

## Comparison of reproductive hormone levels in male and female camels (*Camelus dromedarius*) during rutting and non-rutting seasons and their relation with some minerals and antioxidant status

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### ABSTRACT

This study designed to establish a reference data and compare the reproductive hormone profiles of both sexes of dromedary camels in rutting and non-rutting seasons in Samawa Province, Iraq. Therefore twenty four adult healthy camels (12 males and 12 females) were used to determine reproductive hormone levels (estradiol, FSH, LH, progesterone and testosterone). Some electrolyte and minerals (Ca, K, Na, Cu, and Zn) were also measured to ensure their effects on sexual hormones. The antioxidant and stress status take in consideration by measured cortisol and glutathione peroxidase concentrations. The results revealed there were a significant difference in reproductive hormones between males (LH, progesterone and testosterone) and females (estradiol, FSH, LH, progesterone and testosterone) during rutting and non- rutting seasons, although no significant difference was found about electrolytes and minerals on both sexes. The antioxidant and stress status of both sexes also appeared non-significant effect for glutathione peroxidase and cortisol when compared to both sexes of camels. These results exhibited difference in reproductive hormones of male and female camels during the rutting and non-rutting seasons.

**Keywords:** Reproductive hormones, Camels, *Camelus dromedaries*, Antioxidant status.

**Article type:** Research Article.

### INTRODUCTION

Camels are one of the elements of animal wealth in Iraq spread in the middle and south, but have not received enough attention from breeders and researchers and also suffer from neglect of agricultural institutions. Camels are characterized by their ability to live in harsh conditions, which encourages researchers to move forward in explaining this ability scientifically and for the purpose of finding the best means to continue developing this type of animal and benefit from its products for human consumption and drug use (Abrahaley & Leta 2018). Reproduction in dromedary camels had less interest from the researchers and students compared to other domesticated animals such as cattle, sheep, goat etc. (Zarrouk *et al.* 2003). Especially when investigated camels as seasonal reproductive activity this need to establish hormone levels related to different physiological condition of animal. The biochemical and hormonal parameters, compared to haematological indices, induce a lot of effects on camels of different physiological status reared under traditional condition (Muhammad *et al.* 2011). Regular secretion of sex steroid hormones had clear relationship with sexual behaviour and acceptability of male from female in several animals, but this concept is unapplied in the case of camels and depends on ovarian status and levels of estradiol-17 $\beta$  and progesterone as found in other livestock (Quzy *et al.* 2013), because female dromedary camels' reproduction is characterized by a seasonal activity and induced ovulation (Zarrouk *et al.* 2003).

Mineral levels in plasma of camels might be useful tools to determine the problem in different physiological state, when used by Abd-El Hamid *et al.* (2015) to find relation between some mineral levels and reproductive hormones. It is necessary to study their reproductive hormones and determine their proportions in males and females in different seasons with consideration given to influence of some important electrolyte and minerals that are closely related to reproduction and demonstrate the relation of mineral levels on reproductive hormones as indicators for healthy animal. This study designed to record and compare reference data of reproductive hormones in male and female of dromedary camels during rutting and non-rutting seasons in Al-Samawa Province, Iraq and their relation to the plasma mineral levels and antioxidant status as indicators to use from clinician and veterinarian for following up of reproduction in camels.

## MATERIAL AND METHODS

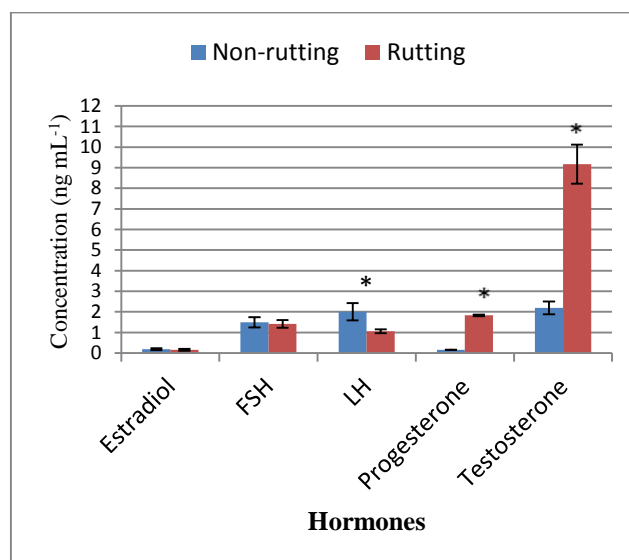
Twenty four mature healthy dromedary camels (12 males and 12 females) age ranged 5-7 years old with average body weight of  $370 \pm 20$  kg were used in this study. The animal obtained randomly from the desert of Samawa Province firstly at June with a temperature reach about  $48 \pm 3^\circ\text{C}$  and at October 2019 with a climate temperature of  $25 \pm 5^\circ\text{C}$  and humidity ranged 40-50%. All examined camels feed on grazing shrubs and supply with white bran and free excess of water with total dissolved salt ranged 1000-2000 ppm measured by TDS device (China).

