

## Chapter one:-

### Introduction

The Sudan has ranked second country in total camel in Africa after Somalia, the population of camel milk in Sudan is estimated to be 4.7 million heads distributed kordofan, Darfur, Eastern-Northern and central states, the country owned 25% of the world camel, about 38.5% of the Arab world camel (Goreish, 2013).also another study showed that the camel population in Sudan exceeded four millions also as source of local and foregoing trade (Ali and Ahmed, 2013).

It is known that camel is the animal adapted to the arid lands in the old world, in Africa and in Asia. The north of Sudan is widely included in arid areas of African continent and the camel population is concentrated between approximately isohyets 100 and 300 mm , constituting the “camel belt”. This area includes the states of North and South-Darfur, North and South-Kordofan, Khartoum, Gezira, Kassala, Red Sea, River-Nile, Northern Sudan, White Nile, Blue Nile and Sennar State. North Kordofan state only has the highest camel population with more than one million heads, representing approximately 5% of the whole world camel population. However, this population is moving and a slight expansion of the camel belt to the South is observed since one decennial as in other countries of Sahel region (Faye 2009).

## Objectives of study:-

- 1/ To estimate the camel milk production and consumption in South Kordofan state.
- 2/ To study the husbandry practices of camel rearing in the area and to specify the owners of the camel.

# Chapter two

## Literature review:-

### 2.1/Milk production

Elzubeir *et al* (2014) reported that activities associated with camel milk production such as frequency and responsibility of milking ,selling milk and processing milk into other products ,camel herders in the semi intensive system are adopting rational and goal oriented management strategies ,therefore improved feeding system ,milking production in commercial level regular two time milking /day. Eissa and Mustafa (2011) reported that milk yield of Sudan camel can reach 10 kg/day in the early lactation and good conditions and declined to 2 kg/day in the late lactation and bad conditions (in best animal) otherwise it range 5 - 10 kg / day, most of the camel milk in Sudan is drunk fresh and sometimes sour (fermented) (Garris) or with tea (Sbanes).

Processing and manufacturing of camel milk in to milk products like butter, ghee, cheese, ice cream, etc.The average production for she camel was 1.5 liters per day this study conducted in Khartoum state (Zaied, 2007).

Estimation of camel milk production was found to be (1500-3000) liters per day for a she camel (Hassan, 1994). The camel milk yield produced was varied from (4-12) liter and that a she camel milked twice a day this in study conducted in Pakistan (Aujla *et al*, 1998).

The camel milk yield produced was 42000 ton as average annual (Noor and Idries, 2007). Also she camel produced 8 to 10 liters per day, and the average period of lactation was 14 months (Tekle, 1989).

The quantity of camel milk produced daily per she camel was 8.4 and 4.75 liters in wet and dry seasons, and the period of lactation was 13.38 month on average in Ethiopia (Gebissa, 2015).

The productivity of camel milk in Sudan was between 820 and 2400 liter /lactation for 12 – 18 months lactation (Faye, 2009).

Also the camel milk yield was ranged from 8.4 to 4.75 liters daily and the lactation period of camel milk was 13.38month on average in Ethiopia (Gebissa, 2015)

Other study showed that she camel produce 8 – 10 liter per day, and average period of lactation was 14 month (Tekle, 1989).

## **2.2/Camel milk products:**

### **2.2.1/ Camel cheese;-**

Investigated manufacturing procedures and compositional characteristics of fresh soft camel chase manufactured from camel milk by using ultra filtration (UF) and found that it was higher moisture and ash ,whereas protein and fat content were lower compared to chase manufactured by traditional methods ,also for sensory evaluation ,the scores for texture and overall acceptability of chase by (uf)were higher than traditional method (Mehaia,2006).

The camel milk was filtered and heated to 72°C/15 seconds CaCl<sub>2</sub> (0.02 %) or CaSO<sub>4</sub> (0.015 %) was added with continuous shaking. After wards allowed

cooling up to 40°C and 1 % starter culture was added. The temperature was maintained for 35°C-40°C and after 30 minutes different concentrations of rennet/pepsin were used for the coagulation of milk and 600 mg/L rennet/pepsin was found to be sufficient for the coagulation of camel milk. At this concentration, coagulation time was found to range between 1.5-2 hours for rennet and 10-15 minutes for pepsin. Further coagulated milk was kept for 2 hours at 40°C and afterwards cutting was done. After cutting the cheese curd, cooking was performed at 40°C till the whey gets separated. Moisture, fat and yield of cheese were 38-45 %, 18-22 % and 7-9 % respectively (Mal and Pathak, 2009).

A total of percentages of camel milk and camel milk products by survey in three Ethiopia zone in Garisa, Wajir and Eastleigh the main urban centres with high camel milk consumption. 75% of the respondents generally take camel milk or milk products every day. Raw and sour milk are the most popular products. The most important purchasing criterion for raw camel milk was taste (19 and 18%) while packaging was more important for pasteurized milk (18, 18 and 16%) for Wajir, Garisa and Eastleigh respectively.

For Yoghurt, the most important purchasing criteria were taste (18%) and aroma (19%). The taste of sour milk is the most important attribute in both Garisa (30%) and Eastleigh (24%). To enhance marketing of camel milk, the appropriate attributes demanded by customers needs to be seriously addressed. Promotion of camel milk and products to non conventional consumers should be done in order to increase their consumption (Akweya *et al*, 2012).

