International Journal of
Food Science
(IJF)

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CARI Journals

International Journal of Food Sciences
ISSN: 2789-3383 (Online)
Vol. 3, Issue No.1, pp 10 - 20, 2022 www.carijournals.org

Effect of Production System on Chemical Composition and Macro-Minerals of Sudanese camels Milk

[1]**Yasir Salah Ibrahim Adam**,
Assistant Professor, Food Technology, Department of food technology,
Faculty of agricultural Technology and fish science,
Alneelain University Khartoum, Sudan,
E-mail:yasirsalah1977@gmail.com.

[2]**El-rasheed Mhammed Younis**

Department of animal production,

Faculty of agricultural Technology and fish science,

Alneelain University, Khartoum, Sudan,

[3]**Khogali Mahmoud Khogali**,
Assistant Professor,
Department of Field Crops and Horticulture,
Faculty of agricultural Technology and fish science,
Alneelain University Khartoum, Sudan,
E-mail:khogalisaliheen123@gmail.com.

Abstract

Purpose: This study was conducted to determine the production system effect on camel milk composition and macro-elements content in Sudan.

Methodology: Sample purchased from camel milk production markets (Albutana- Tumbool, Kordfan-Elobied, and Khartoum-Alsalam market) in 6 replicates.

Findings: There were no difference in moisture, and protein % among camel milk from different area, on the other hand there were significantly different in fat and ash content % with highest values for Khartoum camel milk and lowest values for Kordofan camel milk. Macro-minerals (Na, K, Mg, Ca, and P) content in camel milk were determined and there was different content. Ca, Na, K, Mg and P higher in Khartoum camel milk and lowest content values for Kordofan camel milk. The study was extended to determine soil macro-elements contents in Albutana and Kordofan areas which were fed by grazing system, and ignored soil in Khartoum whereas camels lives in a farm.

Unique contribution to theory, practice and policy: Camels produce more milk of high nutritional quality and for a longer period of time than other species in an environment that might be rightly termed as hostile in terms of extreme temperature, drought and lack of pasture, in Sudan camel's milk constitutes the sole diet of camel herders for considerable periods and they rely completely on camel's milk for more than month without having drinking water especially during the migratory routes. Camel milk from different areas and production system had different chemical content in fat and ash % and similar in moisture and protein %, within the same season. However, macro-minerals in camel milk increasing by soil macro minerals contents specially on grazing system.

Keywords: *Camel, milk, composition, macro-elements*

1.0 INTRODUCTION

Sudan has a livestock wealth of more than 165 million heads of livestock, including live stock, poultry and equines, as well as 76000 tons of fish stocks (livestock estimates for 2017) MARF (2017). Camels have been a trend of growing numbers of camels in the world between 2001 and 2011 (FAO, 2013). This increase might be attributed to their adaptation to various environments, development in camel farming, and the improvement of ecological image of camel farming and products. The total large camels' population in the world in 2013 was estimated at around 25 million animals. This number is probably underestimated because camels are migrant animals. It is difficult to conduct a census for camels such as the wild Australian camel population. The general estimate of the camel world population may probably be around 30 million head (Faye, 2013). About 88% of the camels are found in Africa, while Asia has 12%. The main concentration of dromedary camels in Africa is in the East African countries with 80% of the total camel population raised under various production systems. The most important countries with a camel population of more than 1 million are Somalia, Sudan, Ethiopia, Niger, Mauritania, Chad, and Kenya. A significant proportion of the world camel population is found in countries defined by FAO as Net Food Importing Developing Countries (71% of total world camels), Low Income Food Deficit Countries (68% of total world camels), and Least Developed Countries (59% of total world). Furthermore, in Sudan camel's milk constitutes the sole diet of camel herders for considerable periods and they rely completely on camel's milk for more than month without having drinking water especially during the migratory routes (Al-Khori and Majid, 2000).

