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Effect of Different Feeding Regime on Body Weight, Ovaries Size Developments and Blood Estradiol, Progesterone Level in Pre-Pubertal She-Camel (*Camelus dromedarius*)

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Abstract: The present study aimed to investigate the effect of nutrition on body weight gain, ovaries development, blood components (total protein, albumen, globulin, cholesterol and glucose) and hormone level (estradiol and progesterone) in pre-pubertal she-camels. Fourteen dromedary she-camels (*Camelus dromedarius*) were divided in two groups (A and B) similar body weight and age at the start of the experiment (200 kg and 12 month, respectively). Group A received diet with 13% Crude Protein (CP) and 2.9 Mcal Metabolisable Energy (ME). Group B received the traditional diet of the farm. Both diets contained 25:75 forage:concentrate. Individual feed intake was calculated after 14 days of adaptation period. Feed offered and orts was recorded daily during the whole experimental period of 12 months. Blood samples were taken from each group every 15 days throughout the experimental period. Estradiol, progesterone concentrations were measured using ELISA kits. Body weight and average daily gain for the Ist 6 months did not show significant differences between treatments. On the contrary for the last 6 months, treatment A significantly increased body weight and daily weight gain when compared to B (70.07±8.17 kg and 0.389±0.05 kg day^{-1} vs. 37.86±8.17 kg and 0.210±0.05 kg day^{-1}, respectively. Group A was more efficient converting feed to body weight comparing with group B. Feed Conversion Ratio (FCR) for the whole period was 11.25 and 13.74 for Group A and B, respectively. Group B had greater ovary size than Group A but the difference was not significant. Size of right ovary was smaller than the left one and season had positive effects on both right and left ovary sizes. Greater ovary sizes were observed in Winter and Spring comparing with Summer and Autumn. Group A had higher blood estradiol level comparing with Group B while there was no difference between groups in progesterone levels. It was concluded that feeding regime did not affect body weight, daily body weight gain and blood progesterone levels but improved feed conversion ratio and blood estrogen levels.

Key words: *Camelus dromedarius*, puberty, body weight gain, ovary size, estradiol, progesterone

INTRODUCTION

In Saudi Arabia, the total number of camel is in the range of 800,000 (MA, 2006). In spite of the expansion of camel farming, the improvement of productivity was poor. Reproductive efficiency is the primary factor affecting productivity and is hampered in the female camel by late attainment of puberty and the long calving interval (Kaufmann, 2005; Musa *et al*., 2006). Age at puberty in she-camel has been reported to be 3-6 years this wide variation due to different environmental conditions (Matharu, 1966; Williamson and Payne, 1978; Khanna *et al*., 1990; Shwartz, 1992; Musa *et al*., 1993). Wilson (1989) reported that factors such as adequate nutrition, body weight, photoperiod, temperature and water availability can influence the onset of sexual activity. Late puberty reduces the life time production. High fertility levels in the camel are essential not only for profitable production but also to provide opportunities for selection and genetic improvement.

Tibary and Anouassi (1997) observed that well-fed and watered dromedary females show ovarian activity throughout the year and determinant factors for observed seasonality in conception date (November-April) are related to a decrease in male libido during the Summer months. Nutrition has effect on age at puberty. Attainment of puberty is influenced by the overall growth and weight of the animal which are affected by nutrition;

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animals with higher plain of nutrition come to puberty earlier (Wilson, 1989). Influence of body weight on puberty is more than the age (Marai *et al*., 2009). Estrogen and progesterone are two important female sex steroid hormones. Secretion level of these sex steroids has a definite correlation with sexual behavior. Estradiol-17β is responsible for the reproductive epithelia and development of secondary female sex characteristics (Sumar, 2000).

Thus, considering that the diet could have an effect on the age of puberty, the objective of this study was to evaluate the diet effects on body weight gain, ovary size development and blood estradiol-17β and progesterone levels as reproductive indicators for pre-puberty in female camels.

MATERIALS AND METHODS

Animals and diets: This experiment had been conducted at Camel Breeding, Range Protection and Improvement Center in Al-Jouf area, KSA. Fourteen dromedary females (*Camelus dromedarius*) were used and divided into two equal groups, according to body weight and age at the start of the trial (200 kg and 12 months, respectively). Group A received a diet with 13% Crude Protein (CP) and 2.9 Mcal Metabolisable Energy (ME). Group B received the traditional diet of the center (Table 1).

