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Hormonal, biochemical, and hematological profiles in female camels (*Camelus dromedarius*) affected with reproductive disorders☆

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ABSTRACT

The aim of this study was to assess the blood profiles in female camels affected with common reproductive disorders. Estradiol-17β (E_2), progesterone (P_4), thyroxin (T_4), zinc (Zn), copper (Cu), calcium (Ca), phosphorus (P), magnesium (Mg), cholesterol, glucose, triglycerides, total protein, albumin, globulin, hematocrite, and total and differential white blood cell counts (WBC) were determined in blood of female camels affected with endometritis ($n=15$), vaginal adhesions ($n=15$), and ovarian cysts ($n=15$). Normal cyclic animals were used as controls ($n=15$). Diagnosis of reproductive disorders was based on transrectal palpation, ultrasonographic examination, and exploration of the vagina. Increased WBC counts ($P=0.03$) and a tendency for neutrophelia ($P=0.05$) were noted in female camels with vaginal adhesions. These animals were also characterized by having higher concentration of serum P_4 ($P=0.0001$), T_4 ($P=0.001$) and total protein ($P=0.007$), in comparison with female camels with endometritis, ovarian cysts, or controls. Animals having ovarian cysts with thin walls and homogenous hypoechogenic contents had greater serum E_2 ($P=0.001$) and P_4 ($P=0.0001$) than those having ovarian cysts with thick walls and non-homogenous echogenic contents. Animals with endometritis, vaginal adhesions, and ovarian cysts revealed lower serum Zn concentration than that of control group ($P=0.003$). Other blood parameters did not differ significantly compared to controls. In conclusion, this is the first report characterizing blood constituents in female camels with various reproductive disorders. These profiles may be valuable in clarifying the etio-pathogenesis of these disorders.

1. Introduction

Reproductive inefficiency is a major problem in many camel herds, where delayed first service, long calving interval, relatively short breeding season, and poor conception rate are major contributors (Al Eknah, 2000; Kaufmann, 2005). Likewise, herd management, nutritional and pathological factors could be involved (Sghiri and Driancourt, 1999; Tibary and Anouassi, 2000; Kaufmann, 2005). Nevertheless, the basic causes of the reproductive problems in a herd are not always clear. In this concern, blood profile might be a potential aid in characterizing the problem.

Hormones, trace elements, minerals, enzymes and hemograms have been described in the blood of female camels during different reproductive statuses including the estrous cycle (Elias et al., 1984; Eltohamy et al., 1986; Homeida et al., 1988; Mohamed, 2004), pregnancy (Eltohamy et al., 1986; Skidmore et al., 1996; Zhao et al., 1998), postpartum period (Eltohamy et al., 1986; Agarwal et al., 1992) and for breed (Mohamed and Hussein, 1999; Abu Damir et al., 2008), age (Haroun, 1994), season (Abdalla

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et al., 1988; Amin et al., 2007), management and nutrition (Faye et al., 1992; Mohamed, 2004; Ali et al., 2008) variation. However, blood profiles in relation to reproductive disorders have not been described in this species.

Endometritis/metritis have been described as the most common form of infertility in dromedary camels (Tibary and Anouassi, 2000). Diagnosis of endometritis/metritis in cattle has been hampered by lack of a universally accepted definition of disease and simple, effective diagnostic techniques (Barlund et al., 2008). The most accurate method for diagnosis of endometritis/metritis has been the examination of the contents of the vagina for the presence of pus (LeBlanc et al., 2002; Sheldon et al., 2006). Traumatic injuries and chronic inflammation of the vagina can lead to the formation of complete adhesions between the vaginal walls and development of pyometra (Tibary and Anouassi, 2000).

Ovarian cysts are a major reproductive disease responsible for economic loss in the dairy industry (Borsberry and Dobson, 1989). The condition is characterized by persistent anovulatory follicular structure in the absence of corpus luteum and interrupted normal estrous cycle (Lopez-Diaz and Bosu, 1992). Ovarian cysts have been classified as follicular or luteal and anestrus and short cycles (nymphomania) have been reportedly the most frequent clinical signs in cows with luteal and follicular cysts, respectively. However, persistently elevated plasma estradiol concentrations, found in follicular cysts, may prompt desensitization of the hypothalamus–pituitary axis, leading to anestrus (Carrière et al., 1995). Although types of ovarian cysts have been described in the dromedary camels (Shalash and Nawito, 1963; El-Wishy, 1990; El-Khouly et al., 1990; Skidmore et al., 1996); the cystic ovary condition is not well documented as in cattle or other domestic animals and Skidmore et al. (1996) and Tibary and Anouassi (1996) have suggested that the term "cystic ovaries" does not always apply to Camelidae because large proportions (30–40%) of females developed some forms of cystic ovaries if not bred given that ovulation in these species is induced.