## **2.2.2/ Fermented camel milk:**

Burntse (2002) stated that produced cultured camel milk by straining the milk to remove dirt particles, boiling, cooling to ambient temperature. Also indicated that in Kasala and Tambool the product is called (roub) (Suliman *et al*, 2006).

### **2.2.2.1/Fermented camel milk (gariss):**

The period of the fermentation is age of gariss which was reported by the persons responsible for gariss production four different ages of gariss were registered (5-8hour, 12hrs, 48hrs and more than 48hrs.) each fermentation time (age of gariss) was analyzed for the physico-chemical properties of gariss prepared from different location and in different seasons in Kordofan and Khartoum production sites, gariss has different in physico-chemical properties (Mohamed *et al*, 2013).

## **2.2.4/ Pasteurized camel milk:**

The camel milk had pasteurized at 72 °C for 5 minutes (Wernery *et al*, 2003). Camel milk has major role in the nourishment of the pastoralist as constraints all the essential nutrients found in bovine milk, most of camel milk produced is consumed locally as it does not reach the urban markets because of many constraints, currently there are increasing demand of camel milk among the urban settlers, which are due mainly to the increase awareness on its medicinal value (Elzubeir, 2014).

## **2.3/ Factors facing camel milk:-**

Milk has a very wide importance both as a source of food and source of income in pastoral and agro-pastoral areas. On the contrary, the level of milk production is very low because of low production from endogenous milk cow and camel. Even at the present level of milk production, the product suffered lack of market and low price. Measures to solve the problem were limited partly for reasons of little research done and lack of attention given to the livestock subsector by policy markets (Demissie, 2014).

The study showed that the camel milk production affected many factors such as: farming system, productivity traits, season, and stage of the lactation and parity on milk production and composition of camel kept under pastoral environment, in central Punjab, Pakistan (khan et al, 2012).

## **2.4/ Chemical composition of camel milk**

The chemical composition and nutritional quality of camel milk was studied. Results showed 11.7% total solids, 3.0% protein, 3.6% fat, 0.8% ash, 4.4% lactose, 0.13% acidity and a pH of 6.5. The levels of Na, K, Zn, Fe, Cu, Mn, niacin and vitamin C were higher and thiamin, riboflavin, folacin, vitamin B<sub>12</sub>, pantothenic acid, vitamin A, lysine and tryptophan were relatively lower than those of cow milk. Gas liquid chromatography analysis of milk fat showed a molar percent of 26.7 for palmitic, 25.5 oleic, 11.4 myristic, and 11.0 palmitoleic. In vitro protein digestibility and calculated protein efficiency ratio values were 81.4% and 2.69, respectively (Khalil *et al*, 2006)

### **2.4.1/Fat content:**

The camel milk fat has been characterized according to several approaches and also found that camel milk fat different when compared with the cow milk fat ,camel milk fat content is low in cholesterol and fat ranged from 1.8 to 2% fat when compared with 3.5 to 4% of cow fat (Basheer and Ali,2013).also other study showed the camel milk content varies between 2.9 - 5.4% of the less content of short-chained fatty acid than that of Buffalo and ewe milk fat (Mehia, 2006).

### **2.4.2/Vitamin content:**

Camel milk has a high nutritive value with quantity of vitamin (c) ,the milk contained high level of vitamin (c) and niacin (Thiagarajan,2001).

Also other study showed that the camel milk vitamin content is increase than other cattle milk, is three to five times more vitamin C than Cow milk, also rich in B vitamins (Bashir and Ali, 2013).

## **2.5/Husbandry of camel milk:**

The camel milk breeder kept their animals in Kraal made up of thorny bushes to protect the animal from some predator ,except calves where they kept in Calves pens ,all categories of camel house together ,kraal was cleaned every of  $14.3 \pm 15.22$  days interval ,also daily milking frequencies were 3 times during wet season(Gebissa, 2015).Also found that good feeding and watering



important for camel milk production ,so camel move 14-20kms away from their village in search feed to meet their nutritional requirements ,by grazing on the trees and grasses when trees not available ,during rainy season camel added salty with their forage ,in addition she camel milked and suckled by calf (Tekle,1989) .

The camel herd was managed by husbandry system based on practices ,by transhumant made of move with their herd from one area to another ,the herd grazing on sorghum residues in dry season and some *Acacia spp.* and they move to forest in the rain season, then the herd was driven to hafeers (constructed water reservoirs) once every three days ,and young calves were allowed to stay freely with their mother and were only separated at milking time which practiced three times a day, the practice of milking as: processing done in standing position with one knee raised to the support plastic pail ,the milker stood on one leg putting the plastic pail in this other leg and used both hands for milking (Salman, 2002).

## **2. 6/Camel milk consumption:**

Milk is as ancient as mankind itself, as it is the substance created to feed the mammalian infant. All species of mammals, from man to whales, produce milk for this purpose. Many centuries ago, perhaps as early as 6000-8000 BC, ancient man learned to domesticate species of animals for the provision of milk to be consumed by them. These included cows (genus *Bos*), buffaloes, sheep, goats, and camels, all of which are still used in various parts of the world for the production of milk for human consumption (Webb et al., 1974).