1.1 Statement of the Problem

Variations in the composition of camel milk may be attributed to several factors such as analytical methods, geographical area, nutritive conditions, breed, stage of lactation, age and number of callings (Khaskheli *et al*., 2005). Geographical origin and seasonal variations are factors which influence most changes in composition of camel milk. Konuspayeva *et al*., (2009) studied the effect of geographical origin on the composition of camel milk and the study showed that camel milk from camels located in east Africa has more fat than milk from camels in Africa and western Asia. Seasonal variations also play a significant role in the composition of camel milk, even with camels of the same breed and from the same region (Bakheit *et al.*, 2008). Camel milk production in Sudan estimated in 2017 about 61000 tons (MARF, 2017).

1.3 Objectives of the Study

This study was conducted to determine the production system effect on camel milk composition and macro-elements content in Sudan.

2.0 LITERATURE REVIEW

In many arid areas, camels play a central role as milk suppliers. The comparative advantage of the camel as a dairy animal over the other species in the same environment is difficult to quantify;

however, it is widely recognized that in absolute terms, the camel produces environment is difficult to quantify; however, it is widely kg/day (Al-Khori, and Majid, 2000), less than these, reported in three herds of recognized that in absolute terms, the camel produces recognized that in absolute terms, the camel produces more milk and for a longer period of time than any other milk animal held under the same condition (Farah, 1996.).

3.0 MATERIALS AND METHODS

3.1 Samples collection:

3.1.1 Soil samples:

Soil samples were taken from different surfaces up to 30cm using a stainless-steel sampling auger. A total number of 6 soil samples within each growth from the study area were taken and stored in plastic bags.

3.1.1.1Soil analysis:

The laboratory method outlined by Richards (1954) was followed. They are briefly described below:

3.1.1.2Exchangeable (Na):

Sodium was extracted with 1N ammonium acetate (pH 7.0) and determined by

Exchangeable Sodium Percentage **(ESP):**

Was calculated by: ESP= $\frac{EX.Na}{CEC}$*100

Soluble Cat ion and anions: water soluble (Na) was determined by flame photometer, (Ca) and (Mg), carbonates by titration, Sulphates estimated by subtraction of anions from cat ions.

3.1.2 Milk samples

One liter from a round camel from three area at north kordofan elbowed market, Botana Tumbol market, and Khartoum Alsalam market.

3.1.2.1Camel milk chemical composition

Moisture, crude protein, fat, and Ash content were determined according to (AOAC, 2008).

Moisture content was based on weight loss from a definite quantity of meat, dried over night in drying oven at 102 °c. The dried sample was cooled in desiccator and weighed. The moisture content was calculated as percentage of fresh sample weight as follows :

Moisture % = weight of fresh sample - weight of dried sample

Weight of fresh sample

Crude protein content was determined by using Kjeldahl method and calculated by multiplying the amount of nitrogen by 6.25. One ml of dried sample was weighted in kjeldahl flask. Half a tablet of catalyst mixture (10 parts k_2so_4 to part of $cuso_4$). And 25 ml concentrated H_2so_4

concentration were added. The content of the flask was digested under boiling atmaximum heat for 2 hours. And then the flask was cooled and transferred to distillation unit. The sample was distilled by using NaOH solution 40% the content was titrated against HCL acid 0.1N and crude protein percentage was calculated.

Fat content of milk was determined as given by (AOAC1990) in clean dry Gerber tube, 10ml of sulfuric acid (densty 1.85gm\ml at 20C) were poured , and than 110..94 ml of milk were added .amyl (1-2ml) was added to the mixture , followed by the addition to distilled water .the gerber tubes were centrifuged at 1100 revolution per minutes (rpm) for 4-5 minutes and the tube were than transferred to a water bath adjusted at 65Cfor three minutes . The fat percent was than read out directly

Ash content was determined by weighing 2 ml of dried free sample into dried crucible of known weight. The crucible were placed inside muffle furnace at 550 c° for 4hours, After complete ashing, the crucible with ash were transferred directly to a desiccators, cooled , weighed and calculated as percent of original weight sample.