Animals' individual feed intake was calculated after 14 days of adaptation period. Feed offered and orts were recorded daily during the entire experimental period of 12 months. Diets contained 25:75 (roughage:concentrate, respectively). Diet A roughage and concentrates were in combined in a pellet. Fresh water was freely available. Blood samples were collected from the jugular vein into anticoagulant vacuum tubes for plasma separation. Blood samples were taken at morning from same three animals from each group, every 15 days during the whole experimental period. Blood plasma was separated by centrifugation (1,500 g for 10 min) and frozen at -20°C until analyses. Estradiol and progesterone concentrations were measured using ELISA kits (Diagnostic Automation Inc. CA. USA).

Table 1: Diet ingredients and chemical composition (Dry matter basis)

Items	Diet A	Diet B
Ingredients (%)		
Barley	60.22	62.23
Wheat bran	9.63	12.08
Soya Meal (48%)	4.25	-
Salt	0.47	-
Limestone	2.10	-
Acid buffer	1.00	-
Molasses	3.00	-
Premix	0.30	-
Alfalfa	19.03	15.23
Wheat straw	-	10.46
Nutrients (%)		
Dry Matter (DM)	90.20	92.52
Crude Protein (CP)	13.08	12.43
Crude Fiber (CF)	10.19	15.35
Calcium	1.67	0.35
Phosphorus	0.42	0.27
ME M cal kg^{-1*}	2.90	2.70

ME = Metabolisable Energy; *Values reported should be Na, Cl, K, etc. (Salt is an ingredient and was already quoted)

The following parameters were also measured or calculated: body weight every 15 days in kg (animals weighed after 10 h of fasting). Body weight gain in kg. Daily weight gain in g day^{-1}. Blood samples twice a month for estradiol and progesterone levels in plasma. Ovaries size, axes were measured by ultrasongraph SSD-500, Aloka Co. LMT Japan and calculated the size by using the equation of ellipsoid volume: '4/3 π a*b*c' a.b.c. = axes of ellipsoid (http://en.wikipedia.org/wiki/volume).

Statistical analysis: Data was subjected to statistical analysis using the SAS program (SAS, 2000). Data for changes in body weight analyzed according to the following equation:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:

Y_{ij} = The observation of the dependent variable obtained from Jth animal of Ith treatment
μ = The overall mean
T_i = The effect of ith treatment (i = A or B)
e_{ij} = The residual term

For the ovary size and estradiol, progesterone level the equation was:

$$Y_{ijk} = \mu + T_i + S_j + e_{ijk}$$

Where:

Y_{ijk} = The observation of the dependent variable obtained from Kth animal of Ith treatment, of Jth season
μ = The overall mean
T_i = The effect of ith treatment (i = A or B)
S_j = Effect of jth season (j = Winter, Spring, Summer or Autumn)
e_{ijk} = The residual term

The General Linear Model (GLM), Least Squares Means (LSMEANS) procedures were used. The PROC MIXED procedure for repeated measures should have been used.

RESULTS AND DISCUSSION

Changes in live body weight: Table 2 shows no significant differences between treatments for LBW and BWG for the 1st 6 months. On the contrary, for the last 6 months, treatment A showed greater BWG when compared to treatment B ($p<0.05$). The body weight gain for whole period did not show differences between groups.

Regarding FCR for last 6 months and the whole period, Group A was significantly more efficient in converting feed to growth comparing to Group B (Table 3). Group A consumed less feed and had higher body weight gain indicating a better use of the feed. The difference between Groups A and B in feed intake was also significant ($p<0.05$). These results agreed with those of Mohamed (2006) who observed a clear variation in camel performance when fed different types of rations. Despite the fact that there was not significant difference in DWG for the whole period, numerical values in group A were higher than in group B. Therefore, encouragement of rapid growth during the pubertal period by the good plain of nutrition can assist early sexual development and breeding maturity in she-camel (Marai *et al*., 2009).

Changes in ovaries size: No interaction between treatment and season were detected. Size of the left ovary was non significantly greater than the right one (Table 4) agreeing Zeidan *et al*. (2011) who reported that weight of left ovary is greater than right one. The right ovary size was not significantly different between groups while left ovary size in group B was significantly bigger than group A. Season of the year had also positive effects on ovary size in both right and left ovaries which agreed with Zeidan *et al*. (2011) who reported that highest weight of ovary was observed during Winter and the lowest during Summer. Moreover, the results agreed with Shujait *et al*. (2007) who reported that ovarian length, width and weight were significantly affected by the season. They were greater in Winter and Spring when compared to Summer and Autumn. Group A had significantly higher blood level of estradiol-17β comparing with group B ($p<0.05$). Season also modified blood estradiol levels however the effect was not significant. The highest levels of estradiol-17β were observed in Winter and Spring when compared to Autumn and Summer. This result agreed with Zeidan *et al*. (2011), Abd El-Azim (1996) and Agarwal *et al*. (1987) who reported that estradiol-17β concentration in follicle fluids was higher during Winter and Spring than Autumn and Summer. El-Hariary *et al*. (2010) reported that with regard to oestradiol-17β, the hormone level was significantly higher during Winter and Spring than Summer and Autumn. Progesterone level in treatment A did not differ from treatment B. Season did not affect blood progesterone levels significantly. The higher level of progesterone was observed in Autumn. Progesterone level in this study was <1.00 ng mL^{-1}. This result agreed with Homeida *et al*. (1988) and Skidmore *et al*. (1994) who reported that plasma progesterone level remained under 1.00 ng mL^{-1} throughout the follicular wave.

