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Research Article

IMPACT OF LACTATION STAGE ON NUTRITIVE VALUE AND CHARACTERISTICS OF SHE-CAMEL MILK

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ABSTRACT

This study was conducted in Elobied, North Kordofan, Sudan with the objective of elucidating the impact of lactation stage on nutritive value and quality via sensory evaluation of camel milk. Sixty she-camels were divided into three similar groups and milk samples were collected from each she-camel at similar parity number and lactation stage. The lactation stages selected for the study were the beginning, middle and end of the lactation stages respectively. The early lactation stage (from 1-4 months from parturition A), middle lactation stage (4-8 month from parturition, B) while late lactation stage (C) from 8 months.-12 months. A questionnaire was distributed to 30 expert tasters (panelists) in order to find out the physical properties of camel milk and the yogurt made from it. The samples for nutritive value testing were analyzed by methods described Kittivachra *et al.,* (2006). The samples data were analyzed statistically by analysis of variance and Chi square. The results indicated significant differences (P<0.5.) in nutritive value as affected by lactation stage. The nutritive value results showed higher fat content of milk sampled from group A, followed by B, then C where the highest fat percentage was 4.28, 4.20 and 3.98 for group A,B and C respectively. The protein percentage was higher at the beginning of the lactation stage, A (4.62%), followed by group B (3.59%), and lowest in group C (3.40%). As for lactose, it was high in A (6.26%) followed by group B. (4.82%) and lowest in group C (4.61%), while solids non fat were highest in A (11.86%), followed by that of group B(9.15%) and the lowest in group C (8.74%), and minerals were the lowest in group A (0.71%), followed by that of group B (0.75%) and the highest in group C (0.97%).

Keywords: She-Camel Milk, Lactation Stage, Nutritive Value, Characteristics.

INTRODUCTION

Among large livestock population of Sudan, the camel represents a species with special significance. It is the species that can be raised on desert zone with very little biomass and scanty vegetation. Camel is altogether an animal with importance in all harsh environments that it is adapted to live and its products like meat, milk labor and camel owners in rural areas with prestige and seen as wealthy. According to FAO statistics, there were 19 million camels population in the world, of which 15 million were in Africa and 4 million in Asia. Out of this estimated world population, 17 million are believed to be one-humped dromedary camels (*Camelusdromedarius*) and 2 millions two-humped(*Camelusbactrianus*) (Bakheit*et al.,* 2008). The camel is a multi-purpose animal with high productive potential. Somalia, Sudan and Ethiopia are the major owners of camel in Africa (Eisa, 2011). Sudan is the vast agricultural country in Africa. It has over 130 millions heads of livestock. The country is Sudan ranked the second country in the world in Camel population. According to last estimation of camels in Sudan there are 3.908 million heads (Ministry of Animal Resources and Fisheries, 2010). Camels in the Sudan are spread in a belt configuration (camel belt). It extends between latitudes 12 - 16 N. This belt is characterized by erratic rainfall, less than 350 mm/year. Migration to the southern parts of the country is limited by diseases such as Trypanosomosis, internal and external parasites and the unsuitability of the clay soils with camel pads (Salim*et al.,* 2006). Camel milk has been acknowledged for a long time to provide a potential treatment for a series of diseases such as dropsy, jaundice, anti-hypertensive, asthma, and leishmaniasis or kala-azar. It has been reported that camel milk contains the low quantity of β-casein and the lack of β-lactoglobulin which cause allergic reaction ,in lactose intolerant person Konuspayeva *et al.,* (2009) .Nevertheless, it contains insulin-like and protective protein used for the treatment of many ailments like diabetes, autism, and diarrhea and possesses anti-tumors properties (Farooq , *et al.,* 2015). Moreover, camel milk is endowed with very strong immune system and remedy for peptic ulcers anti-malignant. Korashy HM, *et al.,* (2012). Camel milk is generally an opaque white color and has a faint sweetish odor and sharp taste; sometimes it can be salty. Abbas S, (2013). Its opaque white color because of the fats are finely homogenized throughout the milk whereas, the changes in taste are caused by the type of fodder and availability of drinking water Kumar YK, *et al.,* (2015). Its density ranges from 1.026-1.035 and the pH from 6.2-6.5, both are lower than those of the cow's milk and maximum buffering capacity of skim milk is at pH 4.95 Farooq*et al.,* (2015).

