

# Chemical Composition and Microbiological Characteristics of Sudanese Cow's, Goat's and Camel's milk

Eiman O. Basheer<sup>1</sup>, Ibtisam H. Elhassan<sup>1</sup>, Ahmed El. Ismail<sup>1</sup>, Azza M. Khalid<sup>1</sup>, Nada A. Fath elrahman<sup>1</sup>, Mohammed A. ELnour<sup>1</sup>, Randa A. Ibrahim<sup>2</sup> and Sara Y. Ahmed.<sup>3</sup>

<sup>1</sup>NFRC/ National Food Research Center, Shambat, Sudan

<sup>2</sup> Faculty of Agricultural Studies, Sudan University of Science and Technology

<sup>3</sup> Ministry of Agriculture and Forest, Sudan.

## Abstract

This study was conducted to evaluate the chemical composition and microbial characteristics of Sudanese fresh cow's, goat's and camel's milk. The samples was subjected to chemical analysis in terms of; Total Solids (T.S), protein, fat , lactose and pH. In addition to, some minerals: Calcium and phosphorus. The samples subjected to microbial analysis such as; Total Viable Bacterial Count (TVBC) and *E. coli* detection. The data from the different analysis was subjected to the statistical analysis by using SAS program. The results revealed that, chemical composition significantly ( $P \leq 0.05$ ) influence with milk source. Goat's milk was the highest T.S and fat 12.40% and fat 3.83%, respectively, whereas, the camels milk was the lowest T.S and fat 11.34% and 3.22% respectively. The results of protein content were (3.33%, 3.40% and 3.27%) for cow's, goat's and camel milk respectively. The fresh milk had pH- value with a mean of 6.60

Highest calcium and phosphor content was reported for cow's milk 127.76 and 93.80 mg/100, while, lowest was reported for camels milk 116.80 and 89.80 mg/100g, respectively. Total Viable Bacterial Count (TVBC) significantly ( $P \leq 0.05$ ) influence with milk source, fresh cow's milk was reported the highest TVBC  $2.73 \log_{10} \text{cfu/g}$ , while, fresh camel's milk was reported the lowest one  $2.46 \log_{10} \text{cfu/g}$ . It worth mentioning that, all fresh milk under investigation was *E.coli*.

**Key words:** cow, goat, camel, fresh milk, chemical composition, microbiological.

## INTRODUCTION

Livestock is an important agricultural resource in Sudan. Its population is 105 million heads distributed throughout the country according to climatic conditions (MLFR, 2015). However, milk production from these animals was estimated to 4.4MT (MLFR, 2014). Milk is considered as a nearly complete food since it is a good source for protein, fat and major

minerals. Also, milk and milk products are main constituents of the daily diet, especially for vulnerable groups such as infants, school age children and old age. Cow's milk is a good source of protein, fat, vitamins, lactose, in addition to, 0.7% of ash and rich in minerals (DF, 2003). Goat's milk is composed of different nutrients which are important to their young and humans. Among those important nutrients that are found in goat's milk are protein, fat, lactose, vitamins and minerals. Most of the components of goat's milk are greater than that of other milk producing animals. For instance, goat's milk contains 25% more vitamin B<sub>6</sub>, 47% more vitamin A and 13% more calcium than cow's milk (Chen *et al.*, 2004). Sudan has the second largest number of camels in the world after Somalia with about 4.7 million heads (Hassab El nabi, 2018). Camel milk is consumed as a major staple food, mainly by the desert nomad tribes because it is one of the most readily available raw materials, which contains all the needful nutrients required in the dry conditions of the desert. Moreover, camel milk like any other human consumable milk consists of fat, proteins (soluble proteins and caseins) and one major carbohydrate (lactose) as major components (Farah and Fischer, 2004). It also contains minerals and vitamins as minor components, to abridge; camel milk can be titled as a nutritious source of all the required essentials of a complete diet (Mustafa, 2011).

**Objectives**

- \* To compare the chemical composition of milk from different source; Cow's, goat's and camel's milk.
- \* To assessment the microbial characteristics of milk from different source; Cow's, goat's and camel's milk.

