Selenium and iodine status of two camel breeds (Camelus dromedaries) raised under semi intensive system in Saudi Arabia

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Abstract

Selenium (Se) and iodine (I) are very important trace minerals for animals and human health. Selenium is an essential constituent of the antioxidant enzyme GSH-Px, while I as a thyroid hormone play a crucial role in regulating body metabolism. The aim of this study was to provide preliminary data on the Se and I status of two camel breeds (Majaheem and Maghateer: Camelus dromedaries) raised under the semi intensive system in Saudi Arabia (SA). Ten Majaheem male camels and ten maghateer, age 1.5±0.5 yrs old, were slaughtered and blood and tissues (liver, kidney and meat) were collected. Blood serum samples were analyzed for Se, thyroxine (T4), triiodothyronine (T3), glucose, cholesterol, true protein and albumin. Tissues samples were wet digested and analyzed for Se level using Atomic Absorption Spectrophotometer. Results showed a significant breed effect on serum and tissues Se with higher concentration of Majaheem compared with Maghateer breed. The same trend was found for glucose and total protein. Furthermore, serum Se was significantly correlated with liver Se (r²=0.698; P<0.01), meat Se (r²=0.453; P<0.05), T3 (r²=0.527; P<0.05) and T4 (r²=0.476; P<0.05). Thyroxine was significantly correlated to T3 (r²=0.693; P<0.01).

In conclusion, a highly significant breed effect was reported for Se metabolism. The highest Se concentration occurs in kidney followed by liver and meat.

Introduction

With an increase of camels’ meat consumption in Saudi Arabia (SA) and other countries, meat quality become an important issue by human as a healthy and highly nutritional meat compared with other farm animals. Both camel breed and feeding management system play an important role in improving meat quality and quantity (Basmail et al., 2012). The total number of camels in Saudi Arabia was recently estimated to be 241,895 head (not including camels outside holdings or in the desert area), with more than 46% of these in Al-Riyadh region (MEP, 2010). Camel production systems are now starting to shift toward the semi-intensive approach, due to the effects of lower rain fall and drought on crop and pasture plants, which depend mainly on feed supplements as a means of meeting nutrient requirements (Gaili et al., 2000). However, improved understanding of existing new semi-intensive production system as a prerequisite for developing a package of innovations to be introduced for enhancing camel productivity. On the other hand, Wiener (1979) reviewed the genetic variation in the incidences of many minerals metabolic disorders regarding the deficiencies and imbalances. He concluded that animal breeds and strains differ in their mineral requirements with various concentrations in blood and tissues.

Majaheem and Maghateer breed are reported to be the most numerous and widely distributed in Al-Riyadh region, Saudi Arabia (MEP, 2010). Trace minerals are essential for the growth, productivity, reproduction efficiency and health of farm animals (Underwood and Suttle, 1999). Selenium and Iodine are well known to be very crucial for animal metabolism through their involvement in enzymes and hormones structure and functions (Zia-ur-Rahman et al., 2007). Selenium deficiency results in many metabolic disorders because of its functional redox components of many enzymes such as glutathione peroxidase (Miyamoto et al., 2003) and thioredoxin reductase (Arner and Holmgren, 2000). These enzymes are required for the immune system and anticarcinogenic function (Navarro and Lopez, 2000; El-Bayoumy, 2001). Iodine (I) is essential for thyroid hormone synthesis as a structural components. Thyroid hormones [thyroxine (T4) and triiodothyronine (T3)] play a significant role in animal body metabolism (Cassar-Malek et al., 2007; Kale et al., 2007; Todini, 2007). They stimulate protein synthesis, increase adipose tissues lipolysis and blood glucose (Chatterjea and Shinde, 2005; Todini, 2007). Selenium is well known to affect thyroid hormones functions as a main component of type 1 deiodinase, which is needed to convert thyroxine (T4) into the more active triiodothyronine (T3) hormone (Beckett et al., 1987). Both selenium and iodine deficiencies are recognized as global problem which affect animal and human health. Moreover, those animals that produce human food such as meat, milk and eggs are considered to be an important source of these minerals to avoid human health problems. So, it is very crucial to evaluate their Se and iodine status as an important piece of information. Unfortunately, only few studies conducted to evaluate the selenium and iodine status and metabolism of different camel breeds and other farm animals, with no studies reported in Saudi Arabia. Therefore, the purpose of this study was to investigate the selenium and iodine status and metabolic trend of two meat camel breeds (Majaheem and Maghateer) raised under traditional semi intensive system in Saudi Arabia.

