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HORMONAL AND METABOLIC ATTRIBUTES OF FEMALE CAMELS (*CAMELUS DROMEDARIUS*) RAISED IN DESERT

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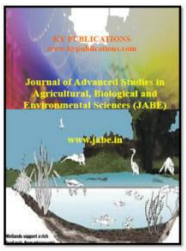

ABSTRACT

Forty female Camels living in the Arabian Gulf area were selected for blood sampling. These Camels were raised in a conventional manner and were mostly fed fresh lucerne and barley grain. Blood samples were collected via jugular venipuncture and placed into serum vaccutainers. Analysis of serum samples was conducted to determine biochemistry and hormone levels. Calculations of means, standard deviations, and minimum and maximum values were performed using the SPSS software to generate the coefficient of determination (R2) between biochemistry and hormone characteristics. The calculated mean values, along with their corresponding standard deviations, were recorded. Glucose: 158.78±56.42 mg/dL; total protein (TP): 9.78±5.50 g/dL; aspartate aminotransferase (AST):64.03±32.80 (IU/L); alanine aminotransferase (ALT): 11.66±4.96 (IU/L); low-density lipoprotein (LDL): 30.19±24.52 mg/dl; high-density lipoprotein (HDL): 24.37±14.40 mg/dl; insulin: 17.35±8.69 µIU/mL; and insulin-like growth hormone (IGF1) 110.76±50.02 ng/ml. The results of the present research provide definitive figures that doctors in Saudi Arabia may utilise as references for camels. A statistically substantial association was observed between ALT and AST, which may be used to estimate their respective levels.

Keyword: Hormonal Attributes, enzymes, lipoprotein, camel.

INTRODUCTION

The Arabian Peninsula is most likely one of the main areas where the dromedary camel was domesticated between 5000 and 6000 years ago (Abdallah and Faye, 2012). It is also the location where the diversification of camels is among the most significant globally. Previously, some twelve "breeds" were identified (Faye et al., 2011) according to their coat hue. It supplies superior animal protein in the form of milk and meat, as well as serving as a mode of transportation and production. In addition, the camel has become more popular and significant as a racing animal in the Arabian Gulf area throughout the recent decades. The camel is well adapted to challenging environmental conditions marked by little

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water and vegetation, along with elevated ambient temperatures and uneven terrain. This may be attributed to its unique anatomical and physiological adaptations to such climates.

According to FAOSTAT (2024), the population of camels in Saudi Arabia is around two million. The Coastal and Tihami camels, found in the southern and western regions of Saudi Arabia, are renowned for their copious maternal milk production. Zamal camels are renowned for their superior physical power. The majority of Arabian camels are categorized based on their coloration, and the most exceptional ones are evaluated in beauty competitions. The hues shown include Al-Majahim (black), Al-Wadh (white), Al-Sha'al, and Al-Safar, all of which vary from light to dark brown. Among these, Al-Sha'al stands out as sandy and red. Originally indigenous to the peninsula, camels that are sent to other nations are subjected to genetic mutations that impact their genetic makeup and result in alterations in their physical characteristics. Beautiful and racing camels in the Arabian Gulf camel markets may have a value of hundreds of thousands of dollars. These camels are raised and trained with meticulous attention to detail following traditional methods. This entails a diet consisting of green lucerne, barley grain, and sometimes honey, ghee, milk, and eggs.

The primary factor contributing to the rise in milk and meat production in camels was demographic expansion. Concerning the greater expansion in meat output, it may be attributed more to the rise in the rate of slaughter rather than the improvement in meat productivity. From 1961 to 2009, the average carcass weight remained constant at 224 kg, but the slaughtering rate rose by 6.62% every year. Dairy productivity remained constant throughout the last 48 years because the rise in dairy output was directly correlated with the increase in the percentage of dairy animals from 62% to 69%. This translates to an annual growth rate of 5.53% (Faye and Bonnet, 2012). Hence, the rise in producible output was mostly driven by mechanical factors and the expansion of the population .

Biochemical analysis of serum components may provide very useful data on the nutritional intake, sex, age, and physiological condition of the animal. Age and lactation have been investigated about some biochemical components of Saudi Arabian camels (Osman and Al-Busadah, 2003). Numerous studies have been conducted. Nevertheless, it is well recognized that there are differences in biochemical components related to the sampling process, analytical methods, physical characteristics, ambient circumstances, or changes in the breed (Beaunoyer, 1992). The objective of this work was to quantify the levels of certain hormones and biochemical components.