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Objective of study

The present study aimed to elucidate theimpact of lactation stage on nutritive value and characteristics of she-camel milk as perceived by consumers. This was proposed to be achieved via:
Determination of the nutritional value is done through the chemical composition analyses and sensory evaluation of camel milk.

MATERIALS AND METHODS

Study area

The experiments were carried out in Khartoum North, Sudan (Latitudes 15o:38'-15o.63'N; Longitudes 32.55-33oE), in laboratory of

animal Resources Research centre for Feed Analysis and Animal Nutrition Research Centre in Kuku. The milk samples analysis and panel test was carried out in Elobied, Sheikan Locality, North Kordofan State atKhlooj milk production Company Laboratories. North Kordofan State lies between latitudes 11°:15/ and 16°:30/ N and longitudes 27° and 32°E at an altitude of 560 meters above sea level. Maximum temperatures range between 30 and 35°C, with peaks of above 40°C during the months of April, May and June, rainy season extends from July to October an August is greatest monthly rainfall. The study area can be categorized into two major soil groups, sandy and loamy soils. The dominant trees species in the study area are composed of Acacia species, grasses and herbs are dominated as the under story vegetation in the study area (Technoserve, 1987).

Samples collection

Milk samples were collected from three she-camel groups at different lactation stages from herds around the rural areas of the State. Plates 1 and 2 shows milking of the she-camels. The milk quantities were sampled and stored in vacuum flasks for analysis as indicated in plates (3 and 4).and subdivided to equal amounts for determination of nutritive value and sensory evaluation of camels milk as affected by stage of lactation. The parameters studied are milk components and composition and physical characteristics of the taste ,color, Textures ,flavoring ,Acceptance and quality.

Determination of chemical composition

The chemical composition of the she-camel milk is determined as follows:

After taking milk samples to the laboratory, the samples were cooled to 11°C and were divided into the three lactation stages. Lactometers apparatus was used for determination of density and then analyzed via master mini apparatus as shown in plate 5.

Sensory Evaluation of Camel Milk

The cooled milk samples were subdivided and mixed according to the three lactation stages(A. B.C) and pasteurization separately then every sample was divided into three groups as indicated in Plate (6). Sample of fresh natural milk and sweeten and not flavored samples were given to the panelists.

Data collection of the questionnaire and Sensory Evaluation

Ten cups and the questionnaire were distributed among 30 members and they were requested to give their judgments