Blood samples (10 mL) were collected directly from jugular vein of each animal into test tube containing Gel/clot Activator (without anti-coagulant) which was immediately centrifuged to collect plasma. The mineral levels including Calcium (Ca), sodium (Na), potassium (K) zinc (Zn) and copper (Cu) were determined using colorimetric kits (BioMed, Germany). Reproductive hormones (estradiol-17 $\beta$ , progesterone, LH, FSH, testosterone), glutathione peroxidase, and cortisol were assayed using enzyme – linked immune sorbent assay (ELISA) kit manufactured by Human Company. Statistical analyses were performed using analysis of variance (T test) through SPSS computer package version 21. The differences are considered to be significant at ( $p < 0.05$ ), and the differences between means were assessed by LSD (SPSS 2016).

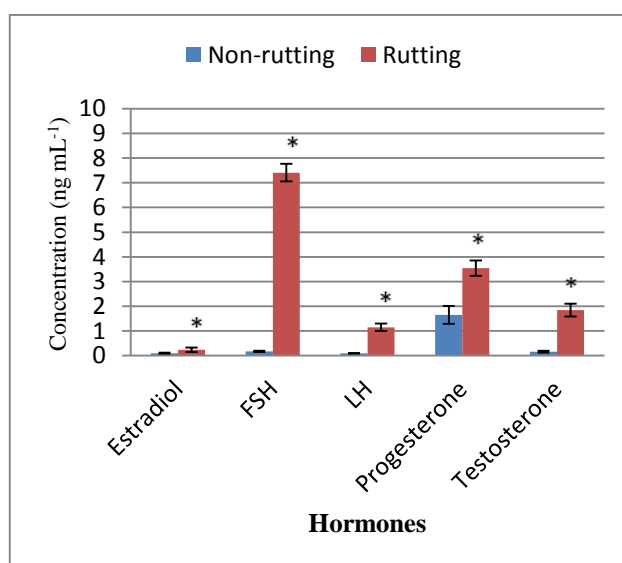
## RESULTS AND DISCUSSION

The relationship between the two sexes of camels and reproductive hormone levels during rutting and non-rutting seasons are shown in Figs. 1-2. Significant increases were found in the male reproductive hormones (LH, Progesterone and Testosterone) during rutting season compared to non-rutting one. The elevation in these hormones was attributed to the direct effect of the season on the activity of the pituitary glands, especially the LH which responsible for testosterone secretion from the Leydig cells (Al-Bulushi *et al.* 2019). The testosterone is the major sex hormone in balancing most of the reproductive functions as well as spermatogenesis (Hafez & Hafez 2001). The increased testosterone level in male referred to activity of Leydig cells to the LH hormone or the upraised LH secretion from pituitary gland (Rateb *et al.* 2011). Androgen level was regulated via the pituitary – gonadal axis by FSH, GnRH and LH (Buijtelts *et al.* 2012). The progesterone in males play a very important role in testosterone biosynthesis in the Leydig cells in addition to its role in the spermiogenesis, sperm capacitation and acrosome reaction (Oettel & Mukhopadhyay 2004), which appeared clearly during rutting season in examined animals. In this study the level of estrogen was high in males during rutting season (although there was no a significant difference compared non-rutting season). The estrogen plays a necessary role in development and maintenance of testicular function by regulation of epididymal fluid reabsorption and semen pH (Hess *et al.*, 2011). These results agreed with Ibrahim *et al.* (2016) and Farh *et al.* (2018) who recorded close levels of reproductive hormones in male camel during non-rutting season as well as concentration and availability of sperm. In our results a significant decrease was observed in the levels of LH, testosterone and progesterone in males at non-rutting season which indicates a reduced reproductive ability of these males as well as a drop in the quality of semen produced during this period (Al Eknah 2000). The environmental factors like temperature, rain and light controlled the reproductive season (from December till March) in male and female camels by stimulating the reproductive hormones from pituitary gland and then the gonads. In non-rutting season a complete disappearance of hormonal stimulation and subsequently decreasing in the reproductive activity (Al Eknah 2000) were observed. The female reproductive activity depends directly on the GnRH and FSH which secreted from the hypothalamus and pituitary gland. The rutting season stimulates pituitary hormones to induce the ovaries to promote the folliculogenesis followed by estrogen secretion (Ismail 1987). In our study a significant increase in the level of female reproductive hormones (Estradiol, FSH, LH, Progesterone and Testosterone) during rutting- compared to

