

Normal values and seasonal differences in the serum concentration of vitamin A and beta-carotene in the Iranian camel (*Camelus dromedarius*)

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Abstract:

BACKGROUND: Vitamin A which is found in different tissues and organs plays a particular role in detecting clinical signs in various deficiency conditions. However, sometimes the marginal deficiency is present in a way that clinical signs are not visible but performance defects, such as infertility is seen. **OBJECTIVES:** In this study, the normal baseline levels of vitamin A and β -carotene in clinically healthy camels (*Camelus dromedarius*) in the Yazd province were investigated. **METHODS:** A total of 168 Iranian camels of both sexes were sampled from February 2009 to July 2010. Spectrophotometry was used for measuring the serum values. **RESULTS:** The mean \pm SE concentration of vitamin A and β -carotene were 63.9 ± 4.7 and 9 ± 1.1 $\mu\text{g/dL}$, respectively. Although, the β -carotene concentration was significantly higher in summer, vitamin A was not influenced by season. No significant difference in the serum levels of the measured parameters was observed in different ages and sexes. **CONCLUSIONS:** The results of this study, for the first time, indicate the concentration of vitamin A and β -carotene in the camels in Iran. This finding can be used as a reference guide for evaluation of the deficiency or excess of vitamin A and β -carotene in camels in Iran. Furthermore, due to the lower levels of vitamin A and β -carotene in Iranian dromedaries during winter, supplementary feeding of vitamin A is recommended during this season.

Introduction

Vitamin A ($\text{C}_{20}\text{H}_{30}\text{O}$) is an essential fat-soluble vitamin, important for a healthy life in both man and animals. Vitamin A has many physiological functions in vision (being critical for regeneration of the visual purple, necessary for dim-light vision), growth, cellular differentiation, morphogenesis, immune response, reproduction, transmembrane proton transfer and gap junction communication. Its role in pulmonary health, immune system, bone strength and skin has

been proved. The roles of retinoids in preventing different types of cancers have been indicated in the past decades. Green feed are the major source of carotenoids, including β -carotene, which are metabolized to vitamin A by epithelial cells of the small intestine and then stored mainly in the liver. The word retinol is commonly used by scientists when referring to vitamin A (Olson, 2001). Retinol is the predominant circulating form of vitamin A in blood, and is released from the liver in response to tissue demand in a 1:1 ratio with its carrier, retinol-binding protein. Serum retinol can be measured in either a

venous or free-flowing capillary blood sample. Beta-carotene, as the most common and effective pro-vitamin A, can serve as an antioxidant, and augments the immune system. It has been shown to enable immune cells to act more efficiently by increasing lymphocyte response to mitogens, and to assist helper T cells and natural killer cells. Resistance to some diseases has also been observed in animals with high circulating β -carotene levels (Kane, 2009).

Deficiency of vitamin A may be caused by an insufficient supply in the ration or its defective absorption from the alimentary tract. In young animals, the manifestations of the deficiency are mainly those of compromise of the brain and spinal cord. In adult animals, the syndrome is characterized by night blindness, corneal keratinization, pityriasis, defects in the hooves, loss of weight and infertility (Radostits et al., 2007). In animals the main recognized function of β -carotene is as a precursor for vitamin A. β -carotene was found to have a positive effect on fertility in cattle; its deficiency in cattle results in higher incidence of silent estrus, decreased conception rates, increased embryonic death and inferior composition of colostrum (Simpson and Chichester, 1981).

In a study undertaken by Agab and Abbas (1999) vitamin A deficiency was ranked the fifth important camel disease with 7.5% prevalence and the peak of occurrence during summer. The authors observed complete disappearance of the condition during autumn, owing to availability of green fodder as the source of β -carotene. There are a few reports of symptomatic vitamin A deficiency in camels including night blindness of camel herds in Sudan (Agab et al., 1993) and Eritrea (Gebrehiwet, 1999). There are findings indicating that the illness may affect serum carotenoid concentrations. However, in a study on the serum concentration of vitamins in pneumonic camels by Elnisar et al., (2011), β -carotene showed insignificant changes. A few scientists studied normal blood values of vitamin A and β -carotene in healthy dromedary camels, worldwide (Al-Senaïdy, 1998; Bogin, 2000; Mohamed, 2006).