Camel milk is traditionally consumed raw by pastoralists. For a long time, camels were kept for subsistence and only a limited amount was being sold. The demand for camel milk has increased today due to its high nutritional and therapeutical value. The pastoralists now sell camel milk as an income generating activity (Farah 1996). The bulk of marketed milk reaches the consumers through informal marketing channels (Matofari 2007).

Raika community in Jodhpur district in India is commonly known for keeping camels and might have been consuming camel milk in their diet, the camel milk consumption may be responsible for reduction of the occurrence of Diabetes in the Raika community which is researchable issue. With this aim present study was conducted in Raika community comprising of 258 individuals from two villages viz. Mongra and Bhatinda of Jodhpur district, Rajasthan. The usage of camel milk and diabetes nearly 27 percent of the Raika community kept she camel but consumption of camel milk by the Raika community was less (18.6 %) and consuming low quantity( Raj, 2008).

Camel's milk can be consumed by patients intolerant to lactose without undesirable reactions. Twenty-five patients with clinical and laboratorial diagnosis of lactose intolerance underwent provocation tests with growing amounts of cow's milk and subsequently with camel's milk. Results except for two patients, who had mild reactions to the maximum dosage of camel's milk (250 mL), the acceptance was excellent. Pasteurization of camel's milk did not affect tolerance. Also, most of the patients showed significant clinical reactions when drinking very low amounts of cow's milk (Cardoso *et al* ,2010).

To enhance marketing of camel milk, the appropriate attributes demanded by customers needs to be seriously addressed. Promotion of camel milk and products to non conventional consumers should be done in order to increase their consumption.( Akweya *et al*,2012).

## **2.7/Medicine value of camel milk:**

In India used camel milk as therapy for jaundice, anemia, leshmaniasis and Tuberculosis (Rao *et al*, 1970). Also found camel milk used as therapy for: Stress, peptic ulcer and skin cancer (Wernery, 2003).

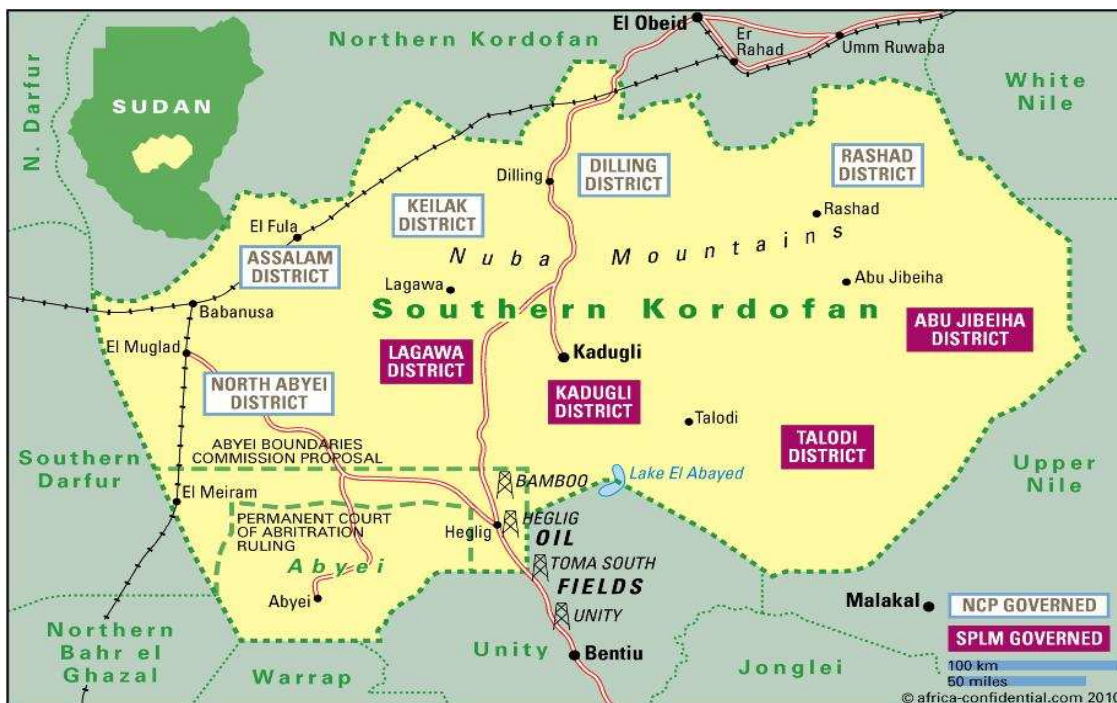
Therefore camel milk used against pathogenic strain of Escherichia coli and listeria monocytogenes and found that camel milk colostrums samples had bacteriostatic effect against them (Benkerroum *et al*, 2004).

# Chapter Three:- Materials and Methods

## 3.1/ Area of Study:

South Kordofan is one of the states of Sudan it is located in southern Sudan (North ) jointed with north Kordfan in northern direction , with Wight Nile state from north –east direction and with southern Sudan (southern ) in south direction , It has an area of 158,355 km<sup>2</sup> and an estimated population of approximately 1,100,000 people (2000),kadogli is the capital of the state , it has many type of livestock such as cows , seeps , goats and camel .

There are 9 districts of Southern Kordofan state these are: Tlodi, Kadogli, Eldalanj, Elrshad, Abugbiha, Elabbasia, Eldbibat, El leeri and Klogi.