3.1.2.2 Camel milk macro-minerals

Macro elements in milk camel of calcium (Ca), magnesium (Mg), sodium (Na) and potassium (K) were analyzed using atomic absorption (Sin et *al*., 2005), phosphorus (P) analyzed using atomic absorption spectrophotometer.

To a 5 ml aliquot of milk in a 100 ml volumetric flask add 50 ml of 24% (w/v) TCA and dilute to volume with deionized water Shake the samples at 5-min intervals for 30 min and filter transfer a5-ml aliquot of the filter to a 5 ml ml volumetric flask add 1 ml of 5% (w/v) lanthanum solution and make to volume with deionized water

A mixed standard should be prepared containing 50 mg /L Ca 06 mg/L Mg 16 mg/L Na 50 mg/L k 500 mg/L La and 12 % (w/v) TCA All determination should be made versus a reagent blank containing 500 mg/L La and 12% TCA follow the direction on the "Standard Condition" pages for preparation of standards for each element and standard condition

3.2. Statistical analysis

The data collected from the different treatments was subjected to analysis of variance and whenever appropriate the mean separation procedure of Duncan was employed (Steel and Torrie, 1980). The SAS program (SAS, 2002), was used to perform the general linear model (GLM) analysis.

4.0 RESULT AND DISCUSSION

International Journal of Food Sciences
ISSN: 2789-3383 (Online)
Vol. 3, Issue No.1, pp 10 - 20, 2022

4.1 Chemical composition of camel milk

The chemical composition of camel milk was presented in table (1). Protein and moisture, % had no significantly different among camel milk, on the other hand, fat content (%) significantly different with means value (3.37, 3.60, 4.00) for kourdofan, Butana and Khartoum camel milk respectively. Fat content in camel milk was higher than ELhag *et al*, (2003) ELbadawi (2004) whereas found (3.01). The Ahs with means value (0.87, 0.94, 0,96) for Khartoum, Butana and kourdofan camel milk respectively. Ahs content in camel milk was higher than ELhag *et al*, (2003) content 0.80 %

The moisture content of fresh camel milk (%) had ranged between (88.83-87.25). moisture content in camel milk was agrees of the results of Jardali and Ramet, (1991) as (87.73), Ahmad (1990) who reported a value ranging between (84-88) in this study the crude protein had no significantly different ($p \geq 0.05$) with means

Table 1.

Chemical composition of camel milk from three different areas in Sudan.

	Treatments			
Parameter, %	Kourdofan	Butana	Khartoum	± SEM
Fat	3.37^{b}±0.15	3.60^{b}±0.1	4.0^{a}±0.14	0.08
Moisture	$88.53^{\mathbf{a}}$±1.29	88.83^{a}±1.13	87.25^{a}±0.25	0.58
Crud protein	$3,05^{a}$ ±0.05	$2,93^{a}$ ±0.8	$2,95^{a}$ ±0.0.5	0.58
Ash	0.96^{a} ±0.05	0.94^{a} ±0.02	0.87^{b} ±0.03	0.02

^{ab}Means ± SD with different superscripts in the same row are significantly different ($P \leq 0.05$).

SEM: Standard error of the means from ANOVA d.f 6.

value 2.93,2.95,3.05 for Butana, Khartoum and kourdofan respectively camel milk proteins were higher than), ELhag *et al*,(2003) where reported (3.4%) and Ahmad.,(1990) also (3.0%). Physiological stage, feeding conditions, season, physiological variations, genetic make-up and health status of the camel were reported to influence the composition of camel milk (Konuspayeva *et al*. 2009). In general, the average amount of components of camel milk is protein 3.4%; fat 3.5%; ash 0.79%, while water covers 87% (Al-Haj and Al-Kanhal 2010). Camel milk is still the most important nutritional source for pastoralists in many

International Journal of Food Sciences
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African and Asian countries (Valérie 2007). Camels produce more milk of high nutritional quality and for a longer period of time than other species in an environment that may be rightly termed as hostile in terms of extreme temperature, drought and lack of pasture (Yagil and Etzion 1980; Valérie 2007). The milk has many properties that make it a very useful choice, as camel's milk is used in some parts of the world to cure certain diseases Attia *et al.* 2001, Askale and Samson 2018 .