### 3. Materials and Methods

\* Proximate composition and mineral content in term of: total solids, protein, fat, ash, pH, calcium and phosphor was determined according to AOAC (2005).

\* Microbial characteristics were determined according to Harrigan, (1998).

### 4. Results and discussion

#### 4.1 Chemical composition

Table 4.1, shows the chemical composition of fresh milk from the different sources. Total solids (T.S) content significantly ( $P \leq 0.05$ ) affect with the milk source. The highest T.S was reported for goat's milk 12.40%, whereas, the lowest one was reported for camel's milk 11.34%. Eissa (2008) found that, cow's milk had moisture content of 12.64%, while goat's milk had a T.S content of 12.40%. Lee and Lucey (2010) reported that, cow's milk is composed of 88% water. Lower total solids of camel's milk was 9.2%, found by Hassab El nabib (2018). Protein content significantly ( $P \leq 0.05$ ) influence by the milk source. The results of protein content were (3.33%, 3.40% and 3.27%) for cow's, goat's and camel milk respectively. The protein content of cow's milk was similar to that mean 3.3%, which was

found by Bano *et al.*, (2011). Milk source significantly ( $P \leq 0.05$ ) influence on fat content. The highest fat content was reported for goat's milk 3.83%, while, the lowest fat content reported for camel milk 3.22%. Eissa (2008) reported that, cow's and goat's milk had fat content of 3.67% and 4.18% respectively. Hassab El nabi (2018) found that, camel milk has fat content of 3.1%. Chen *et al.*, (2004) stated that, goat's milk is easily digestible because of the small size of it's fat globules. Cow's, goats and camel milk had lactose content of 4.45, 4.42 and 4.40%, respectively. Mohammed (2014) found that, cow's milk had lactose content of 4.6%, while, goat's milk had lactose content of 4.1%. Lower lactose of camel 4.36%, milk was found by Siddig *et al.*, (2016). The pH value of camel's milk was slightly lower (6.53) when compare to other sources. Dairy fact (2004) stated that, milk mineral salts are mainly chlorides, phosphates and citrates of sodium, calcium and magnesium. The current result supporting with that, results reported by Yagil, (1982) who stated that, chloride is found in rich amount in camel milk due to the feed stuff. Generally, milk composition is affected by different factors including; genetic factors, breed, stage of lactation, season and nutrition system Dabora (2016).

**Table 1:** Chemical Composition and Microbiological Characteristics of Sudanese Cow's, Goat's and Camel's milk

Parameters	Cow's	Goat's	Camel's	Mean
<b>Total solids %</b>	12.12 <sup>b</sup> (±0.00)	12.40 <sup>a</sup> (±0.01)	11.34 <sup>c</sup> (±0.04)	11.98
<b>Protein %</b>	3.33 <sup>b</sup> (±0.02)	3.40 <sup>a</sup> (±0.03)	3.27 <sup>c</sup> (±0.16)	3.33
<b>Fat%</b>	3.68 <sup>b</sup> (±0.02)	3.83 <sup>a</sup> (±0.04)	3.22 <sup>c</sup> (±0.24)	3.57
<b>Lactose %</b>	4.45 <sup>a</sup> (±0.01)	4.42 <sup>ab</sup> (±0.12)	4.40 <sup>abc</sup> (±0.22)	4.42
<b>pH</b>	6.69 <sup>a</sup> (±0.02)	6.60 <sup>b</sup> (±0.12)	6.53 <sup>c</sup> (±0.20)	6.60

Values are means ± SD.

Means in the same column for the different superscript small letters are significantly different ( $P \leq 0.05$ ).