South Kordofan State map- africa confidential.com

### **3.2/ Experimental design;**

The study was conducted at South Kordfan State during the period March 2014 included three districts ( Tlodi, Kadogli and Eldalanj)., Structured questionnaires were distributed to 60 of camel milk consumers (20 for Tlodi, 20 for Kadogli and 20 for Eldalanj) and then 38 questionnaires were also distributed to producers (18 for Tlodi, 10 for Eldalanj and 10 for Kadogli).

### **3.3 Statistical analysis:-**

In this study SPSS Program was use for the analysis of data. ANOVA (analysis of variance) was used to test the variability of different variables among camel milk producers in different areas and household heads. Chi-square test was used to examine differences between levels of significance of different variables among different areas between household heads for parameters such as type of income; importance of dairy animals, constraints in dairy production, feed and water shortage. Descriptive analysis in terms of percent was also used in this work.

# Chapter Four

## The result

### 4.1/ Camel milk production: \_

The data in table (1) showed that 50 % of respondents producers were male and 50% of them were female in Tlodi ,while 90% male and 10%female in Khadogli ,and 80% male and 20% female in Eldalanj.

Results in table (2) revealed that all respondents in Tlodi were in Khalwa stage, while in Khadogli 40% Khalwa, 20% Basic and 40% secondary IN Eldalanj 10% Kalwa, 50% basic , 30% middle and 10% secondary.

The quantity of milk she camel produced per day represented that 11.1% of the producers in Tlodi said that (1-2 liters) and 88.9% said (over 3-4 liter ), while in Khadogli area 100% of producers said that (over 2-3 liter ). In Eldalanj 90% of the producers said (over 2-3 liter) and only 10% said (over 3-4 liter) (table 3).

Data in table (4) showed no significant variations were found between the three areas in the mean values of the quantity of milk produced per day by the camel.

**Table (1) sex of producers**

<b>Locality</b>	<b>Male</b>	<b>female</b>
<b>Tlodi</b>	50%	50%
<b>Kadogli</b>	90%	10%
<b>Eldalanj</b>	80%	20%
<b>Total</b>	68.4%	31.6%

**Table (2) Educational stages for producers:**

<b>Locality</b>	<b>khalwa</b>	<b>Basic</b>	<b>Interm. secondary</b>	<b>university</b>	<b>postgraduate</b>
<b>Tlodi</b>	100%	0%	0%	0%	0%
<b>Kadogli</b>	40%	20%	0%	40%	0%
<b>Eldalanj</b>	10%	50%	30%	10%	0%
<b>Total</b>	60.5%	18.4%	7.9%	13.2%	0%

**Table (3) Quantity of milk she camel produces per day**

<b>Locality</b>	<b>1-2liter</b>	<b>Over 2-3liter</b>	<b>Over3-4liter</b>	<b>More</b>
<b>Tlodi</b>	11.1%	88.9%	0%	0%
<b>Kadogli</b>	0%	100%	0%	0%
<b>Eldalanj</b>	0%	90%	10%	0%

**Table (4) Quantity of milk she camel produced per day:**

<b>Locality</b>	<b>In liters</b>
<b>Tlodi</b>	1.89 ± 0.32 <sup>c</sup>
<b>Kadogli</b>	2 ± 0.00 <sup>b</sup>
<b>Eldalanj</b>	2.1 ± 0.32 <sup>a</sup>
<b>Sig</b>	*

Means bearing different superscripts are significantly different (P>0.05)



Data in table (5) explained that 66.7% of respondents used corn meal for camel milk production while only 11.15% of them used sesame meal in Tlodi. However, in Khadogli 60% of producers used Groundnut meal and 40% sesame meal whereas, in Eldalanj 70% of the respondents used Groundnut meal and 30% sesame meal for their lactating she – camels.

Considering the logistic problems associated with camel milk production in the area in Tlodi only 5.6% of respondents said drought affected camel milk production while, 77.8% of the respondents said war is the main problem. However, in Khadogli 40% for each of the respondents said war and epidemics diseases and 20% of them said high cost of feeding and medicine. In Eldalanj 50% said war, 30% raids, 10% high environmental conditions and 10% epidemics diseases table (6).

The data in table (7) indicated that 83.3% of respondent's inTlodi said use of camel milk was for food and 16.7% of them were for therapy, while in Khadogli and Eldalanj all of them said for food.

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**Table (5) feeds to maximum milk production:**

<b>Locality</b>	<b>Groundnut meal</b>	<b>Corn meal</b>	<b>Sesame meal</b>
<b>Tlodi</b>	40%	66.7%	11.15
<b>Kadogli</b>	60%	0%	40%
<b>Eldalanj</b>	70%	0%	30%

**Table (6) Effect of Logistic problems on milk production:**

locality	drought	War	Raids	Harsh environmental condition	Epidemics disease	High cost of feeding medicine
Tlodi	5.6%	77.8	16.7	0%	0%	0%
		%	%			
Kadogli	0%	40%	0%	0%	40%	20%
Eldalanj	0%	50%	30%	10%	10%	0%

**Table (7) Use of camel milk:**

<b>Locality</b>	<b>Food</b>	<b>Therapy</b>
Tlodi	83.3%	16.7%
Kadogli	100%	0%
Eldalanj	100%	0%

The data in table (8) demonstrated that 100% of respondents producers in the area said the milking intervals for she camel were two times per day , and also 100% of them said the suitable time for milking she camel was in evening and morning (Tlodi , Kadogli and Eldalanj). Also the results indicated that 100% of respondent producers said the she camel was milking with calf (table 9).

