013; Amany et al., 2015; Hefnawy et al., 2011; Schlumbohm and Harmeyer, 2004).

Subclinical pregnancy toxemia is considered in does with an elevated concentration of ketone bodies in blood but without abnormal clinical signs (Ramin et al., 2005; Van Saun, 2000). Measurement of blood β -hydroxy butyric acid (BHBA) concentration is considered as the gold standard diagnostic test to detect subclinical pregnancy toxemia (Duffield, 2000). Hematological and biochemical findings have a major role in diagnosis of pregnancy toxemia. In Libya, there are currently no reports available on the diagnosis of clinical and subclinical pregnancy toxemia in goats. Therefore, this study was aimed to evaluate the clinical, hematological and biochemical parameters in Libyan goats with clinical and subclinical pregnancy

MATERIALS AND METHODS

The present study was carried out in Eljabel Alakder region, northeast of Libya. A total of 63 pregnant goats were included in this study. All does enrolled in this study were in late stage of gestation (4 to 6 weeks before kidding). Stage of pregnancy was confirmed using ultrasonography. Two breeds were represented on the farms, Libyan local breeds (Mahali) and crossed breeds (mahali x shami). Goats were grazed most of the year and only offered grain during winter months. All does were regularly vaccinated against enterotoxemia and hemorrhagic septicemia. All animals were routinely treated against ecto- and endoparasites. All the farms were visited during the period from April 2016 to October 2018. On the basis of clinical examination and assessment of β -hydroxybutyrate concentration (BHBA), does were classified into three groups. Group A: Consist of 20 does with no clinical abnormalities and plasma BHBA < 0.8 mmol/l, used as control. Group B: Consist of 28 does with subclinical pregnancy toxemia (SCPT) (does show no abnormal clinical signs and plasma BHBA from 0.86 to 1.6 mmol/l). Group C: Consist of 15 does with clinical pregnancy toxemia (CPT) (does show clinical signs typical of pregnancy toxemia and plasma BHBA >1.6 mmol/l). For each case, history, age, breed, number of fetus, results of clinical examination and hematobiochemical findings were recorded and analyzed. Animal data obtained included heart rate, respiratory rate, temperature and rumen motility. Blood samples was collected in EDTA vials and serum vials from jugular vein for hematological and biochemical analysis. Hematological analysis includes red blood cell count (RBCs) (Schalm et al., 1975), packed cell volume (PCV%) (Coles, 1986; Dalrymple, 2004), and hemoglobin concentration (Hb) (Jain, 1986). Biochemical analyses, which were performed by spectrophotometric

methods.

The examined parameters included β -hydroxy butyric acid (BHBA), glucose, total protein, alanine transferase (ALT), aspartate transferase (AST), urea, creatinine, calcium (Ca), phosphorus (P), magnesium (Mg), sodium (Na) and potassium (K) values were determined by flame photometer.

Statistical analysis

Statistical analysis was performed using the Sigma Stat 3.1, statistical software (SPSS Inc., Chicago, IL, USA). The obtained data are presented as mean \pm SD. Difference between groups was analyzed by using one way analysis of variance (ANOVA). The differences in means were considered statistically significant at $p < 0.05$.

RESULTS

A total of 63 pregnant goats were included in this study. The mean of age of goats with clinical and subclinical pregnancy toxemia was 3.8 years (age ranged from 3 to 5 years). The mean age of control group was 3.5 years. Physical and clinical examination of does in group A (control) and B (SCPT) revealed no abnormal clinical signs. The clinical findings in does suffering from clinical pregnancy toxemia (Group C) revealed anorexia, depression, dullness, dyspnea, increased heart rate, weakness, dropped head, acetone smell from the mouth, stiffness, grinding of teeth and neurologic signs include blindness, stiffness, incoordination, tremors in neck muscle, convulsions and lateral recumbency. As shown in Table 1, there were no significant deference in the body temperature, respiratory and pulse rate among group A, B and C, while significant ($p \leq 0.05$) decrease in the ruminal motility of does in group C (CPT) in comparing with group A (control) and B (SCPT). As shown in Table 2, the results of hematological parameters of red blood cell count and the values of hemoglobin reveals non-significant changes among different groups, while significant ($p \leq 0.05$) increase of PCV% in group C in comparison with group A and B. As demonstrated in Table 2, the serum glucose and total protein showed a highly significant ($p < 0.001$) decrease of in group C (clinical pregnancy toxemia) rather than group A (control). On the other hand, this value in group B (SCPT) was slightly decreased than in group A (control). Serum BHBA showed a highly significant ($p < 0.001$) increase in SCPT and CPT does than control. serum AST and ALT activity showed a significant ($p < 0.001$) increase in clinical pregnancy toxemic does than subclinical pregnancy toxemic does and controls. Serum urea and creatinine levels showed significant increase in clinical and subclinical pregnancy toxemic goats when compared with controls. Regarding the electrolytes serum levels, serum sodium and potassium levels were significantly decreased

Table 1. Clinical parameters in control, subclinical pregnancy toxemic (SCPT) and clinical pregnancy toxemic (CPT) goats.