non-rutting seasons. Many studies revealed the positive effect of season (from December till March) for exhibiting the reproductive activity which followed by normal estrous cycle (Ismail 1987; Eiwishy 1987). During non-rutting season, significant decrease in reproductive hormones occurs which is usually followed by interruption in ovarian activity and true inactive ovaries is found during this period (Eiwishy 1987). In the case of inactive ovaries, the activity of pituitary gland was clearly lower in comparison with that of active ovaries. Moreover, the FSH hormone in the plasma is fewer than that of active ovaries. (Hegazy *et al.* 2004). Our results agreed with those studies about the effect of season on estrous cycle in she camel.



**Fig. 1.** Reproductive hormone levels of male camels in rutting and non-rutting seasons.



**Fig. 2.** Reproductive hormones levels of female camels in rutting and non-rutting seasons.

Many investigators have used electrolyte concentrations such as Na<sup>+</sup>, K<sup>+</sup> and Ca in addition to Cu and Zn in camels as indicators for animal health (Bogin 2000). In the present study the concentrations of some minerals were measured in the two sex of camels to investigate if there are any effect of sex on these parameters. Figs. 3-4 showed non-significant differences among mineral and sex of dromedary camels in different period of breeding, although there were differences in values, but appeared non-significant to avoid the effect of these minerals on the levels of reproductive hormones. These results came in agreement with Elkhair (2016) who recorded non-significant differences among the minerals in accordance with sex of the camels. Furthermore, in a study in Saudi Arabia conducted by AL-Busadah & Homeida (2007), they established non-significant values for minerals in different sexes of camels from the various breeds of Saudi camels. Cortisol is the hormone, which is regarded as

an indicator of stress in cattle (Grandon 1997) and wildlife (Knowles *et al.* 1995). The plasma cortisol level was higher after transportation (Anderson *et al.* 1999), hypoxemia in new-world camelids (N.WCs) but not affected by food deprivation in the dromedary camel (Riquelme *et al.* 1998). Antioxidant defence mechanisms were developed to reduce the free radical formation and limit their damaging effects. GPX degrade superoxide and peroxides respectively as radical scavengers by reducing free radicals and cessation of the new radical-chain reactions (Abdel Rahim 2005). Low levels of antioxidants result in development of oxidative stress which may damage or kill cells along with alteration in the immune status of animals leading to increase susceptibility to various infections and diseases (Beckman & Ames 1998). In the present study, there were no significant differences between the seasons of breeding either males or females for both cortisol and glutathione peroxidase, in spite of the wide range in values (Figs. 5-6). It means that there were no effect of oxidative stress on animals during the period of sampling, which may be related to the values of hormones between males and females in rutting and non-rutting seasons to appear non-significant difference. These results matched with those of Ibrahim *et al.* (2016) and Abd-El-Rahman *et al.* (2017) obtained through their studies on antioxidant status and hormonal profile of dromedary camels.