The objective of this study was therefore to assess the profiles of selected blood components in female camels affected with endometritis, vaginal adhesions and ovarian cysts.

2. Materials and methods

2.1. Animals and management

A total of 60 non-lactating multiparous Najdi female camels (*Camelus dromedarius*) aged 8–12 years were included in this study. Forty-five cases were presented at the Veterinary Teaching Hospital of Qassim University – Saudi Arabia suffering from endometritis (repeat breeding females with muco-purulent or purulent vaginal discharges, $n = 15$), vaginal adhesions (complete occlusion of the vaginal passage, $n = 15$), ovarian cysts (follicle larger than 25 mm detected at two successive examinations with 7 days apart, $n = 15$). Fifteen normally cyclic females were included in the experiment as controls.

The genital tract was examined by transrectal palpation, by ultrasonography (Dynamic Imaging Ltd., Scotland-UK, attached to 7.5 MHz transrectal transducer), and through exploration of the vagina. Ovaries were carefully examined for structures, consistency, and size, uterus was palpated for consistency, contractility, contents, and thickness and vagina and cervix were examined for their normal passage into the uterus and for discharges. Ovarian cysts were categorized into those having thin walls with clear hypoechogenic contents (type 1, $n = 6$), and those showing thick walls with many echogenic transecting fibrinous strands in the follicular fluid (type 2, $n = 9$). Cases of vaginal adhesions were also subdivided into those with ($n = 8$) or without ($n = 7$) intra-uterine fluid accumulation.

The experiment was conducted during the breeding season (September 2008 to February 2009). All animals used were healthy, ranged in body condition score from 3 to 4 (score from 1 to 5, Sghiri and Driancourt, 1999), and were injected biannually for prophylaxis against trypanosomosis by Quinapyarmine sulphate and Quinapyramine chloride (Triquin©, Wockhardt, Mumbai-India).

2.2. Blood analysis

Two blood samples were drawn from the jugular vein of each animal at the time of clinical examination between 10 and 12 h AM, one on EDTA and the other in plane tubes for serum harvesting. The whole blood sample was used for estimation of hematocrite and total and differential white blood cell counts (WBC) within 30 min of collection using standard hematological techniques (Feldman et al., 2000).

Serum was separated from the other tube by centrifugation for 10 min at $1200 \times g$ and was immediately frozen for future analyses. Serum concentrations of estradiol-17β (E_2), progesterone (P_4), and thyroxin (T_4) were determined by ELISA using commercial kits (Human Gesellschaft fur Biochemica und Diagnostica, Wiesbaden – Germany). The coefficient of variance of intra- and interassay were 5.2 and 9.3%, 4.8 and 9.2%, 3.8 and 6.4% and the sensitivity of the assay was 3 pg ml^{-1}, 0.03 ng ml^{-1}, and 0.4 μg/dl, for the E_2, P_4, and T_4, respectively.

Serum samples were also analyzed for copper (Cu) and zinc (Zn) after a 10-fold dilution with water of ultrapure analytical grade by atomic absorption spectrometry (Shimadzu Model 6200, Tokyo, Japan). Serum concentrations of calcium (Ca), phosphorus (P), magnesium (Mg), total protein, cholesterol, triglyceride, glucose, total protein, and albumin were determined photometrically using commercial kits provided by Human mbH. Globulin was calculated by taking the difference between total protein and albumin.

2.3. Statistical analysis

Data are presented as means ± S.E.M. and the analysis was conducted using SPSS program, version 16.0 (2007). Differences among groups were evaluated by ANOVA. *t*-test was used to compare between levels of hormones in animals with ovarian cysts of type 1 or 2. The same test was used to compare between animals that had vaginal adhesions with or without intra-uterine fluid accumulation. While, differences in differential leukocytic count were evaluated by x^2-test. Level of significance was set at $P < 0.05$.