IJCRR
Vol 06 issue 05
Section: Healthcare
Category: Research
Received on: 20/11/13
Revised on: 19/12/13
Accepted on: 25/01/14

MACRO MINERALS PROFILES IN CAMEL'S MEAT

Omer H. Arabi[1], Selma Fadl Elmawlla[2], Elsir Abdelhai[2], Abdel Moneim E. Sulieman[3]

[1]Faculty of Animal Production, University of Gezira, Elmanagil, Sudan
[2]Faculty of Veterinary Medicine University of Butana, Ruffaa, Sudan
[3] Faculty of Science, University of Hail, Hail, Kingdom of Saudi Arabia

E-mail of Corresponding Author: arabi@uofg.edu.sd

ABSTRACT

The macro minerals presented in this study have an essential role in the physiological activities in camels. The aim of this study was to determine the macro minerals profiles in camel's meat in different seasons and ages.

Methodology: the study focused on the determination of macro minerals profiles in camel's meat. Meat 180 samples were taken monthly in summer, winter and autumn, from three groups of ages; 1-3, 4-6 and 7-9 years, Ash samples were analyzed for macro minerals (Ca, Mg, P, Na and K,). These minerals were determined according to the AOCS method.

Results: It was found that the macro minerals (Ca, P, Mg, Na and K) profile in camel's meat showed a significant difference ($p>0.05$) in different season. The concentration of Ca and Mg was higher in summer in young age animals (1-3 years) and lower in old age animals (7-9 years). While the concentration of K was higher in winter in old age animals (7-9 years) and lower in young age animals (1-3 years). There was no significant difference in concentration of P after three months of preservation ($p<0.05$). Also, there was no significant difference in concentration of Mg after one month of preservation ($p<0.05$).

Conclusion: the concentration of Ca, Mg and K was affected by season and age, whereas the Na and P concentration was not. Further studies on micro minerals (Fe, Cu and Zn) profile in camel meat are recommended.

Keywords: Camel meat , Camelus dromedaries, Macro Minerals

INTRODUCTION

Camels are one of the most important source of the national economy and food security for many countries in the world. They occupy a very useful role in human food, especially meat. Meat is an essential food for human growth and development, as it provides protein, energy, vitamins and some minerals and these contribute to health (Sarmad *et al*., 2011). Camels are an excellent source of high quality animal protein, especially in areas where the climate adversely affects the performance of other meat animals. This is because of their unique physiological characteristics, including a great tolerance to high temperatures, solar radiation, water scarcity, rough topography and poor vegetation (Kadim *et al*., 2007).

The amounts of mineral elements in ash and protein contents in camel's meat are reported to be similar to beef (Kadim *et al*., 2006). Except for Na, camels have a similar elemental composition (Zn, Ca, K, Mg, Cu and Mn) to beef (Fennema, 1996). The quality of meat from young camels of three years old or less is comparable to beef (Elgasim and Elhag, 1982 and Kadim *et al*., 2007). Kadim and Mahgoub (2009) reported that minerals

content of muscles generally tend to increase with age of the camel.

The proposed study area (*Tambul*, *Albutana* area, Central Sudan) is famous of its high population of camels. No analytical work has so far been undertaken on macro minerals content in meat of camel in *Tambool* area. In this study, data are presented for Ca, K, Mg, Na and P in camel's in this area, because no mineral supplementation for camels is used. The hypothesis assumes that the level of macro elements is influenced by seasons age of animal and preservation period. The objective of this study is to determine the macro minerals profiles in camel's meat in different seasons and ages.

MATERIALS AND METHODS

Samples

The meat samples were collected from 180 mature camels, varying age (1-9 years old) in *Tamboul* local market. Samples were taken monthly in summer, winter and autumn. These samples were transported hygienically to the Department of Physiology and Biochemistry, Faculty of Veterinary Medicine, University of *Albutana*. According to the storage period, samples were divided into four groups: fresh samples, one month-stored samples, two months-stored samples and three months-stored samples. The samples were labeled, wrapped and kept in a refrigerator at (- 4ºC) overnight and then kept on a deep freezer at (-18ºC).

At the end of each storage period the samples were transported hygienically to Department of Meat Production, Faculty of Animal Production, University of Khartoum, where they were labeled, wrapped and kept in a refrigerator overnight until used.

Macro minerals determination

Camel meat samples were subjected to chemical analysis to determine moisture, total protein, total fat and ash as described by (AOCS, 1990). Ash samples were analyzed further for macro minerals (Ca, Mg, P, Na and K,).

Determination of potassium and sodium

Potassium (K) and sodium (Na) concentrations were accomplished by means of flame photometer model (Corning 400 flam photometer). These minerals were determined according to the AOCS (1984) method.