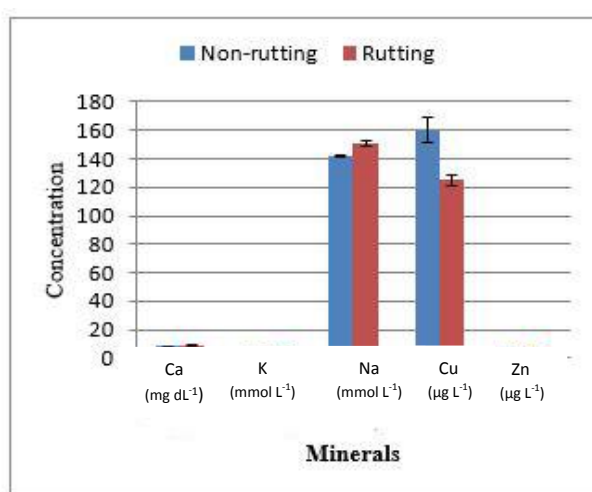


Fig. 3. Serum mineral concentrations of male camels in rutting and non-rutting seasons.

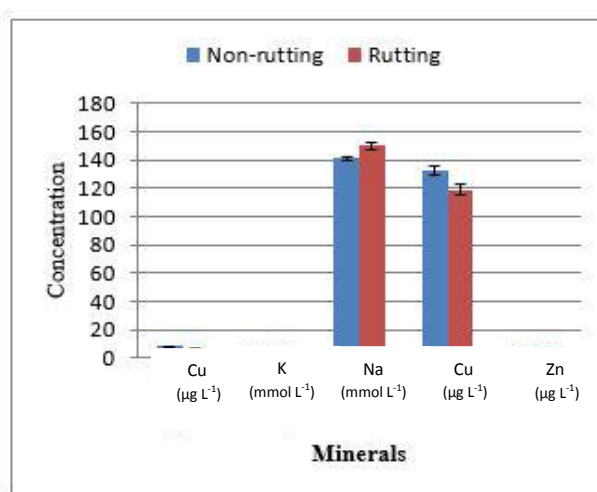


Fig. 4. Serum mineral concentrations of female camels in rutting and non-rutting seasons.

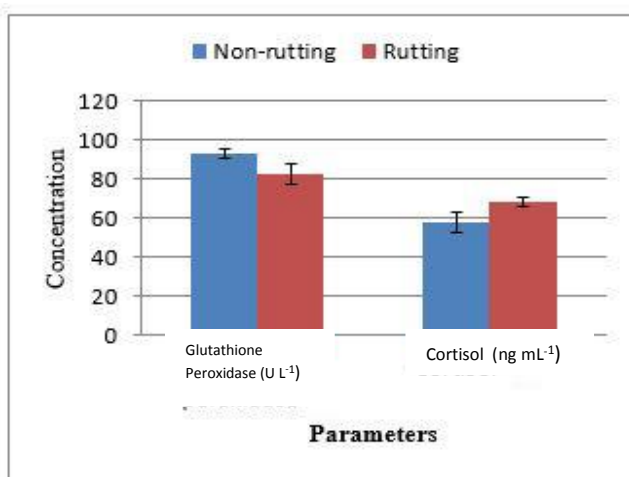


Fig. 5. Glutathione peroxidase and cortisol levels in male camels during rutting and non-rutting seasons.

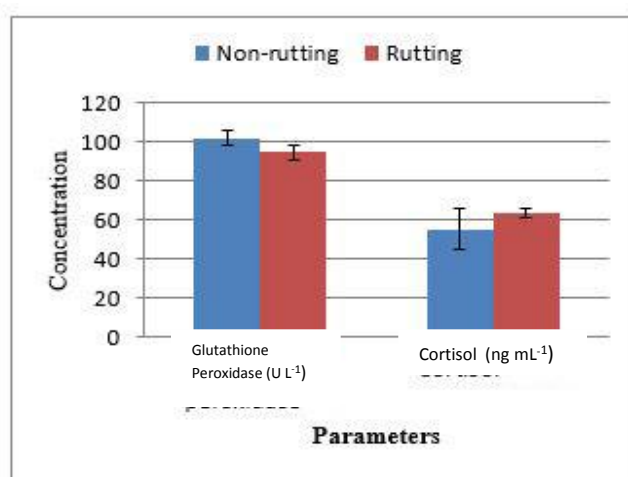


Fig. 6. Glutathione peroxidase and cortisol levels in female camels during rutting and non-rutting seasons.

## CONCLUSION

The present study revealed there were a significant difference among reproductive hormone levels between the same sex of dromedary camels in rutting and non-rutting seasons with take in consideration the effect of mineral levels on reproductive hormones and the stress status of animals.

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