MATERIALS AND METHODS

Animals

A sample of forty mature female dromedaries, aged between 6 and 18 years old with a median age of 8 years, was selected for this research. All animals in the Hail area in the northwestern section of the Kingdom of Saudi Arabia were privately owned by farmers. Under restricted conditions, camels were mostly given alfalfa hay, berseem, and either barely grains or pelleted ration containing 18% crude protein. Clean water was consistently provided to animals.

Blood sampling and plasma harvesting

Whole blood samples were collected via jugular venipuncture. Samples were collected in EDTA tubes, spined out at 3000 rpm for 3 minutes in cold (5˚C) centrifuge. Plasma samples were harvested and stored deep frozen (- 80˚C) until assayed.

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Hormonal Determinations

Insulin: Insulin was determined by a commercial sandwich ELISA kit (MyBioSource, Cat. No. MBS060615, California, USA). The range of standard curve is 3.12-100 mIU/mL, sensitivity is 1 mIU/mL, and intra- and inter-assay CVs are <10 and <15%, respectively.

IGF-I: Camel IGF-I was determined by a commercial sandwich ELISA kit (MyBioSource, Cat. No. MBS077229, California, USA). The range of standard curve is 15.6-400 ng/mL, sensitivity is 2 ng/mL, and intra- and inter-assay CVs are <15 and <15%, respectively.

Enzymes and lipoprotein: The enzymes and lipoprotein were assessed using Humalyzer 3,000, and liquid reagents from Tufnell Drive, Kamwokya, Kampala and Uganda were used for each enzyme. All steps were done following the manufacturer instructions. The standard sample was distilled water, which was analysed in the Humalyzer system before introducing the samples. The liquid reagents were prepared following the kit instructions and mixed with serum. The enzymes were measured in IU/L. the lipoprotein were measured in mg/ml.

Statistical Analysis

Descriptive analyses were performed to evaluate variables: AST, ALT, glucose, total protein, LDL, HDL insulin hormone and IGF-1 hormone. One-way analysis of variance (ANOVA) was performed for statistical comparisons among groups. Analysis of the normal distribution of data was examined with the Kolmogorov–Smirnov test; if the data were not normally distributed, then a Kruskal-Wallis one-way ANOVA (non-parametric statistical test) was used to test for the presence of significant differences among all groups (SPSS, version 22). The data were considered statistically different if $p < 0.05$. Data were expressed as the means ± SEM. Pearson correlation method is used to evaluate the association between two variables. If the p-value is < 5%, then the correlation between two variables is significant.

RESULT AND DISCUSSION

Liver enzyme values indicate the integrity of the hepatocyte membrane, necrosis of hepatocytes or biliary epithelial cells, cholestasis, or induction phenomena, rather than the liver function tests. The sequential measurement of transaminase activity duration and magnitude may be used to forecast disease activity and severity, as well as provide an approximate estimate of the number of affected cells. The aminotransferases AST and ALT are abundantly found in the liver and several other tissues. Renal, cardiac, and skeletal muscles have greater AST activity compared to the liver. The average AST value in our research was 64.03±32.80 IU/l, with a range of 17.9-154 IU/l as shown in Table 1. In Omani racing camels, the recorded value was 88.8±70.03 IU/l, with a range of 57-374 IU/l (Elhag Eltahir et al., 2016). In Saudi camels, the obtained values ranged from 24.1-35.1 IU/l (Al-Busadah, 2007), while in Egyptian camels, the recorded value was 31.4 IU/l (Seleim et al., 2003). Osman and Al-Busadah (2003) documented an average AST value of 164.6 U/l in Saudi camels, which was similar to that of sheep (141.6 U/l) but much more than that of cattle (72.4 U/l). Additional research is required to ascertain if the variations in AST (Alcohol Specific Tomography) between Saudi camels and camels from other regions of the globe are influenced by genetic factors or clinical manifestations.

The activity of ALT is greatest in the liver and is about 10,000 times higher than the enzyme activity in the plasma of healthy animals. It has significant diagnostic value in identifying liver

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abnormalities. Our investigation found that the average ALT value in Saudi camels was 11.66±4.96 IU/l, with a range of 5-27.7 (Table 1). Comparable to the range of ALT levels in the blood of Saudi camels, which varied from 8.0 to 14.5 IU/l (Al-Busadah, 2007). In their 2003 study, Seleim et al. documented a measurement of 19.9 IU/l in Egyptian camels. The mean blood glucose level in Omani racing camels was 13.3±5.97 IU/l, with a range of 9-37 (Elhag Eltahir et al., 2016). A study conducted by Osman and Al-Busadah (2003) revealed that the average ALT level in Saudi camels was 17.2 U/l, which was similar to the figure in sheep (21.0 U/l) but lower than that in cattle (34.0 U/l). Such findings suggest that Saudi camels have normal and healthy liver functioning. Significant correlations were shown only between the serum ALT and AST in this investigation (Table 2). Nevertheless, more investigation on a larger sample size of animals is necessary in order to evaluate the significance of these associations.