Determination of calcium and magnesium

Calcium (Ca^{+2}) and magnesium (Mg^{+2}) were determined together according to the AOCS (1984) method.

Determination of phosphorus

Phosphorus (P) was determined by Spectrophotometer at 440 um according to fertilizers and feeding stuffs regulations, after diluting the ash extract (1:20) then the solution was reacted with ammonium vando molybdate reagent. An orange and yellow complex vanadium phosphomolybate was formed.

Data analysis

Data were analyzed as with a 3x3 factorial arrangement of treatments using analysis of variance. To test the research hypothesis ANOVA table and an interaction between three factors (preservation period, season and age of animal) analyzed by general linear model by using SPSS version 21 computer programs. Duncan's for multiple comparison test was used. Main effects were considered significant at $P>0.05$.

RESULTS AND DISCUSSION

Camel's meat production represents about 0.7% of the world meat production (216, 315 tons) (Anderson and Hoke, 1990). The objectives of this study is to determine the macro minerals profiles in camel's meat in different seasons and ages. Ca, P and Mg have structural function and Na and K involved in membrane function (Mertz and Underwood, 1987). The concentration of these minerals were converted to a dry mass as g/100g of sample, highlighted in Tables 1. 2 and 3. The camel's meat from *Tambool* area revealed that the

concentration of the macro minerals; Ca, K, Mg, Na and P were found within the normal range. Therefore, the natural food of camels generally consists of the foliage of trees, shrubs and grass. When left to graze freely, camels food may include a large number of different species (Higgins, 1986).

Trace element levels in camel's meat are affected with camel food and the pasture soils (Barrett and Larkinc, 1974). The concentration of Ca, Mg, Na, K and P was higher in summer and lower in autumn and winter, and significantly different (P>0.01) (table 1), because these camels depend on well water during summer (Sarmad *et al.*, 2011). There was a significant difference (p>0.05) due to the age of animal on the concentration of Ca, Mg, Na, K and P (table 3), the concentration of these minerals was lower in young animals. This is consistent with the findings of (Kadim *et al.*, 2008) who reported that mineral content of muscle generally tends to increase with the age of the camel. There was a significant difference (p>0.05) due to the preservation period on the concentration of Ca, Mg, Na, K and P (table 3), the concentration of these minerals was not consistent with different preservation periods.

When, study the interaction of age*season*preservation periods, there was a significant difference at (p>0.05) on the concentration of Ca, Mg, Na, K and P, a higher concentration of Ca, Mg, P and Na was found in summer then autumn and winter. While, the concentration of K was higher in autumn and winter and lower in summer (table 4).

When, study the interaction of season*age*preservation periods, there was a significant difference at (p>0.05) on the concentration of Ca, Mg, Na, K and P a higher concentration of Ca was found in old age animals (7-9 years), and lower concentration was found in young age animals (1-3 years). Higher concentration of K and Mg was found in young age animals (1-3 years), and lower concentration was found in old age animals (7-9 years)(table 5).

There was a significant difference in concentration of Na and P according to interaction of season*age in different preservation periods (p>0.05). There was no significant difference in concentration of P after three months of preservation (p<0.05) (table 4). Also, there was no significant difference in concentration of Mg after one month of preservation (p<0.05) (table 5).

The data presented above indicate the presence of macro minerals in the environment of *Tambool* area in adequate amount. These findings have implications for our understanding of the metabolism of minerals, as the summer season generates a hard environment and high concentration of blood.

CONCLUSION

It could be concluded that the macro minerals (Ca, P, Mg, Na and K) profile in camels meat showed a significant difference (p>0.05) in different season. The concentration of Ca and Mg was higher in summer in young age animals (1-3 years) and lower in old age animals (7-9 years). While the concentration of K was higher in winter in old age animals (7-9 years) and lower in young age animals (1-3 years). There was no significant difference in concentration of P after three months of preservation (p<0.05). Also, there was no significant difference in concentration of Mg after one month of preservation (p<0.05). Further studies on micro minerals (Fe, Cu and Zn) profile in camel meat are recommended.

ACKNOWLEDGEMENT

We would like to acknowledge the great help received from the my colleges at the Department of Physiology and Biochemistry, Faculty of Veterinary Medicine, University of *Albutana*. Also, we are grateful to the members of the Department of Meat Production, Faculty of Animal Production, University of Khartoum.