The data in table (10) showed that 44.4% of respondents in Tlodi said they used corn meal as feed to camel , 50% groundnut meal and 5.6% sesame meal, while in Kadogli 100% used sesame meal , and in Eldalanj 90% groundnut meal and 10% sesame meal .

Table (11) showed that the main diseases in the area were Goffar (*Trypanosoma evansi*) and Groub (*Sarcoptes scabiei*) , 83.3% of respondents in Tlodi said Goffar disease was prevalent in the area while 16.7% they said Grub. In Kadogli 70% said Goffar and 30% Grub and in Eldalanj 20% Goffar and 80% grub.

Results in Table (12) revealed that 5.6% of respondents in Tlodi said seasonal changes affected camel milk production while 94.4% of them said did not affected. However, in Kadogli and Eldalanj 100% of them said affected.

The average numbers of lactating she camels owned by the individual producer in the area is 33 she camels. The results showed that (table 13) the highest numbers ( $46.888 \pm 33.638$ ) of lactating she camels was found in Tlodi area while the lower numbers ( $16.6 \pm 6.0221$ ) were in Kadogli.

**Table (8) Milking intervals for she camel;**

<b>Locality</b>	<b>Once</b>	<b>Two time</b>	<b>Three time</b>	<b>more</b>
<b>Tlodi</b>	0%	100%	0%	0%
<b>Kadogli</b>	0%	100%	0%	0%
<b>Eldalanj</b>	0%	100%	0%	0%

**Table (9) Milking for she camel with**

<b>Locality</b>	<b>Calf</b>	<b>Without calf</b>
<b>Tlodi</b>	100%	0%
<b>Kadogli</b>	100%	0%
	100%	0%
<b>Eldalanj</b>		

**Table (10) feeds used by producers of camel milk:**

<b>Locality</b>	<b>Corn meal</b>	<b>Groundnut meal</b>	<b>Sesame meal</b>
<b>Tlodi</b>	44.4%	50%	5.6%
<b>Kadogli</b>	0%	0%	100%
<b>Eldalanj</b>	0%	90%	10%

**Table (11) camel disease:**

<b>Locality</b>	<b>Goffar</b>	<b>Grub</b>	<b>Reeh (CBPP)</b>	<b>Abufishafish (pleuroneumonia)</b>	<b>none</b>
<b>Tlodi</b>	83.3%	16.7%	0%	0%	0%
<b>Kadogli</b>	70%	30%	0%	0%	0%
<b>Eldalanj</b>	20%	80%	0%	0%	0%

**CBPP = Contagious bovine Pleuropneumonia disease**

**Table (12) Effect of seasonal changes on milk production:**

<b>LOCALTY</b>	<b>YES</b>	<b>NO</b>
<b>TLODI</b>	5.6%	94.4%
<b>KADOGLI</b>	100%	0%
<b>ELDALANJ</b>	100%	0%

**Table (13) the number of lactating she camel per producer**

<b>Locality</b>	<b>No. she camels</b>
<b>Tlodi</b>	46.88 ± 33.63 <sup>a</sup>
<b>Kadogli</b>	16.6 ± 6.02 <sup>c</sup>
<b>Eldalanj</b>	37.3 ± 21.94 <sup>b</sup>
<b>Grand Mean</b>	33.596
<b>Sig.</b>	*

Means bearing different superscripts are significantly different (P>0.05)

## **4.2/ Camel milk consumption;**

The data in table (14) showed that 60% of consumers in Tlodi were male, 40% female while in Eldalanj 85% male and 15% female, in Kadogli 90% male and 10% female. Table (15) showed about 10% of respondents in Tlodi Khalwa , 30% Basic , 15% Intermediate , 25% Secondary and 20% university , while in Eldalanj 15% Khalwa , 20% basic , 15% Intermediate , 35% Secondary and 15% University , in Kadogli 20% Khalwa , 20% basic , 10% Middle , 10% Secondary and 40 % University .

The data in table(16) showed that 20% Of respondents in Tlodi have large family ( over 10 individuals ) , 55% medium family (6-10 ) and 25% small family (1-5) while in Eldalanj 10% large family , 40% middle family and 50% small family , in Kadogli 5% large family , 50% middle and 45% small family.

The data in table (17 ) showed that 85% of respondents in Tlodi milk of camel , 15% not prefer , while in Eldalanj 80% prefer , 20% not prefer , in Kadogli 70% prefer and 30% not prefer . ,

The data in table (18) showed that 30% of respondents in Tlodi drink milk of camel as raw , 70% as heated , while in Eldalanj 45% as raw , 55% heated , in Kadogli also same them. .

The data in table (19) showed that 65% of respondents Tlodi use gariss, 35% roub, while in Eldalanj 85% gariss, 5% cheese, 10% roub, in Kadogli 85% gariss and 15% roub.