Table 2: Treatment effects on changes in body weight and body weight gain

Parameters (kg)	Treatment A	Treatment B
1st 6 months		
LBW	259.07±18.18	275.00±18.18
BWG	60.50±5.960	73.14±5.960
Last 6 months		
LBW	329.14±22.73	312.86±22.73
BWG	70.07±8.170^{a}	37.86±8.170^{b}
Whole period		
BWG	130.57±9.860	111.00±9.860

Different letters within the row indicates significant difference ($p\leq0.05$); LBW = Live Body Weight; BWG = Body Weight Gain

Table 3: Treatment effects on feed conversion ratio

Parameters	Treatment A	Treatment B
Ist 6 months		
FI (kg)	3.81±0.03^{b}	4.10±0.03^{a}
DWG (kg)	0.340±0.03	0.410±0.03
FCR	11.20	10.00
Last 6 months		
FI (kg)	4.26±0.03^{b}	3.41±0.03^{a}
DWG (kg)	0.390±0.05^{a}	0.210±0.05^{a}
FCR	10.92	16.23
Whole period		
FI (kg)	4.05±0.02^{b}	4.26±0.02^{a}
DWG (kg)	0.360±0.03	0.310±0.03
FCR	11.25	13.74

Different letters within the row indicates significant difference ($p\leq0.05$); FI = Feed Intake; DWG = Daily body Weight Gain; FCR = Feed Conversion Ratio

Physiological status: Regarding blood parameters as indicators of the physiological status of the camels, only albumin and glucose showed significant differences due to treatments (Table 5).

Albumin level was significantly higher in treatment A when compared to treatment B, Albumin provides the body with the protein needed to both maintain growth

Table 4: Treatment and season effects on ovaries size and blood estradiol and progesterone levels

Parameters	Right ovary/cm^3	Left ovary/cm^3	Estradiol (ng mL^{-1})	Progesterone (ng mL^{-1})
Treatment				
A	33.18±2.70	32.92±2.22^{b}	38.16±3.87^{a}	0.139±0.02
B	36.95±2.71	39.63±2.23^{a}	28.73±3.87^{b}	0.108±0.02
Season				
Autumn	29.76±3.42^{b}	33.33±2.81^{b}	29.44±5.56	0.226±0.03
Spring	34.99±3.17^{a}	36.73±2.61^{a}	34.42±6.81	0.070±0.04
Summer	29.67±3.42^{b}	33.00±2.80^{b}	33.06±5.56	0.120±0.04
Winter	40.45±3.33^{a}	38.77±2.74^{a}	36.85±3.40	0.070±0.02

Different letters within the same column indicates significant differences ($p\leq0.05$)

Table 5: Treatment effects on mean blood total protein, albumin, globulin, glucose and cholesterol

Items	Treatment B	Treatment A
Total Protein (TP) (g L^{-1})	67.66±1.17	64.98±1.20
Albumin (Alb) (g L^{-1})	44.28±0.66[a]	41.65±0.68[b]
Globulin (Glo) (g L^{-1})	23.28±1.04	23.33±1.06
Alb/Glo	2.01±0.08	1.95±0.08
Glucose (Glu) (mg dL^{-1})	140.29±4.73[b]	162.26±4.83[a]
Cholesterol (Chol) (mg dL^{-1})	29.50±1.40	32.52±1.43

Different letters within row indicates significant difference ($p<0.05$)

and repair tissues which reflected, higher body weight gain in Group A compared to Group B. Glucose level in treatment A was lower than in treatment B due to consuming more glucose as energy driving force, to support metabolic activity to increase body weight. In general total protein, albumin and globulin blood level in this trial were near to levels obtained by El-Hariary *et al.* (2010).