We acknowledge the immense help received from the scholars whose articles are cited and included in references of the manuscript. We are also

grateful to authors, editors and publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

REFERENCES

1. Anderson, B.A. and I.M. Hoke (1990). Composition of Foods: Beef Products, Raw, Processed, Prepared. 1st Edn., United States Development of Agriculture, Washington, DC, USA.
2. AOCS, (1990). Official Methods and Recommended practices. 5th ed. Commercial Fats and Oil. Washington, DC. USA.
3. AOCS, (1984). Official Methods and Recommended practices. 5th ed. Commercial Fats and Oil. Washington, DC. USA.
4. Barrett, M.A. and P.J. Larkinc, (1974). Milk and Beef Production in the Tropics. 1st Edn., Oxford University Press, London, ISBN: 9780198594406, pp: 245.
5. Elgasim, E.A. and Elhag, G.A. (1982). Carcass characteristics of the Arabian Camel. Camel News Letter (9): 20-24.
6. Fennema, O.R. (1996). Food Chemistry. 3rd Edn. Marcel Dekker Inc., New York, USA., ISBN: 9780824796914, pp: 1069.
7. Higgins, A. (1986). The Camel in Health and Disease. 1st Edn. Bailliere Tindall Press, London, ISBN: 9780702011672, pp: 168.
8. Kadim, T. Isam, Osman Mahgoub, Waleed Al-Marzooqi and S. K. Khalaf (2009). Journal of Camelid Sciences. 2, 30 http://www.isocard.org 37.
9. Kadim, T. Isam, Osman Mahgoub and Waleed Al-Marzooqi (2008). Journal of Camelid Sciences. Meat Quality and Composition of Longissimus thoracis from Arabian Camel (Camelus dromedaries) and Omani Beef: A Comparative Study. 37-47 http://www.isocard.org 37.
10. Kadim, I.T.; Mahgoub, O. and R.W. Purchas (2007) A review of the growth, and of the carcass and meat quality characteristics of the one-humped camel (Camelus dromedaries) Department of Animal and Veterinary Sciences, College of Agricultural and Marine Sciences, Sultan Qaboos University,
11. Kadim, T. Isam, Mahgoub, O., Al-Marzooqi, W., Al-Zadgali, S., Annamali, K., Mansour, M. H. (2006). Effects of age on composition and quality of muscle *Longissimus thoracis* of the Omani Arabian camel (Camelus dromedaries). Meat Sci., *73*, 619-625.
12. Mertz, W. and E.J. Underwood (1987). Trace Elements in Human and Animal Nutrition. 5th Edn., Academic Press, San Diego, ISBN: 9780124912519, pp: 480.
13. Sarmad G. Mohammed, Hassan T. Abdulsahib, Ibrahim M. Jasim and Mushtak T. Jabbar (2011). Assessment of Camel Meat Pollution with Trace Metals in Desert Area of Basra Province. American Journal of Agricultural and Biological Sciences 6 (4): 475-479.

Table 1: The effect of seasons on some minerals profiles (g/100g)

Duncan's Multiple Comparison				
Mineral	Seasons			
	Mean ± S.E.			
	Summer	Autumn	Winter	LS
Ca	0.60±0.05c	0.46±0.03b	0.18±0.04a	*
K	0.68±0.05b	0.61±0.07a	0.65±0.03a	**
Mg	0.15±0.02b	0.12±0.02b	0.10±0.01a	**
Na	0.91±0.10b	0.26±0.03a	0.27±0.02a	**
P	0.79±0.06b	0.25±0.02a	0.17±0.01a	**

LS: level of significance, ** significant at P>0.01, *significant at P>0.05.

Table 2: The effect of age of animals on some minerals profiles (g/100g)

Duncan's Multiple Comparison				
Bacterial Growth	Age/year			
	Mean ± S.E.			
	1-3	4-6	7-9	LS
Ca	0.45±0.06b	0.40±0.08a	0.40±0.06a	*
K	0.59±0.04b	0.46±0.08a	0.49±0.08a	*
Mg	0.14±0.02b	0.09±0.02a	0.09±0.02a	*
Na	0.50±0.10b	0.47±0.13a	0.49±0.09b	*
P	0.41±0.09b	0.37±.10a	0.42±0.08b	*

LS: level of significance, *significant at P>0.05.

Table 3: The effect of preservation period on some minerals profiles (g/100g)

Duncan's Multiple Comparison					
Bacterial Growth	Preservation period				
	Mean ± S.E.				
	Fresh	One month	Two months	Three months	LS
Ca	0.44±0.01d	0.33±0.07a	0.44±0.07b	0.44±0.09b	*
K	0.53±0.07c	0.44±0.10a	0.51±0.07b	0.57±0.07d	*
Mg	0.13±0.03b	0.09±0.02a	0.10±0.02a	0.10±0.02a	*
Na	0.56±0.14c	0.33±0.07a	0.49±0.13b	0,56±0.15c	*
P	0.43±0.10c	0.35±0.10a	0.40±0.11b	0.43±0.11a	*

LS: level of significance, *significant at P>0.05.