Parameters	Control (n=20)	SCPT goats (n= 28)	CPT goats (n=15)
Body temp. (°C)	38.4±0.3	38.3±0.6 ^{NS}	38.0±0.1 ^{NS}
Respiratory rate/min.	34.3 ±0.01	33.7±0.15 ^{NS}	36.4±0.09 ^{NS}
Pulse rate/min.	72.24 ± 2.41	74.5 ±0.08 ^{NS}	76.00 ±3.02 ^{NS}
Rumen movement/min	2.03 ±0.03	1.89 ±0.09 ^{NS}	1.03 ±0.07 ^{**}

Means with different superscripts indicate significant difference at $p<0.05$.

Table 2. hematological and biochemical parameters in control, subclinical pregnancy toxemic (SCPT) and clinical pregnancy toxemic (CPT) goats.

Parameter	Control goats (n=20)	SCPT goats (n= 28)	CPT goats (n=15)
RBCs ($\times 10^6/\mu\text{l}$)	8.46±0.71	8.08±0.53 ^{NS}	7.83±0.45 ^{NS}
PCV%	32.87±0.42	29.06±0.63 ^{NS}	38.9±0.82 [*]
Hb (mg/dl)	9.53±0.13	10.07±0.21 ^{NS}	9.89±0.11 ^{NS}
BHBA (mmol/l)	00.47±0.08	1.17±0.43 ^{**}	3.02±0.58 ^{**}
Glucose (mg/dl)	60.53±0.32	47.16 ±0.62 [*]	34.06 ± 0.40 ^{**}
Total protein (mg/dl)	7.13±0.04	6.03±0.02 [*]	4.38 ± 0.06 [*]
ALT (U/l)	28.23±0.56	30.02 ± 0.34 ^{NS}	67.54± 1.74 ^{**}
AST (U/l)	54.17±0.78	57.17 ±1.28 ^{NS}	97.73. ± 2.07 ^{**}
Sodium (mmo/l)	144.33±0.27	142.40 ± 0.82 ^{NS}	125.00 ± 1.03 [*]
Potassium (mmol/l)	4.74±0.13	4.00± 0.19 ^{NS}	3.02± 0.08 ^{**}
Calcium (mmol/l)	2.16±0.05	1.97± 0.09 ^{NS}	1.75 ± 0.15 [*]
Phosphorus(mmol/l)	2.02±0.03	2.12 ± 0.14 ^{NS}	1.93 ±0.04 ^{NS}
Magnesium (mmol/l)	1.22±0.11	1.01± 0.03 ^{NS}	0.98 ± 0.09 ^{NS}
Urea (mg/dl)	19.05 ±0.14	26.78±0.12 [*]	30.43± 0.12 ^{**}
Creatinine(mg/dl)	0.98±0.05	1.67±0.03 [*]	2.03±0.08 [*]

Means with different superscripts indicate significant difference at $p<0.05$.

($p<0.05$) in CPT than control, while the same previously mentioned elements showed non-significant changes in group B when compared with control group. Regarding the values of some serum minerals including calcium, phosphorus and magnesium, there were no significant changes in the values of phosphorus and magnesium among the three groups, while serum calcium levels were significantly decreased ($p<0.05$) in clinical pregnancy toxemic goats.

DISCUSSION

Pregnancy toxemia is one of the most common metabolic disease in goats and sheep frequently occurred during late stage of gestation. The present study, aimed to evaluate the clinical, hematological and biochemical findings in Libyan goats suffering from pregnancy toxemia. Diagnosis of goats with pregnancy toxemia is based on the stage of gestation, physical and clinical examination and laboratory analysis. In this study, the mean age of goats suffering from pregnancy toxemia was 3.8 years, these results were in agreement with Bostedt and Hamada (1990). Clinical

examination of pregnancy toxemic goats indicated anorexia, depression, dullness, dyspnea, increased heart rate, weakness, lateral recumbency and nervous signs. These clinical signs are similar to those previously observed in pregnancy toxemic goats (Abdelaal et al., 2013; Al-Qudah, 2011; El-Sebaie, 1995; Hefnawy et al., 2011; Jyothi et al., 2014; Rook, 2000; Souto et al., 2013). In the present study, the goats with subclinical pregnancy toxemia observed slight variation of clinical parameters but within the normal range.