#### 4.2 Minerals content

Data in Table 2, show the effect of milk source on minerals content of fresh milk from cow's, goat's and camel's milk. Calcium content significantly ( $P < 0.05$ ) affected by milk source. Goat's milk was the highest calcium  $Ca^{++}$  content 127.76mg/100g when compared to cow's and camel's one 120.33 and 116.80 mg/100g, respectively. Ghada (2005) reported that, cow's, goat's and camel's were 130.28, 119.9 and 130.28, respectively. Holland *et al.*, (1998) found that, goat's milk had calcium content of 124.66mg/100g. Sawaya *et al.* (1984) found camel's milk had calcium content of 116.66 mg/100g. Furthermore, Calcium is very important to human being. It is needed for tissue and bone development and adequate calcium intake is important for maintenance of bone health.

Regarding phosphorus  $P^{++}$  content of fresh milk. A significant ( $P \leq 0.05$ ) differences were noticed among the fresh milk samples. Cows, goats and camels fresh milk had phosphorus content of 92.33, 93.80 and 89.80mg/100g, respectively. Ghada (2005) reported that, cows, goats and camels were 130.28, 119.9 and 130.28, respectively. Holland *et al.*, (1998) found that, goat's milk had calcium content of 124.66mg/100g. Sawaya *et al.* (1984) found camel's milk had calcium content of 116.66 mg/100g.

**Table 2:** Minerals content (mg/100) of Sudanese Cow's, Goat's and Camel's milk

Parameters	Cow's	Goat's	Camel's	Mean
Calcium ( $Ca^{++}$ )	120.33 <sup>b</sup> (±0.00)	127.76 <sup>a</sup> (±0.01)	116.80 <sup>c</sup> (±0.04)	121.63
Phosphorus ( $P^{++}$ )	92.33 <sup>b</sup> (±0.02)	93.80 <sup>a</sup> (±0.03)	89.80 <sup>c</sup> (±0.12)	91.97

Values are means ± SD.

Means in the same column for the different superscript small letters are significantly different ( $P \leq 0.05$ ).

### 3.3 Microbial aspects

#### 3.3.1 Total Viable Bacterial Count (TVBC)

Table 3, revealed that, Total Viable Bacterial Count (TVBC) significantly ( $P \leq 0.05$ ) influence by differences of milk source. Fresh cow's milk was reported the highest TVBC  $2.73 \log_{10} \text{cfu/g}$ , while, fresh camel's milk was reported the lowest one  $2.46 \log_{10} \text{cfu/g}$ . Eissa (2008) reported that, cow's milk had higher load of TVBC when compared to camel's milk. Similar observation was noticed by Mohammed (2018) found that, cow's milk was higher  $3.34 \log_{10} \text{cfu/g}$ , TVBC than goat's milk  $3.24 \log_{10} \text{cfu/g}$ . The current result supporting with that, stated by Farah (1996) who reported that, camels milk contains consider amount of Lysozom and vitamin C.

#### 3.3.2 *E.coli*

Table 3, show that, *E. coli* was absent in all fresh milk under investigation. Similar result was found by Mohammed (2018), The current result within Sudanese standard SSMO (2007) which Mohammed (2018) stated that, *E. coli* is the best indicator of fecal contamination or state of hygiene and the natural habitat for this organism is the intestines of human and vertebrate animals. Ghana standards for milk and milk products also require that no cells of colifarns, *E. coli* should be detected in the final product (Ghana Standard 337-2003). **Table 3: Microbial aspects of Sudanese fresh Cow's, Goat's and Camel's milk**

Parameters	Cow's	Goat's	Camel's	Mean
TVBC (CFU/g)	2.73 <sup>a</sup> (±0.12)	2.68 <sup>b</sup> (±0.12)	2.46 <sup>c</sup> (±0.12)	2.62
<i>E.coli</i>	Nil	Nil	Nil	

Values are means  $\pm$  SD.

Means in the same column for the different superscript small letters are significantly different ( $P \leq 0.05$ ).

### 4. Conclusion and Recommendations

The study concluded that, chemical composition and microbial aspects significantly ( $P \leq 0.05$ ) effect with the differences of the milk source. The study recommended that, further study of chemical composition and microbial characteristics must be needed and

recommended must be implementation the quality control system such as HACCP and ISO 22000 throughout milk production.

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