Materials and methods

Sample collection and preparation

Majaheem and Maghateer are reported to be the most dominates breeds in Saudi Arabia (MEP, 2010). Groups of Majaheem and Maghateer camels were maintained in stalls,
under good healthy and nutritional conditions, started using camels aged from 6.0±1.0 month old up to approximately 18.0±3.0 month old following the traditional semi intensive production system in which they fed barley and alfalfa hay with very limited grazing and without any mineral supplements. The mean value of Se (mean±SD) in the diet of the two camel breeds on dry matter basis was 0.49±0.15 mg/kg. Ten healthy male camels (Camels dromedaries) from each breed, Majaheem and Maghateer, with average body weight of 348.0±12 kg, were randomly selected for this study. Before slaughtering, blood samples were collected from the jugular vein using vacutainer tubes without heparin. Serum collected by centrifugation for 3000 rpm/15 minutes and prepared according to AOAC (2005) for Se, T3 and T4 levels. The levels of serum T3 and T4 were measured by Human ELISA test kits (Gesellschaft fur Biochemica und Diagnostica, 65205 Wiesbaden, Germany). Validation of these hormones assays assessed the detection limit, standard curve and coefficient of variations of the results. Additionally, the levels of serum glucose, total protein, cholesterol and albumin were determined by spectrophotometry using commercial reagent kits (United Diagnostic Industry, Dammam, Kingdom of Saudi Arabia). For accuracy and precision check, normal and abnormal controls, provided by the company, were used. After slaughtering at Al-Riyadh abattoir, liver, kidney and meat samples were collected using stainless steel surgical blades and prepared by wet digestion using sulphuric acid, nitric acid and hydrogen peroxide and diluted with 0.1 M HCl in 25 mL volumetric flask. All prepared samples were analyzed for selenium by Inspection Diagnostic Analysis Consultant Laboratories (IDAC) at Riyadh, SA, by Atomic Absorption Spectrophotometer.

Statistical analysis

Data were analyzed using SAS (2001) program and by one way analysis of variance tests to compare the means of mineral concentrations in blood serum and tissues between the two different camel breeds. A Pearson correlation analysis was conducted for the serum Se, T3, T4 and tissues Se concentration. The significant levels were declared at P<0.05.

Results and discussion

Selenium concentration in blood serum and tissues

According to previous studies, 100 ng/mL Se concentrations in blood serum of camels consider being within the normal level for proper metabolic functions as reported for other ruminant animals (Maas et al., 1990; Hamliri et al., 1990; Barri and Sultan, 2007; Shen and Lia, 2010). Researchers from different countries reported lower or higher Se levels, range between 12 to 200 ng/mL, which can be resulted from the different dietary Se intake, sex, age, breed, physiological status and many other factors that not well documented. Results from this study, showed a higher level of Se for the Majaheem breed (147.1 ng/mL) and lower for the Maghateer breed (73.32 ng/mL) that raised under the semi intensive production system. Therefore, Se concentration in blood serum of the Majaheem was significantly higher (P<0.0001) by more than two folds compared with Maghateer breed as shown in Table 1. This finding is disagreed with the results reported by Faye et al., (2009) with higher values range from 196 to 209 ng/mL for the same breeds, but raised in the Northern part of Saudi Arabia. Furthermore, the same breed effect trend was detected for Se concentrations in liver, kidney and meat samples. Figure 1. Selenium concentration in liver, kidney and meat tissues of Majaheem (A) and Maghateer (B) breeds for a comparison purpose within each breed.
Thyroid hormones levels in blood serum

According to our knowledge, there is no many previous studies reported the Se, T3 and T4 status of different dromedary camels breeds especially in Saudi Arabia (SA). The levels of T3 and T4 in blood serum of the two camel breeds were presented in Table 2. There were no significant differences between the two breeds in term of levels of T3 and T4 in blood serum, eventhough the levels for Majaheem were numerically higher compared with the Maghateer breed. A wide variation of T3 and T4 in camels and other ruminant were found and reported by many researchers because of many undefined factors. Levels of T3 and T4 for both breeds were similar to the levels reported by Nazifi et al. (2009) (166.24±7.12 ng/dL and 12.30±0.412 µg/dL, respectively) for Iranian camels, but higher than cows at different physiological status (Mohebbi-Fani et al., 2009), T4 from 4.23 to 7.03 µg/dL and T3 from 69.21 to 106.08 ng/dL; ewes (Colodel et al., 2010) T4 2.64 to 4.91 µg/dL and T3 from 137 to 196 ng/dL; and water buffalo (Tajik et al., 2010), T4 0.489±0.01 µg/dL and T3 157.50±7.12 ng/dL.