Table 4: The interaction between age of animals*season*preservation period on the profile of Ca, K, Mg, Na and P in camel's meat

Mean ± S.E. of **Calcium** count in the three ages*season				
	Summer	Autumn	Winter	LS
Fresh	0.59±0.04c	0.50±0.06b	0.22±0.06a	*
One Month	0.43±.07b	0.48±0.04b	0.11±0.03a	*
Two Months	0.67±0.05c	0.41±0.03b	0.27±.06a	*
Three Months	0.72±0.04c	0.46±0.04b	0.14±0.02a	*
Mean ± S.E. of **Potassium** count in the three ages*season				
	Summer	Autumn	Winter	LS
Fresh	0.34±0.04a	0.55±0.09b	0.71±0.03a	*
One Month	0.16±0.05a	0.58±0.11b	0.59±0.06b	*
Two Months	0.26±0.05a	0.60±0.07b	0.63±0.03b	*
Three Months	0.36±0.08a	0.70±0.05b	0.70±0.03b	*
Mean ± S.E. of **Magnesium** count in the three ages*season				
	Summer	Autumn	Winter	LS
Fresh	0.13±0.02ab	0.19±0.03b	0.06±0.03a	*
One Month	0.15±0.03b	0.10±0.03b	0.03±0.01a	*
Two Months	0.12±0.03b	0.11±0.03b	0.03±0.01a	*
Three Months	0.18±0.03b	0.08±0.02a	0.04±0.01a	*
Mean ± S.E. of **Sodium** count in the three ages*season				
	Summer	Autumn	Winter	LS
Fresh	1.08±0.18b	0.33±0.04a	0.27±0.03a	*
One Month	0.52±0.07b	0.18±0.04a	0.27±0.03a	*

Two Months	0.67±0.22b	0.29±0.03a	0.52±0.22b	*
Three Months	1.14±0.25b	0.26±0.03b	0.29±0.04b	*
Mean ± S.E. of **Phosphorus** count in the three ages*season				
	Summer	Autumn	Winter	LS
Fresh	0.81±0.03c	0.30±0.03b	0.18±0.03a	*
One Month	0.65±0.10c	0.23±0.05b	0.15±0.03a	*
Two Months	0.82±0.03c	0.20±0.03b	0.18±0.03a	*
Three Months	0.88±0.03c	0.26±0.03b	0.16±0.03a	*

LS: level of significance, * significant at P>0.05, NS: not significant

Table 5: The interaction between season* age of animals*preservation period on the profile of Ca, K, Mg, Na and P in camel's meat

Mean ± S.E. of **Calcium** count in the three season*ages				
	1-3 years	4-6 years	7-9 years	LS
Fresh	0.47±0.03b	0.49±0.11b	0.35±0.06a	*
One Month	0.39±0.07b	0.26±0.05a	0.36±0.09b	*
Two Months	0.47±0.09ab	0.39±0.08a	0.49±0.04a	*
Three Months	0.45±0.08b	0.46±0.11b	0.41±0.08a	*
Mean ± S.E. of **Potassium** count in the three season*ages				
	1-3 years	4-6 years	7-9 years	LS
Fresh	0.61±0.05b	0.61±0.07b	0.38±0.08a	*
One Month	0.46±0.05b	0.28±0.09a	0.59±0.13c	*
Two Months	0.60±0.06b	0.49±0.08ab	0.40±0.07a	*
Three Months	0.63±0.03b	0.48±0.10a	0.61±0.09b	NS
Mean ± S.E. of **Magnesium** count in the three season*ages				
	1-3 years	4-6 years	7-9 years	LS
Fresh	0.19±0.03b	0.10±0.03a	0.09±0.03a	*
One Month	0.09±0.02	0.10±0.03	0.10±0.03	NS
Two Months	0.14±0.03b	0.08±0.02a	0.06±0.01a	*
Three Months	0.13±0.04b	0.07±0.01a	0.10±0.03a	*
Mean ± S.E. of **Sodium** count in the three season*ages				
	1-3 years	4-6 years	7-9 years	LS
Fresh	0.64±0.23b	0.48±0.12a	0.56±0.11b	*
One Month	0.32±0.08b	0.20±0.04a	0.44±0.07c	*
Two Months	0.56±0.21b	0.60±0.23c	0.32±0.04a	*
Three Months	0.45±0.09a	0.61±0.26b	0.62±0.23b	*
Mean ± S.E. of **Phosphorus** count in the three season*ages				
	1-3 years	4-6 years	7-9 years	LS
Fresh	0.41±0.10a	0.42±0.10a	0.44±0.09b	*
One Month	0.40±0.11a	0.46±0.10b	0.47±0.10b	*
Two Months	0.39±0.10b	0.48±0.22c	0.33±0.08a	*
Three Months	0.46±0.12b	0.43±0.12a	0.42±0.11a	*

LS: level of significance, * significant at P>0.05, NS: not significant.