Plate (1) milking she camels from herds

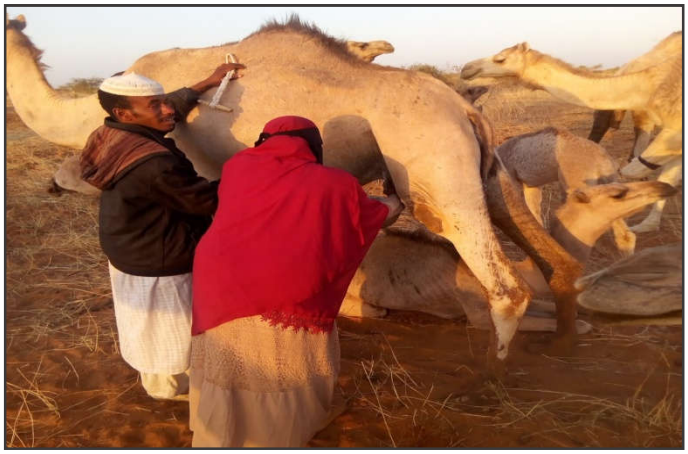

Plate (2)Milking and sampling of camel milk

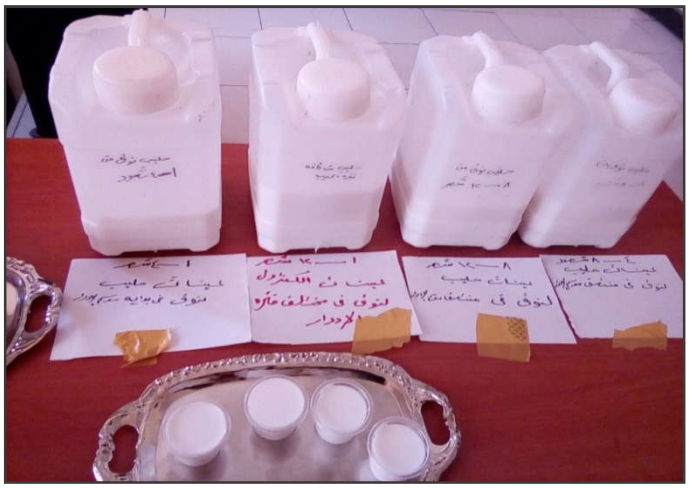

Plate (3)/sample prepared for determination of nutritive value

Plate (4) The panelists at evaluating session

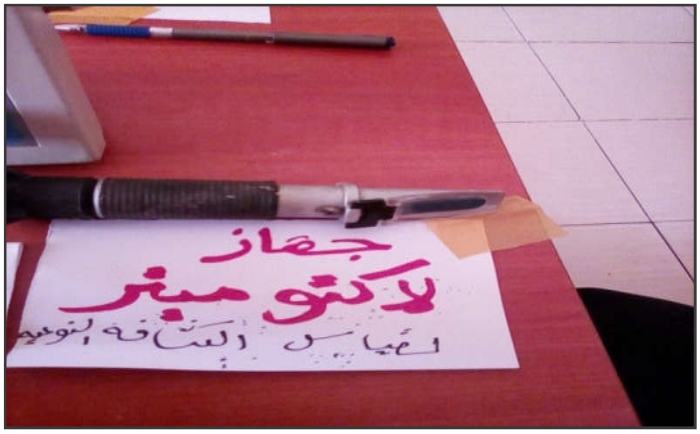

Plate (5)Lactometer

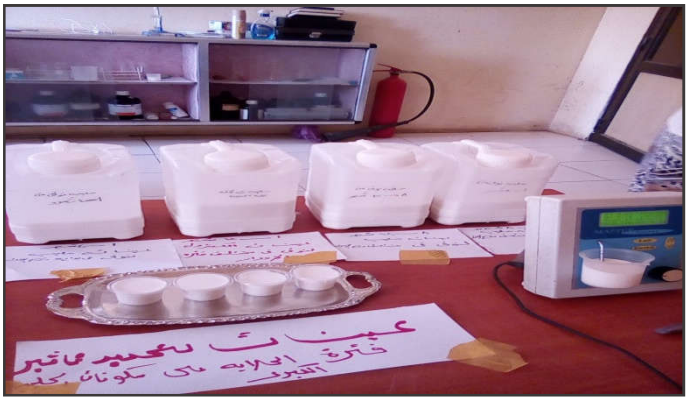

Plate (6) Samples Prepared for the analysis

RESULTS AND DISCUSSION

Impact of lactation stage on chemical composition of Camel milk

Camel milk composition as affected by the stage of lactation is presented in table (1*)*. The results indicated significant differences (P≤0.05) in milk chemical composition as affected by lactation stage. The values showed significantly (P≤0.05) higher fat content of milk samples taken from group at early lactation stage (1-4 months), A, followed by the samples from medium lactation (5-8 months), B, then those at late lactation stage (9-12month) C. The highest fat percentage was A 4.28, medium in B 4.20 and lowest in C 3.98. As for the protein, percentages were 4.62, 3.59, and 3.40% for A, B and Cm respectively. As for lactose, it was the highest in samples of group A (6.26%) followed by those of group B.(4.82) and the low in group C (4.61%). The solids non fat values were highest in sample of group A (11.86%), followed in samples in group B (9.15%) the lowest in group C (8.74%). The mineral contents were the lowest in samples of group A (0.71), followed by those from group B (0.75) and the highest in samples of group C (0.97). The concentration of nutrients was similar in all the samples (A, B and C.) and the degree of temperature of milk under the same conditions was highest in samples of group B (21.5%), followed by those taken from A (21.1%) and the lowest in group C samples (21.1%). and this refereed to the concentration