CONCLUSION

Nutrition had effect on live body weight gain and then on age at puberty. Animals fed during pre-puberty period a balanced diet with 13% crud protein, 2.9 Mcal ME and required vitamins and minerals, improved body weight gain, ovary size and estradiol and progesterone levels in the blood. Researchers expect that these animals will come to puberty earlier than those which received traditional diets. More research on effect of nutrition on decreasing age at puberty of female camels is needed to support such findings.

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REFERENCES

Abd El-Azim, A.M., 1996. Aging and its effect on the reproductive perfomance of male one humped camel during different seasons. Ph.D. Thesis, Fac. Vet. Med., Zagazig University, Zagazig, Egypt.

Agarwal, S.P., V.K. Agarwal, N.D. Khanna and P.K. Dwarknath, 1987. Profiles of steroid hormones in male camel. Indian J. Anim. Sci., 57: 659-964.

El-Hariary, M.A., A.E.B. Zeidan, A.A. Afify, H.A. Amer and A.M. Amer, 2010. Ovarian activity, biochemical changes and histological status of the dromedary she-camel as affected by different seasons of the year. Nat. Sci., Vol. 8.

Homeida, A.M., M.G.R. Khalil and A.A.M. Taha, 1988. Plasma concentrations of progesterone, oestrogens, testosterone and LH-like activity during the oestrous cycle of the camel (*Camelus dromedarius*). J. Reprod. Fertil., 83: 593-598.

Kaufmann, B.A., 2005. Reproductive performance of camel (*Camelus dromedaries*) under pastor management and its influence on herd development. Livest. Prod. Sci., 12: 17-29.

Khanna, N.D., S.N. Tandon and A.K. Rai, 1990. Breeding parameters of Indian camels. Indian J. Anim. Sci., 60: 1347-1354.

MA, 2006. Animal population numbers. Ministry of Agriculture, Kingdom of Saudi Arabia.

Marai, I.F.M., A.E.B. Zeidan, A.M. Abdel-Samee, A. Abizaid and A. Fadiel, 2009. Camels reproductive and physiological performance traits as affected by environmental conditions. Trop. Subtrop. Agroecosyst., 10: 129-149.

Matharu, B.S., 1966. Management production and reproduction in dromedary. Indian Farm., 16: 19-22.

Mohamed, M.I., 2006. Growth performance of growing Maghraby camel fed non conventional feed. Proceedings of the International Science Conference on Camels, May 9-11, 2006, Al-Qassim, KSA., pp: 234.

Musa, B.E., H. Siema, H. Merkt, B. Hago, M. Cooper, W. Allen and W. Jochle, 1993. Manipulation of reproductive functions in male and female camels. Anim. Reprod. Sci., 33: 289-306.

Musa, H.H., E.S. Shuiep, E.M. El-Zubier Ibtissam and C.H. Chen, 2006. Some reproductive and productive tracts of camel (*Camelus dromedarius*) in western Sudan. J. Anim. Vet. Adv., 5: 590-592.

SAS, 2000. User's Guide. Statistical Analysis System, Cary, NC, USA.

Shujait, A., A. Nazir, A. Nafees, Zia-ur-Rahman and M. Sarwar, 2007. Effect of season and age on the ovarian size and activity of one-humped camel (*Camelus dromedaries*). Asian-Aust. J. Anim. Sci., 20: 1361-1366.

Shwartz, H.J., 1992. Productive performance and productivity of dromedaries (*Camelus dromedarius*). Anim. Res. Dev., 35: 86-98.

Skidmore, J.A., W.R. Allen and R.B. Heap, 1994. Oestrogen synthesis by the peri-implantation conceptus of the one-humped camel (*Camelus dromedarius*). J. Reprod. Fert., 101: 363-367.

Sumar, J.B., 2000. Llamas and Alpacas. In: Reproduction in Farm Animals. Hafez, B. and E.S.E. Hafez (Eds.). Lippincott Williams and Wilkins, Philadelphia, ISBN: 9780683305777, Pages: 509.

Tibary, A. and A. Anouassi, 1997. Theriogenology in Camelidae. 1st Edn., Ministry of Agriculture and Information, United Arab Emirates.

Williamson, G. and W.J.A. Payne, 1978. An Introduction to Animal Husbandry in the Tropics. 3rd Edn., Longman, London, UK., ISBN-13:9780582468139, pp: 484-498.

Wilson, R.T., 1989. Reproductive performance in the dromedary camel. Base empirique. Revue Elev Med Vet Pays Trop, 42: 117-125.

Zeidan, A.E.B., M.A. El-Harairy, Sh.A. Gabr, M.A. Tag El-Dien, S.A. Abd El-Rahman and A.M. Amer, 2011. *In vitro* maturation of camel oocytes as affected by different media duringbreeding and non-breeding seasons. J. Am. Sci., 7: 460-472.