Subclinical pregnancy toxemia is defined as abnormal concentration of circulatory ketone bodies in the absence of clinical sings (Duffield, 2000). Clinical examination revealed a significant increase ($p<0.05$) in heart rate in goats with clinical pregnancy toxemia compared to subclinical pregnancy toxemic and healthy goats. These findings are similar to those recorded by Abdelaal et al. (2013), Al-Qudah (2011), Balikci e al. (2009), El-sebaie (1995), Hefnawy et al. (2011), Jyothi et al. (2014) and Scott and Woodman (1993).

In the hematological profile, a significant increase of PCV% were reported in pregnancy toxemic goats compared to the control. The increase in PCV% is usually

related to haemoconcentration and dehydration (Amany et al., 2015; El-Sebaie, 1995; Hefnawy et al., 2011). This increase in packed cell volume could be attributed to dehydration associated with fluid loss due to the reduction of food and water intake (Hefnawy et al., 2011; Rook, 2000).

Regarding the biochemical analysis, the serum glucose showed significant decrease in goats with clinical and subclinical pregnancy toxemia than control. This result is in agreement with those previously recorded in pregnancy toxemic goats by Albay et al. (2014), Balikci et al. (2009), Barakat et al. (2007), Buswell et al. (1986), Cantley et al. (1991), El-Sebaie (1995), Gupta et al. (2008), Gurdogan et al. (2014), Henze et al. (1998), Bani Ismail et al. (2008), Lindsay and Pethick (1983), Manokaran et al. (2011), Marteniuk and Herdt (1998), Rani et al. (2015) and Sharma et al. (2014). The requirements of energy in does are increased in the last four weeks of gestation due to rapid increase in fetal growth (Abdelaal et al., 2013; Dalrymple, 2004; Hefnawy et al., 2011; Lima et al., 2012). Elevation of β -hydroxybutyrate resulted in a significant drop of glucose turnover (Heitmann and Fernandez, 1986; Schlumbohm and Harmeyer, 2003), and theoretically the possible mechanism responsible for the hypoglycemic effects of high concentration of β -hydroxybutyrate is reduction of food intake and glucose turnover (Grohn et al., 1983; Schlumbohm and Harmeyer, 2004).

Regarding the protein profile, serum total protein levels showed a significant decrease in pregnancy toxemic goats than control ones. The results might be attributed to the rapid growth of fetus and abnormal status of liver function (Yarim and Ciftci, 2009).

Regarding the enzymatic activities in goats with clinical pregnancy toxemia, the results showed a significant increase in the serum hepatic enzymes ALT and AST. This result is in agreement with those previously recorded in goats with pregnancy toxemia by Ceron et al. (1994), El-Sebaie (1995), Marteniuk and Herdt (1998), Radostits et al. (2000), Van Saun (2000) and Vihan and Rai (1987). Serum biochemical analysis showed that calcium, potassium and sodium were significantly decreased in cases of pregnancy toxemia compared to the control animals, while there was no marked change in the phosphorus and magnesium levels. During the last trimester of pregnancy, pregnant does with more than one fetus required more calcium ratio for skeletal development in growing fetus (Henze et al., 1998; Schlumbohm and Harmeyer, 2003). Decrease in serum calcium level was noted in the present study, which was in agreement with Anoushepour et al. (2014), Hefnawy et al. (2011), Jyothi et al. (2014) and Souto et al. (2013).

In the present study, the serum urea and creatinine levels showed significant increase in pregnancy toxemic goats, which might be attributed due to involvement of the kidney in the pathogenesis of caprine pregnancy toxemia (El-Sebaie, 1995; Hefnawy et al., 2011; Marteniuk and Herdt, 1998; Nagamani et al., 1996; Ramin et al., 2005). The significant decrease in the serum levels of sodium,

potassium and calcium as well as significant increase in the packed cell volume (PCV) in the pregnancy toxemic goats indicated that there were disturbances in the electrolytes and some minerals which may be attributed to stress of starvation, dehydration and involvement of the kidney in the pathogenesis of caprine pregnancy toxemia (Marteniuk and Herdt, 1998; Hefnawy et al., 2011; Prohaczik et al., 2009).

Conclusions

In the present study, clinical and subclinical pregnancy toxemia was diagnosed in different breeds in Libya. Our results revealed that the caprine pregnancy toxemia have severe impacts on several clinical and biochemical parameters. In order to prevent the economic loss due to pregnancy toxemia, measuring blood metabolites can be potentially useful tool for routine monitoring of subclinical pregnancy toxemia in late pregnant goats.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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