Table 1: Means, standard deviations, maximum and minimum values of serum biochemistry parameters in female camels

Items	Mean	Std. Deviation	Minimum	Maximum
Insulin (µIU/mL)	17.3585	8.69866	8.14	47.16
IGF1 (ng/mL)	110.7652	50.02935	31.63	302.35
Glucose (mg/dL)	158.78	56.42499	42.80	277.10
Total protein (g/dL)	9.78	5.50	4.42	37.86
LDL (mg/dL)	30.193	24.52777	1.3	107
HDL (mg/dL)	24.3743	14.4015	1.7	69.2
ALT (IU/L)	11.6694	4.96058	5	27.7
AST (IU/L)	64.0351	32.80366	17.9	154

Table 2: Coefficients of determination (R2) and their significance between some serum biochemistry and hormone parameters in camels.

	insulin	IGF1	glucose	TP	LDL	HDL	ALAT	ASAT
insulin	1	0.166	-0.094	0.077	-0.148	0.087	0.14	-0.015
IGF1	0.166	1	-0.004	-0.147	-0.013	0.179	-0.148	-0.082
glucose	-0.094	-0.004	1	-0.043	0.085	0.02	0.218	-0.208
TP	0.077	-0.147	-0.043	1	0.087	-0.07	-0.013	0.067
LDL	-0.148	-0.013	0.085	0.087	1	-0.114	-0.154	-0.241
HDL	0.087	0.179	0.02	-0.07	-0.114	1	0.005	-0.055
ALAT	0.14	-0.148	0.218	-0.013	-0.154	0.005	1	.414*
ASAT	-0.015	-0.082	-0.208	0.067	-0.241	-0.055	.414*	1

*: $p<0.05$; **: $p<0.01$.

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Blood glucose level or concentration refers to the measurement of glucose content in an animal's blood, which serves as the main energy source for the body's cells, apart from blood lipids. An animal's body inherently maintains precise control over blood glucose levels as a component of metabolic balance. The transportation of glucose from the intestines or liver to body cells occurs via circulation, and it is then facilitated for cellular uptake by the hormone insulin. Monitoring blood glucose levels is crucial for assessing animal health, especially in camels that are lactating and well-adapted to arid environments. The research documented glucose levels in Saudi camels ranging from 42.80 to 277.10, with an average of 158.78±56.42 mg/dL (Table 1). The present finding is seen to surpass the findings of other investigations. The blood samples from Omani camels varied in concentration from 56 to 158 mg/dL, with an average of 92.8±19.23 mg/dL (Elhag Eltahir et al., 2016). The observed levels fall within the range of normal values defined by Wernery et al. (1999) for 2-12-year-old Arabian camels (76-129 mg/dL), as well as for indoor (130.2 mg/dL) and free grazing (105 mg/dL) Saudi camels (Al-Shami, 2009). Indeed, it was well within the range documented for camels of different ages and breeds (Yadav and Bissa, 1998). The authors of the latter study noted significant variation in blood glucose levels ranging from 27.6 to 214.4 mg/dL. The blood glucose levels in camels are often believed to be greater than those in ruminants (Bhatia, 1986). Various variables influence the blood glucose levels in camels. Cadel glucose levels are significantly influenced by age, declining with older age (Roussel et al., 1982; Elias and Yagil, 1984), and by season (Mehrotra and Gupta, 1989), with greater glucose levels seen in rainy season samples compared to dry season samples (Mohammed et al., 2007). According to Al-Shami (2009), indoor-reared camels exhibited elevated blood glucose levels compared to wild-grazing camels. Primarily, this may be ascribed to the superior nutritional status of the previous group, which was provided with a concentrated diet supplemented with hay. The glucose levels in Saudi camels were significantly greater (134.4 mg/dL) compared to cattle (49.0 mg/dL) or sheep (65.0 mg/dL) subjected to comparable settings (Osman and Al-Busadah, 2003). The glucose levels in the Saudi camels included in our research were within the usual range, suggesting that they were in good health and unaffected by the specific diet or husbandry style.