Table 2.

Camel milk macro-minerals in Kordofan, Albutana, and Khartoum state.

Parameter,%	Treatments				
	Kourdofan	Butana	Khartoum	± SEM	Sig
K++	148^{b}±4.37	154.46^{a}±1.07	155.37^{a}±2.12	1.66	*
P	96.80^{b}±4.31	105.17^{a}±4.25	102.03^{ab}±2.68	2.21	*
Ca	129.33^{c} ±5.05	137.90^{a} ±1.36	145.17^{b} ±1.05	1.45	*
Mg	14.15^{b} ±94	16.23^{a} ±0.60	17.30^{a} ±1.56	0.52	*
Na	43.13^{b}±3.15	49^{a}±1	52.58^{a}±2.56	1.39	*

[ab]Means ± SD with different superscripts in the same row are significantly different (P≤ 0.05).

SEM: Standard error of the means from ANOVA d.f 6.

The results of camel milk macro minerals presented in table 2. And there were significantly different among camel milk from different areas in Sudanese camel milk markets. calcium Ca, magnesium Mg, and sodium Na were highest content values in Khartoum camel milk and lowest content means value for Kordufan camel milk, except Phosphorus P, which higher content value in Albutana camel milk than Khartoum camel milk. Various minerals such as Na, K, Ca, P, Mg are present in camel milk (Khasmi *et al.* 2001; Onjoro *et al.* 2003). The values of trace minerals were significantly higher in camel milk as compared to cow's milk (Agrawal *et al.* 2004).

Table 3.

Kordofan and Albutana Macro Minerals in Soil (ppm)

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ISSN: 2789-3383 (Online)
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	Treatments		
Parameter,%	Kourdofan	Butana	± SEM
K	0.27[a]±0.03	0.41[b]±0.03	0.02
P	1.1±0.11	1.5±	0.07
Ca	14.17 ±0.11	8.83 ±0.44	1.92
Mg	19.33 ±7.57	13.33 ±2.07	3.18
Na	0.34[a]±0.10	0.18[b]±0.06	0.05

[ab]Means ± SD with different superscripts in the same row are significantly different ($P \leq 0.05$).

SEM: Standard error of the means from ANOVA d.f 6.

4.2 Macro Minerals in Soil

Potassium K, phosphorus P, calcium Ca magnesium Mg, and sodium Na for kordufan and Butana soil contents shows in table (3). The results in this study had significantly different in potassium content in Butana soil higher than Kordufan soil with mean value 0.4 and 0.27 respectively. On the other hand, sodium content higher in Butana soil with mean value 0.34 and 0.18 for Kordufan soil . Phosphorus, Calcium and Magnesium had no different. The effect of production system was clearly appear on meat content of macro-element especially Ca, Na, and K which provided from soil and plant El-rasheed, and Adam (2018).. Camels can be adapted to various climatic conditions. They are utilized in transport, sport, wellspring of meat and milk; therefore, they contribute to raising the economy and food security for people (Suliman *et al.*, 2019; Swelum *et al.*, 2020). The decrease in crude protein and ash during winter might be due to nutritional factors as winter feed requirements are higher than that of the other seasons.

Conclusion: camel milk from different areas and production system had different chemical content in fat and ash % and similar in moisture, and protein %, within the same season. However, macro-minerals in camel milk increasing by soil macro minerals contents specially on grazing system. Whereas, camels milk of Khartoum state which live in a farm didn't effect by soil contents of macro-elements.

Recommendation:

Camels' production system especially in the rural areas must be to completely there feed by the elements which it's poor in soil of the grazing area.

More researches to determine and compare elements content in soil and the grazing animals products in the same areas.

Acknowledgment: Thanks and grateful to Mr Mamoon in Al-Neelain University Faculty of Agriculture Technology and Fish Science Department of Food Technology and Dr. Mohammed Hussain and Mr. Mohammed Omer for assistance during the experiments, thanks extended to laboratory staff of food technology.

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