Significantly high positive correlations were detected between T3 and T4, T3 and blood serum Se and T4 and blood serum Se as shown in Table 3. It is well documented in the literature the correlation between Se and thyroid hormones since Se is required for conversion of thyroxine (T4) to active triiodothyronine (T3) as a main component of type I deiodinase (Beckett et al., 1987; Awadeh et al., 1998).

Blood serum metabolites

Blood serum is an important index for many metabolic functions and metabolites disorder in farm animals. The blood serum glucose and total protein were significantly higher (P<0.05) for Majaheem breed when compared with Maghateer, but no differences in term of blood serum albumin and cholesterol (Table 4). Blood glucose levels for both breeds were fallen within the normal rang according to Mehrotra and Gupta (1989) and Mohamed and

| Table 1. Blood serum selenium concentration, triiodothyronine and thyroxine levels in Majaheem and Maghateer camel breeds raised under the semi intensive system in Saudia Arabia. |
| --- |
| Majaheem | Maghateer | SEM | P value |
| Serum selenium, ng/mL | 147.1 | 73.32 | 10.10 | 0.0001 |
| T3, ng/dL | 215.7 | 175.0 | 18.4 | 0.280 |
| T4, µg/dL | 15.72 | 12.51 | 1.044 | 0.128 |

| Table 2. Selenium concentration in liver, kidney and meat (ppb wet weight) of the Majaheem and Maghateer camel breeds raised under the semi intensive system in Saudia Arabia. |
| --- |
| Majaheem | Maghateer | SEM | P value |
| Selenium, ppb wet weight | Liver | 200.43 | 128.12 | 9.69 | 0.0001 |
| Kidney | 1460.20 | 1139.20 | 109.63 | 0.048 |
| Meat | 114.12 | 81.84 | 6.41 | 0.008 |

| Table 3. Correlation coefficient between selenium in serum and tissues and thyroid hormones of the Majaheem and Maghateer breeds raised under the semi intensive system in Saudia Arabia. |
| --- |
| Se L | Se K | Se M | Se S | T3 | T4 |
| Se L | - | 0.231 | 0.453* | 0.698** | 0.304 | 0.527* |
| Se K | 0.231 | - | 0.407 | 0.252 | 0.492* | - |
| Se M | 0.453* | 0.407 | - | 0.527* | - | - |
| Se S | 0.698** | 0.252 | 0.492* | - | 0.476* | 0.693** |
| T3 | 0.026 | -0.037 | 0.304 | 0.527* | - | - |
| T4 | 0.237 | -0.073 | 0.167 | 0.476* | 0.693** | - |

Se: selenium; L: liver; K: kidney; M: meat; T3: triiodothyronine; T4: thyroxine. *P>0.05; **P>0.01.

| Table 4. Blood serum metabolites in the Majaheem and Maghateer camel breeds raised under the semi intensive system in Saudia Arabia. |
| --- |
| Majaheem | Maghateer | SEM | P value |
| Glucose, mg/dL | 202.60 | 151.70 | 12.1 | 0.032 |
| Total protein, g/dL | 5.35 | 4.87 | 0.131 | 0.049 |
| Albumin, g/dL | 3.39 | 3.29 | 0.15 | 0.731 |
| Cholesterol, mg/dL | 78.88 | 81.55 | 3.61 | 0.722 |
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Conclusions

A genetic variation in selenium metabolism of camels (Camelus dromedaries) is demonstrated from this study. Kidney play an important role in Se metabolism since contain the highest concentration of Se followed by liver and meat which differ from other ruminants. Moreover, a highly significant correlation between Se concentration in blood serum and thyroid hormones (T3 and T4) is well documented. A genetic selection may be a promising route to modify Se metabolism in dromedary camels.
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