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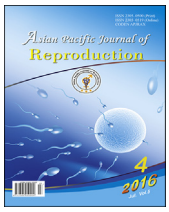

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The relationship between trace mineral concentrations of amniotic fluid with placenta traits in the pregnancy toxemia Ghezel ewes

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ABSTRACT

Objective: This study was conducted to investigate the trace mineral concentrations (Mg, Se, Zn, Cu and Fe) in amniotic fluid (AF) in 40 pregnancy toxemia Ghezel ewes at the time of parturition phase and its association with placental traits.

Methods: Animals were treated with controlled internal drug release for 14 d and injected 400 IU pregnant mare serum gonadotropin at the time of controlled internal drug release removal. After the detection of estrus by use of teaser rams, ewes were hand-mated. Ewes were classified as having subclinical pregnancy toxemia on the basis of beta-hydroxy butyrate (BHBA) results (BHBA > 0.86 mmol/L).

Results: The overall mean AF traces of mineral concentrations were 3.13 ng/mL, 22.1 μg/dL, 134.7 μg/dL, 122.5 μg/dL and 166.6 μg/dL, respectively. There was a significant positive correlation between placental efficiency and Zn concentration in AF ewes ($r = 0.633$, $P < 0.01$), while the relationship was significantly negative between total volume of amniotic fluid and Fe concentration in AF ewes ($r = -0.717$, $P < 0.01$). In this research, no relationship between Se, Mg and Cu trace minerals was observed in AF ewes with placental traits ewes. Results of laboratory analyses demonstrated no relationship between BHBA concentrations and placental traits ($P > 0.01$), except for placental weight ($r = 0.808$, $P < 0.01$). Also, no significant correlation was detected between BHBA with the above trace minerals.

Conclusions: Overall, determinations of these trace minerals in the AF ewes could have been used to obtain information on nutritional and reproductive status for the diagnosis of pregnancy toxemia in Ghezel ewes.

1. Introduction

Maintenance of health is an important key to profitable farm animal reproduction. Therefore, keeping newborns alive and healthy may be the greatest management challenge facing farm owners. Important strategies for meeting these challenges include making sure that the placenta and fetus are in good condition throughout the pregnancy period (especially during late pregnancy). Trace mineral evaluation can play an important role in the survey of reproductive status and diagnosis of various diseases. Evaluation of trace mineral concentrations in body tissues and blood[1] is assumed as an easy, safe, proper and low cost method to determine the normal status in animals[2,3]. Therefore, understanding the normal values, especially in the amniotic fluid (AF), would be a useful index in determination of the physiological aspects of health and pregnancy toxemia in ewes. Gestation is a period of rapid growth and differentiation for both dam and fetus. Each fetus is completely dependent on its mother via the placenta for its supply of essential trace minerals[4]. Thus, many of the circulatory and transport properties of the ewe placenta are similar to those of the human placenta and as such, the pregnant sheep offers an excellent model in which to study the development of AF[5,6].

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In recent years, among various researches (clinical medicine, biology, environmental studies, physiology and nutrition) the topic of trace minerals has received a great deal of attention. Additionally, the measurement of trace minerals is attracting increasing interest in medicine and veterinary sciences, because deviations in trace element uptake and/or metabolism are known to be related to certain diseases[7,8]. These minerals can be commonly found not only in the environment but also in diet. When animal receives trace minerals or intakes of them are deficient, maternal transfer of these essential minerals to the fetus are insufficient for processing normal development (such as differentiation, activation, vitamin synthesis, hormone production and performance of the numerous functions of immune cells) and there may be abnormalities in the majority of body development.

Taking into consideration all the above information, the effects of reproductive status on the amniotic chemistry in ewes has not been described adequately anywhere in the world. Thus, the main hypothesis of this study was the identification of the trace mineral concentration at AF in the pregnancy toxemia Ghezel ewes at the time of parturition phase and its association with placental traits that may be useful to provide and predict some advantages to producers.