**Table (14) Sex type of consumers**

<b>Locality</b>	<b>Male</b>	<b>Female</b>	<b>Total</b>
<b>Tlodi</b>	60%	40%	100%
<b>Eldalanj</b>	85%	15%	100%
<b>Kadogli</b>	90%	10%	100%
<b>Total</b>	78.3%	21.7%	100%

**Table (15) Educational stages of consumers**

<b>Locality</b>	<b>khalwa</b>	<b>basic</b>	<b>Interm.</b>	<b>secondary</b>	<b>university</b>	<b>total</b>
<b>Tlodi</b>	10%	30%	15%	25%	20%	100%
<b>Eldalanj</b>	15%	20%	15%	35%	15%	100%
<b>Kadogli</b>	20%	20%	10%	10%	40%	100%
<b>Total</b>	15%	23.3%	13.3%	23.3%	25%	100%

**Table (16) the members of family**

<b>Locality</b>	<b>Large family(over 10 individuals)</b>	<b>Medium family(6-10)</b>	<b>Small family(1-5)</b>	<b>Total</b>
<b>Tlodi</b>	20%	55%	25%	100%
<b>Eldalanj</b>	10%	40%	50%	100%
<b>Kadogli</b>	5%	50%	45%	100%
<b>Total</b>	11.7%	48.3%	40%	100%

**Table (17) the Preference of camel milk**

<b>Locality</b>	<b>Prefer</b>	<b>Not prefer</b>	<b>Total</b>
<b>Tlodi</b>	85%	15%	100%
<b>Eldalanj</b>	80%	20%	100%
<b>Kadogli</b>	70%	30%	100%
<b>Total</b>	78.3%	21.7%	100%

**Table (18) Drinking camel milk:**

<b>Locality</b>	<b>Raw</b>	<b>Heated</b>
<b>Tlodi</b>	30%	70%
<b>Eldalanj</b>	45%	55%
<b>Kadogli</b>	45%	55%
<b>Total</b>	24 40%	36 60%

**Table (19) Type of milk products**

<b>Locality</b>	<b>Gariss</b>	<b>Cheese</b>	<b>Roub</b>
<b>Tlodi</b>	65%	0%	35%
<b>Eldalanj</b>	85%	5%	10%
<b>Kadogli</b>	85%	0%	15%
<b>Total</b>	78.3%	1.7%	20%

The data in table (20) showed that 95% of respondents in Tlodi drink gariss , 5% never drink , while in Eldalanj 80% drink , 20 % never drink , in Kadogli 80% drink and 20% never drink

The data in table (21) showed that 40% of respondents in Tlodi use camel milk as therapy for diabetes , 20% for jaundice , 40% leshmaniasis ,while in Eldalanj 55% diabetes 45% leshmaniasis , in Kadogli 50% diabetes , 16.7% jaundice and 33.3% for leshmaiasis. . .

The data in table (22) showed that 60% of respondents in Tlodi use milk of camel mixed with urine as therapy , 40% never use , in Eldalanj 75% use , 25% never use , in Kadogli 90% use and 10% never use .

The data in table (23) showed that 55% of respondents in Tlodi drink milk with sugar, 45% without sugar, in Eldalanj 50% with sugar and also 50% without sugar , while in kadogli 42.9% with sugar and 57.1% with sugar .

The data in table (24) showed that 35% of respondents in Tlodi use additives to milk to improve flavor , 65% for taste , in Eldalanj 60% flavor and 40% taste while in Kadogli 55% flavor , 10% texture and 35% taste.

The data in table (25) showed that 45% of respondents in Tlodi use additives like pepper , 25% cinnamon , 30% ginger , in Eldalanj 25% pepper , 50% cinnamon , 30% ginger and 15% helba , while in Kadogli 10% pepper , 45% cinnamon , 30% ginger and 15% helba .

The data in table (26) showed that 90% of respondents in Tlodi use milk as

therapy for other disease, 10% never use, in Eldalanj 80% use and 20% never use , while in Kadogli 70% use and 30% never use .

The data in table (27) showed that 20% of respondents in Tlodi differentiate camel milk to less sweet, 65% salty, 10% high viscosity, 5% less viscosity, in Eldalanj 25% less sweet , 75% salty , while in Kadogli 100% salty .

The data in table (28) showed that 50% of respondents in Tlodi said milk of camel available in summer, 50% in winter, in Eldalanj 55% in summer and 45% winter while in Kadogli 45% in summer and 55% in winter.

The data in table (29) showed that 60% of respondents in Tlodi said owners of camel milk came from ELhammar , 40 % Shnabela , in Eldalnj 65% Hammer , 35% Shanabela , also in Kadogli same percentage.

The data in table (30) showed that respondents in Tlodi said price for one liter of camel milk is  $3.55 \pm 0.51$  SDG , while in ELdalanj is  $2.85 \pm 0.37$  SDG , in Kadogli is  $2.35 \pm 0.49$  SDG (mean  $\pm$  standard deviation ).

The data in table (31) showed that 65% of respondents in Tlodi consumed milk as fresh , 35% as fermented , while in Eldalanj 85% as fresh and 15% fermented , in Kadogli 65% as fresh and 35% as fermented milk .

The data in table (32) showed that respondents in Tlodi said they consumed quantity  $0.55 \pm 0.25131$  liter per individual per day , while in Eldalanj  $0.5 \pm 0.24333$ , and in Kadogli  $0.43 \pm 0.029742$  liter per individual daily .