Albumin and globulin are the major constituents of serum total protein. The total protein test is an expedicious and cost-effective biochemical assay used to quantify the overall protein content in serum. Decreased levels below the established reference range often indicate low albumin concentration, as seen in instances of liver illness or acute infection. Conversely, elevated levels are seen in situations that lead to an elevation in immunoglobulins or during dehydration. The average total protein (TP) in Saudi camels was 9.78±5.50, reaching a range of 4.42-37.86 g/dL (Table 1). In addition, the results are similar to those of Saudi camels (ranging from 4.9 to 10.2 g/dL) as reported by Al-Busadah (2007) and Sudanese camels (7.0 g/dL) as reported by Omer et al. (2008). The average total protein (TP) level in Omani camels was 6.17 g/dL, with a range of 5.5-6.8. The measured sodium level of 0.34 g/dL is within the usual range of 6.0-7.8 g/dL reported by Wernery et al. (1999) and Yadav and Bissa (1998) for Arabian camels aged 2-12 years. For female camels bred in France, Faye et al. (1995) documented a range equivalent to 5.13- 8.66 g/dL. The average total protein (TP) level in Egyptian camels was 7.60±0.25 g/dL according to Seleim et al. (2003), but in Nigerian camels it ranged from 5.3 to 7.5 g/dL according to Mohammed et al. (2007). Nevertheless, the value obtained in the present investigation exceeded the level reported for Indian camels of the same age as documented by Yadav and Bissa in 1998. A study by Yadav and Bissa (1998) found that age, sex, pregnancy, rut, or illness may affect the total serum protein level. The concentration of TP in the serum of male camels was greater

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during the rutting season compared to the non-breeding season, as shown by Koudier et al. (1988). Additionally, Mohammed et al. (2007) stated that female camels exhibited higher amounts of TP than males. Comparable levels were reported by Osman and Al-Busadah (2003) in Saudi camels (7.1 g/dL), which were lower than in cattle (8.2 g/dL) but similar to sheep (6.9 g/dL). The current investigation observed total protein levels that are within the usual range for healthy and physiologically hydrated animals.

An overview of the serum lipoproteins in camels. The blood concentrations of lipoprotein HDL and LDL in Saudi camels were quantified as 24.37±14.40 and 30.19±24.52 mg/dl, respectively. For HDL and LDL, this corresponds to values of 1.35±0.77 and 1.67±1.35 mmol/L, respectively. The obtained result exceeded the published values of 0.81+0.34 and 0.26+0.17 mmol/L for HD: and LDL as reported by Nazifi et al., (2000). The blood concentration of cholesterol, triglyceride, HDL-cholesterol, and VLDL-cholesterol in Iranian camels was shown to be significantly modified by age, with greater levels seen in older animals (Nazifi et al., 2000). Load cholesterol levels rose but high-density lipoprotein levels declined in humans (Noguchi, 1993), calves (Hugi and Blum, 1997), and camels (Nazifi et al., 2000). This research found no statistically significant relationships between HDL and LDL. Nevertheless, more investigation on a larger sample size of animals is necessary in order to evaluate the significance of these associations.

Insulin-like growth factor-1 is primarily produced and released by the liver into the bloodstream. It binds to IGFBP-3 to facilitate the growth hormone responses in tissues and stimulate cell proliferation and specialization (LeRoith et al., 2021, Bailes and Soloviev, 2021). Inhibition of insulin secretion, binding to insulin receptors, reduction of hepatic glucose production, and enhancement of skeletal muscle protein synthesis are all effects of IGF-I (Bailes and Soloviev, 2021). The average concentration of IGF1 was 110.76±50.02 (with a standard deviation of 31.63-302.35 ng/ml). The obtained result was below the published value of 385.13 ± 20 ng/ml by Ali et al. (2023). The substantial disparity in results is likely attributable to factors such as age, anorexia, inadequate nutrition, the animal's health status, or excessive physical activity.

The levels of insulin and insulin-like growth factor-1 showed a similar pattern as the number of females given concentrate increased, indicating a higher calorie intake compared to those fed on pasture and supplemented with a little portion of barley. The present results are consistent with the findings of Karlsson et al. (2020), who observed higher levels of insulin and IGF1 in nursing Holstein and Swedish red dairy cows when provided with additional concentrate, in comparison to animals fed with grass-clover silage. Furthermore, while Charolais steers were still young (around 1 year old), adding maize grains to their diets significantly raised blood insulin levels compared to bulls fed with cassava (Srakaew et al., 2021). In the present investigation, the trend of insulin indicated a similar relationship with blood glucose. The primary constraint on animal production in the camel diet is not just the energy source and amount, but rather the protein/energy ratio, which is the most informative measure for assessing animal health and well-being (Laameche et al., 2021). Optimal metabolic health of farm animals necessitates the inclusion of a certain proportion of concentrates in roughages (Østergaard and Gröhn 2000).

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CONCLUSION

Findings of the current study provide baseline values that may be used by clinicians for Saudi camels in Saudi Arabia and camels raised under similar conditions. Values recorded for all serum metabolic profiles, enzymes and hormones were within the ranges reported for female camels in the Gulf region and indicated normal health of these animals.

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