Determination of vitamin A and β -carotene normal values in camels is essential for diagnosis of deficiency or excess in this animal. Yazd is a semi-arid region in the center of Iran, and camels are important for the people of this province because

camel meat is very popular and much consumed by them. Due to the lack of data about vitamin A and β -carotene in Iranian camels and also due to the importance of camels for meat production in the breeding areas, we studied the serum concentrations of vitamin A and β -carotene, and the effect of season on them.

Materials and Methods

A total of 168 camels (129 males and 39 females) were sampled in five different zones (i.e. Yazd, Mehriz, Tabas, Sadoogh and Meybod) in the Yazd province. The samples were obtained from the live and the slaughtered camels which appeared to be healthy. Venous blood samples were obtained in two seasons; during winter and summer of 2010 (87 in winter and 81 in summer). The age and sex of the camels was also recorded in sheets. Their ages were determined on the basis of their teeth eruption (Smallwood, 1991). The ages of camels varied from 1.5 years up to 20 years. Spectrophotometry (Biowave, UK) was used for determination of vitamin A and β -carotene levels according to Suzuki and Katoh (1990). One mL of obtained sera was mixed with one mL of ethanol. The mixture was extracted by 3 mL of hexane, then shaken vigorously for 30 minutes and centrifuged at 800g for 10 minutes. The absorbance of the upper hexane layer was measured at 325 nm for β -carotene and 453 nm for vitamin A against a hexane blank. The concentrations were calculated by the subtraction of measured values. For analyzing the effect of age on serum values of the measured factors, the camels were divided into three groups as $G1 < 5$ years (#50), $5 \text{ years} \leq G2 \leq 10$ years (#91), and $G3 > 10$ years (#27). The results were then statistically analyzed with multifunctional repeated measures (ANOVA), using the SPSS software. Any p Value < 0.05 was considered as significant.

Results

Values of mean \pm SE vitamin A and β -carotene serum concentrations were 63.9 ± 4.7 $\mu\text{g/dL}$ and 9 ± 1.1 $\mu\text{g/dL}$, respectively. The results of vitamin A and β -carotene serum concentrations versus seasons and ages are shown in Table 1. A significant ($p < 0.05$)

Table 1. Mean±SE concentration of vitamin A and β-carotene in normal camels.

	Season		G1 (n=50)	Age Group		Sex	
	Winter (n=87)	Summer (n=81)		G2 (n=91)	G3 (n=27)	Male (n=129)	Female (n=39)
Vitamin A (µg/dL)	42.7±6.8	86.6±5.6	61.8±9.7	63.5±6.2	96.2±1.2	63.6±5.8	64.9±6.9
β-carotene (µg/dL)	5.1±0.8	12.9±2.1	9.1±1.9	7.9±1	11.67±5.1	9.3±1.4	7.3±1.7

difference in β-carotene serum concentrations between the two seasons was evident (summer>winter); however, the concentrations of vitamin A did not differ significantly in the two studied seasons. No significant difference in the measured parameters was observed between males and females. Statistical analyses for the differences in mean serum values of vitamin A and β-carotene in the three age groups showed no significant difference either.