The data in table (33) showed that 75% of respondents in Tlodi utilized

camel milk in traditional food as mullah , 10% in maddida and 15% in ghee , while in Eldalanj 70% in mullah , 5% in salat and 25% in maddida , in Kadogli 75% in mullah , 10% in salat and 15% in Maddida .

**Table (20) Drinking gariss**

<b>Locality</b>	<b>yes</b>	<b>No</b>	<b>Total</b>
<b>Tlodi</b>	95%	5%	100%
<b>Eldalanj</b>	80%	20%	100%
<b>Kadogli</b>	80%	20%	100%
<b>Total</b>	85%	15%	100%

**Table (21) Use milk as therapy for:**

<b>Locality</b>	<b>Diabetes</b>	<b>Jaundice</b>	<b>Leshmaniasis</b>
<b>Tlodi</b>	40%	20%	40%
<b>Eldalanj</b>	55%	0%	45%
<b>Kadogli</b>	50%	16.7%	33.3%
<b>Total</b>	48.3%	12.1%	39.7%

**Table (22) Use milk mixed with urine as therapy:**

<b>Localty</b>	<b>Yes</b>	<b>No</b>
<b>Tlodi</b>	60%	40%
<b>Eldalanj</b>	75%	25%
<b>Kadogli</b>	90%	10%

**Table (23) Drinking milk with**

<b>Locality</b>	<b>Sugar</b>	<b>without</b>
<b>Tlodi</b>	55%	45%
<b>Eldalanj</b>	50%	50%
<b>Kadogli</b>	42.9%	57.1%

**Table (24) Additives to milk to improve**

<b>Locality</b>	<b>Flavor</b>	<b>texture</b>	<b>taste</b>
<b>Tlodi</b>	35%	0%	65%
<b>Eldalanj</b>	60%	0%	40%
<b>Kadogli</b>	55%	10%	35%

**Table (25) Type of additives:**

<b>Locality</b>	<b>pepper</b>	<b>cinnamon</b>	<b>Ginger</b>	<b>tee</b>
<b>Tlodi</b>	45%	25%	30%	0%
<b>Eldalanj</b>	25%	50%	0%	10%
<b>Kadogli</b>	10%	45%	30%	0%



**Table (26) Use milk as therapy for other disease**

<b>Locality</b>	<b>yes</b>	<b>No</b>
<b>Tlodi</b>	90%	10%
<b>Eldalanj</b>	80%	20%
<b>Kadogli</b>	70%	30%

**Table (27) Differentiate camel milk**

<b>Locality</b>	<b>Less sweet</b>	<b>High sweet</b>	<b>Salty</b>	<b>High viscosity</b>	<b>Less viscosity</b>	<b>Good flavor</b>
<b>Tlodi</b>	20%	0%	65%	10%	5%	0%
<b>Eldalanj</b>	25%	0%	75%	0%	0%	0%
<b>Kadogli</b>	0%	0%	100%	0%	0%	0%

**Table (28) Milk available mainly in**

<b>Locality</b>	<b>summer</b>	<b>winter</b>	<b>autumn</b>	<b>spring</b>
<b>Tlodi</b>	50%	50%	0%	0%
<b>Eldalanj</b>	55%	45%	0%	0%
<b>Kadogli</b>	45%	55%	0%	0%

**Table (29) Owners of camel:**

Locality	hammer	shanabla	kwahla	other
Tlodi	60%	40%	0%	0%
Eldalnj	65%	35%	0%	0%
Kadogli	65%	35%	0%	0%

**Table (30) Price per liter milk:**

Locality	In SG
<b>Tlodi</b>	3.55 ± 0.51 <sup>a</sup>
<b>Eldalanj</b>	2.85 ± 0.36 <sup>b</sup>
<b>Kadogli</b>	2.35 ± 0.50 <sup>c</sup>
<b>Total</b>	2.92 ± 0.67
<b>Sig</b>	*

Means bearing different superscripts are significantly different (P>0.05)

**Table (31) Type of consumption milk:**

Locality	Fresh	Fermented
Tlodi	65%	35%
Eldalanj	85%	15%
Kadogli	65%	35%
Total	71.7%	28.3%

**Table (32) Quantity milk per individual:**

<b>Locality</b>	<b>Litres</b>
<b>Tlodi</b>	0.55 ± 0.25 <sup>a</sup>
<b>Eldalanj</b>	0.5 ± 0.24 <sup>b</sup>
<b>Kadogli</b>	0.43 ± 0.03 <sup>c</sup>
<b>Total</b>	0.49 ± 0.27
<b>Sig</b>	*

Means bearing different superscripts are significantly different (P>0.05)

**Table (33) Utilization of milk in traditional food:**

<b>Locality</b>	<b>mullah</b>	<b>Salat</b>	<b>Madida</b>	<b>ghee</b>
<b>Tlodi</b>	75%	0%	10%	15%
<b>Eldalanj</b>	70%	5%	25%	0%
<b>Kadogli</b>	75%	10%	15%	0%
<b>Total</b>	73.3%	5%	16.7%	5%

# Chapter Five

## Discussion

### 5.1 Camel milk Production:-

The results indicated that the producer of the camel's milk in the area is almost male (68.6%). However the female producers were only 31.4% (Table 1). In the three areas the results showed that higher percentage was reported for the male producers. This high percentage of the male producers could be due to the fact that the tribal traditions of the nomadic communities mainly dependent on male for rearing camels. These results were not in agreement with those of (Zaied, 2007)

Considering the educational situation the results reported that the Khalowa was highest (100%) in Tlodi while in Kadogli and Eldalanj were 40% and 50% respectively (Table 2) this probably might be due to the fact that most of producers were nomadic and no education services were provided with them. These results were not in accordance with those of Elamin (2014).