The effects of lactation stage on sensory evaluation of camel milk

Comparing the chemical composition with sensory evaluation of camel milk in its natural condition without adding flavoring and sweeteners and taking lactation stage into account, it was found that the color was perceived being gradually change with advance of lactation stage in the three stages: first, medium and late lactation stage were given (3.64±0.11, 3-25±0.12 and 3.14±o.3) chi square values Table (3)**.** This change of color in sensory valuation of milk was attributed to the protein and the fats contents in the chemical composition concomitant with the change of fat and the protein % in camel milk. The camel milk was scored whiter in color compared with cows and sheep whereas the color degree was affected by the stage of lactation stage where the color was found to be very white for milk samples taken from she-camels at early lactation stage and white in samples from she-camels at medium stage of lactation and nearly white yellowish in milk samples taken at late stage of lactation stage. The results of this study are in agreement with results reported by some authors who found that highly % fatty acids in camel milk are palmitic and oleic acid that determined milk color (Attila *et al.,* 2000). Camel milk also contains a higher concentration of long-chain fatty acids compared to cow milk (Konuspayeva*et al*., 2009). Similarly, average values of unsaturated fatty acids (43%) are higher in camel milk, especially essential fatty acids (Haddadin*et al.,* 2008). The amount of saturated fatty acids (Konuspayeva*et al*, 2009) is higher in cow milk (69.9 %) than in camel milk (67.7 %). All those factors affected milk color.

Taste of milk was offered 3.17±0.15/ 2.65 ± 0.14 / 2.55 ± 0.2 chi square values for early, medium and late stages of lactation, respectively Table (3)**.** The values were concomitant with the ratio of lactose level in milk for the three groups early medium and late lactation stages where lactose values were: 6.26, 4.82 and 4.61% respectively and taste was reported being little salty, moderate salty and very salty respectively. At the same time there was high lactose, fat and the protein at the first stage of milk period, and their values gradually changed with advanced lactation stage.

Camel milk composition analysis through lactation stages table (1)

Camel milk composition		lactation stage by month				
Summary	**She-Camel Milk Composition**	**First A)(**	**Mid)B(**	**Late C)(**	**Milk Mix From Different Stage(D)**	**SE**
F	Fat	4.28	4.20	3.8	4.06	.8013**
SNF	salt non fat	11.86	9.15	8.74	8.85	.7417**
D	Density	37.43	30.28	28.57	29,10	2.059**
FP	fairing point	0.79	0,5.7	0.54	0,55	. 05949**
P	Protein	4.62	3.59	3.40	3.45	.3070**
L	Lactose	6,26	4.82	4.61	4.60	.3981**
S	Salt	0, .71	0.75	0.79	0.72	.06142**
AD.W	add water	00.0	00.0	00.0	00.0	00000
C	Concentration	11	11	11	11.5	.12900*
TE	Teampritsure	21.12	21.5	21.1	21.8	.3350***

Protein and fatty acids analysis

In she-camelsmilk protein were recorded non-significantly incasein and lacto-albumin *(*P≥o.o5) while significantly higher albumin together withincrease in she-camels milk fat where it recorded significantly (p≤o.o5) higher values table (2). Dominant fatty acids in camel milk are palmitic and oleic acid (Attila *et al.,* 2000).

Protein and fatty acids analysistable (2-4)

	Items	N	Means	SE
PROTEIN	Casein	2	2.100	.2000ns
	ALBIOMN	2	0.34	000000
	Lacto globulin	2	.3150	.0350ns
Fat Fa		2	7.80	00000

Impact of lactation stages on Sensory Evaluation of Camel Milk

The results showed that the sensory evaluation of she-camels milk at different lactation stages were significantly (P<0.05) affected by husbandry, stage of lactation. Results recorded for the Sensory evaluation of camel milk showing values for color, Taste, textures, Flavor, acceptability and quality is presented in Table (3).

Fresh Camel milk

In she-camels milk, at early stages of lactation highly significant values were recorded. These values were 3.64+0.11%3.17+0.15 %3.88+0.21%3.39+0.20% 3.86+0.21% for color, taste, textures flavor and quality while significant values were also given for Acceptability (3.55+0.19%) in she-camels milk at medium stages of lactation were recorded highly significant values of 3.25+0.12%2.65+0.14%3.96+0.19%3.44+0.18% 3.48+0.22% in color, Taste, textures flavor and quality while significantly values in acceptability values were also recorded (3.51+0.17%) in she-camels milk taken at late, stages of lactation were recorded values with high significantly differences (P<0.05) 3.14+0.13% 2.55+0.21 %3.68+0.18%3.36+0.22% 3.39+0.19% in color, taste, textures flavor, Quality while significantly in acceptability (3.28+0.2%).

CONCLUSIONS

It was concluded that she-camel chemical composition changed with advance of stage of lactation. That change in percent constituents especially lactose, protein and minerals changed its qualitative characteristics and acceptability of consumers of milk.

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