2. Materials and methods

2.1. Hormonal drugs

Controlled internal drug release (CIDR) with 30 mg of progesterone, a progestagen analogue (InterAg, Hamilton, New-Zealand), pregnant mare serum gonadotropin (PMSG) (folligon; Intervet International B.V, Boxmeer, the Netherlands), beta-hydroxy butyrate (BHBA) (Randox, UK, BT264QY), Venoject® (Sterile Terumo Europe, Leuven, Belgium) and commercially available kits for analysis of trace minerals (Pars Azmoon, Karaj, Iran) were purchased from Invert Drug Industry (Tehran, Iran).

2.2. Animals, housing and diets

This experiment was performed on 40 clinical pregnancy toxemia Ghezel ewes (2–5 years old, weighing 40–50 kg) maintained in Animal Reproduction Research Station of Tabriz University, located in Tabriz province, Iran (38°07′ N and 46°29′ E) from June to December 2015 during breeding season. Ambient temperature during the experiment ranged from 20 to 26 °C with annual rainfall in this region ranging from 212 to 244 mm. The sheep obtained food by pasture grazing in summer; while in winter they were fed hay and fodder mix applied in rations of 220–270 g per sheep. In addition, salt-licks and mineral mixes were offered as well in the shed.

The ewes were treated with CIDR for 14 d and received 400 IU PMSG injection at the time of CIDR withdrawal. After the detection of estrus by use of teaser rams, ewes were hand-mated. Ewes were classified as having subclinical pregnancy toxemia on the basis of BHBA results (BHBA > 0.86 mmol/L)[9].

2.3. Sampling

Pregnant ewes were placed in an individual birth box around their estimated parturition date. Placenta was collected immediately after delivery and weighed fresh on a digital scale and the placental traits including placental weight (PW) and cotyledon number (CN) were measured and recorded. Placental efficiency (PE) was defined as the ratio of total birth weight (g) to placental weight (g). Cotyledon length (CL), cotyledon depth (CD) and cotyledon width (CW) were measured with an electronic digital caliper that randomly selected 10 cotyledons from each placenta. Total volume of amniotic fluid (TVAF) was measured using a graduated cylinder. The AF was collected by disposable syringes (10 mL) and stored in labeled plastic tubes at −20 °C until analysis of trace minerals.

2.4. Assay of trace minerals

Forty samples of AF were collected from pregnancy toxemia Ghezel ewes at the time of parturition. In the laboratory, these samples were centrifuged at 4 000 r/min for 10 min at approximately 22 °C to remove cellular debris, and stored at −20 °C for later analyses. The AF samples were analyzed for various trace minerals (Mg, Se, Zn, Cu and Fe) by using commercially available kits by atomic absorption spectrometry machine (Shimatzo, Japan). Standard commercial kits were used for analysis and the procedures were adopted as recommended by the manufacturer of these kits.

2.5. Assay of BHBA

A total of 5 mL blood was collected at the time of parturition by jugular venipuncture. Jugular blood samples were collected in vacuum tubes, early in the morning before feeding. To assay BHBA concentration, the serum was separated by centrifugation at 4 000 r/min for 10 min and samples were first frozen in −20 °C and then assessed in groups of 40 samples by atomic absorption spectrophotometric method using Runbut kit.

2.6. Statistical analysis

Means, Pearson correlation coefficient (for continuous data), analysis of variance (ANOVA) by general linear model and regression analyses were performed by using the Statistical Analysis System software[10].

3. Results

3.1. Trace minerals measurements

The trace mineral concentrations of AF that were obtained from pregnancy toxemia Ghezel ewes at the time of parturition were determined. The overall mean AF trace mineral concentrations were (3.13 ± 2.05) (range: 21.18–40.01) ng/mL, (22.10 ± 325.11) (range: 7.07–15.41) μg/dL, (134.70 ± 63.28) (range: 72.01–196.25) μg/dL, (122.55 ± 98.08) (range: 49.02–73.87) μg/dL and (166.67 ± 89.20) (range: 47.09–285.07) μg/dL.

3.2. Placental traits

Table 1 presents the mean, standard error of mean and normal range of placental traits in the pregnancy toxemia Ghezel ewes at the time of parturition.