Discussion

In the present study, the mean serum value of vitamin A was 63.9±4.7 µg/dL, whereas that of β-carotene was 9±1.1 µg/dL. Seasonal variation of blood vitamin A has been stated in camels. Scientists have investigated vitamin A and β-carotene levels in camel-rearing parts of the world, and different values have been reported. Al-Senaïdy (1998) reported the mean concentration of retinol and β-carotene to be 173±5.1 µg/dL and 21.5±1.4 µg/dL, respectively; as studied on 14 Saudi Arabian camels. Bogin (2000) indicated a range of 30-40 µg/dL for vitamin A in the serum of dromedary camels. In their study in UAE, Abbas and Ali (2001) reported a mean serum concentration of 46.01±4.93 µg/dL for retinol. Mohamed (2006) reported serum retinol concentration of 47.95±6.9 µg/dL in Sudanese camels under grazing conditions. The difference in reports may be due to different conditions of ration, management, grazing or some unknown factors.

According to the statistical analysis in the current study, seasons had a significant effect on β-carotene (summer>winter), while vitamin A values were not influenced by seasons. In a study undertaken by Mohamed (2006) on camels under grazing conditions, the highest plasma retinol content was observed during July to October. This is due to the fact that this period is the only time in the year when camels can consume feed containing high levels of naturally-occurring vitamins. Ghadrdan et al., (2003a, b), and also Afshari et al., (2008) studied the effect of season

on blood vitamin A and β-carotene in Holstein cows, water buffaloes and sheep in different parts of Iran. Different results obtained by their researches may be due to the type of husbandry systems including diet, and climatic conditions in the study areas.

Concentration of the measured parameters indicated an increase in parallel with age, although this increment was not significant. Mohamed (2006) showed that the age directly influenced retinol plasma levels.

As a result, due to lower levels of vitamin A and β-carotene in Iranian dromedaries during winter, supplementary feeding of vitamin A is recommended during this season.

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مقادیر طبیعی و تغییرات فصلی ویتامین A و بتا کاروتن سرم شتر ایرانی (*Camelus dromedarius*)

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چکیده

زمینه مطالعه: به دلیل نقش ویژه ویتامین A در بافت ها و اعضا مختلف، در شرایط کمبود آن نشانه های بالینی متنوعی مشاهده می گردد. به علاوه در مواردی که کمبود مرزی این ویتامین بدون حضور نشانه های بالینی مشهود مطرح است، کاهش بهروری همچون ناباروری پدید می آید. **هدف:** در این مطالعه مقادیر طبیعی ویتامین A و بتا کاروتن شترهای به ظاهر سالم در استان یزد مورد بررسی قرار گرفته است. **روش کار:** در فاصله بهمن ماه سال ۱۳۸۷ لغایت مرداد سال ۱۳۸۸ مجموعاً ۱۶۸ نفر شتر ایرانی (از هر دو جنس) مورد نمونه گیری قرار گرفتند. برای اندازه گیری موارد فوق از روش اسپکتروفتومتری استفاده شد. **نتایج:** میانگین و اشتباه استاندارد غلظت ویتامین A و بتا کاروتن به ترتیب $63/9 \pm 4/7 \mu\text{g/dL}$ و $9 \pm 1/1$ تعیین گردید. اگرچه غلظت بتا کاروتن در تابستان به طرز معنی داری بیشتر بود، اما فصل تأثیری بر میزان ویتامین A نداشت. هیچ تفاوت آماری معنی داری در مقادیر پارامترهای اندازه گیری شده در گروه های سنی مختلف و دو جنس مشاهده نگردید. **نتیجه گیری نهایی:** نتایج این مطالعه به عنوان اولین گزارش از تعیین غلظت ویتامین A و بتا کاروتن در شترهای ایرانی می تواند یک راهنمای مرجع برای ارزیابی موارد کمبود یا افزایش مقادیر این موارد در این دام باشد، به علاوه به واسطه آنکه مقادیر ویتامین A و بتا کاروتن در شترهای مورد مطالعه در فصل زمستان کمتر بوده است، خوراندن مکمل های واجد ویتامین A در این فصل توصیه می گردد.

واژه های کلیدی: ویتامین A، بتا کاروتن، شتر، فصل

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