The quantity of milk she camel produced per day was (over 2 -3 liter) in the area. Also the results showed that the highest camel milk yield per day she camel produced was  $2.1 \pm 0.31$ L in Eldalanj while in Tlodi was  $1.89 \pm 0.32$  L (Table 3 and table 4) . This could be due to the problems of unavailability of good quality feed stuff because of the conflict arise there which make the nomads grazing in poor pastoral area. Our results were not coincided with those of Hassan (1994) and Hamad (2008).

The results of the study indicated that the main feed stuff of the camel in the area was corn, groundnut meal in Tlodi, Eldalanj and Kadogli respectively (Table 5). The variations in the different sources of the feeds used for maximum milk production could be due to the requirements of the farmers in the area who selected the type of the cash crop to be grown in the area.

The main logistics problems affected camel milk production in the area was war (table (7) this possibly due to most of respondent nomads were can not able to arrive rich grazing areas.

The milk of camel was used for food in high percentage by respondents producers was in both kadogli and Eldalanj while used less for therapy in Tlodi (table 8) this different could be due to knowledge of respondents about nutritional and therapeutic value of camel milk .

Considering water deprivation affected camel milk production high percentage of all respondent there was (100) this in three area (table 9) this could be due to if camel drank quantity of water was not sufficient can be produce less quantity of milk.

The milking interval for she camel was two times per day (table 10) this might be due to considerations of the camel herders they costumed to milk their she camel two times only. The result was in accordance with that of Elamin (2014).The respondents said that milking she camel with calf (table 11), this probably due to the milking requirements of the local camel breeds.

Regarding camel diseases the respondents producers said that Goffar was one of most important diseases dominated there in pastoral area this in Tlodi , while Garub was existent but in less percentage (table 11) this in line with Hammad (2008) the prevalence of the disease possibly due to suitable environment for growth of disease .

The study indicated that high number of lactating camel (  $46.89 \pm 33.64$  heads) were found in Tlodi while less numbers (  $16.6 \pm 6.02$  heads) were in Kadogli the results were not in agreement with Zaiid (2007).who found the high percentage (30.7%) of respondents said they have owned above 100 head of camels.

## **5.2/Camel milk consumption:**

The result indicated that most of respondents consumers there were male this in Kadogli while less of them were female this also in Kadogli too (table 14) this probablty due to most of respondent female were not response with questionnaire for traditional and social reasons.

The educational status for respondents consumers was University this in Kadogli as high percentage while lest percentage was Khalwa , Intermediate and Secondary in both Tlodi and Eldalanj (table 15) the high percentage of the University education of consumers in Kadogli might be due to fact that Kadogli is an urban area where early education was established than the other areas.

The family numbers of the consumers in the area ranged between (6-10 individuals) this in Tlodi while over 10 individuals this in kadogli (table 16) this might be due to social and traditional status of the consumers.

The high preference of camel milk for respondents consumers was in Tlodi while less of respondents were not preferred this in Tlodi too (table 17) this could be due to palatability and lactose intolerance for respondents, this result was not in agreement with Zaiid (2007) also was not in line with Hammad (2008) who stated 44% of the respondents preferred while 56% were not preferred..

The results indicated that high percentage (table 18) of heated camel milk was consumed this in Tlodi while less of consumers drink it as raw this in Tlodi also this could be due to presence of pathogenic bacteria in the raw milk.

The respondent explained that the most camel milk product preferred than other products was Gariss this in both Kadogli and Eldalanj while the less preferred product was cheese this in Eldalanj ( table 19) this probably due to feeding costumes of the people in the area.

The usage of camel milk as therapy for diabetes by the most respondents consumers this mainly in Eldalanj while used less as therapy for Jaundice this in Kadogli ( table 20) this might be due to the type of disease which more existent in their locality and they never try used it for specific disease .

The usage of camel milk mixed with urine as therapy by most of respondents consumers is in Kadogli whereas, less of respondents they said never used it

mainly in Kadogli ( table 21) this could be due to their ideas about therapeutic value of camel milk.

Drinking of camel milk without sugar is preferred by more than half of respondents consumers who said that this in Kadogli while less of respondents said drinking it with sugar this in Kadogli also ( table 22) this could be due to the fact that some of them suffered from diabetes or intestinal diseases when drinking with sugar .

The usage of spices to improve some characteristics of camel milk most of respondents said that added it to improve the taste of milk this in Tlodi where less of respondents said to improve texture this in Kadogli (table 23), this probably due to their different preferences.

The variation of camel milk than other milk all respondents said that it has salty taste this in Kadogli while some of respondents said less viscous (table 24) this could be due different preferences of the consumers or could be due to the other different factors affecting milk composition.

Regarded availability of camel milk its founded that most of respondents consumers said mainly in summer this in Eldalanj and Kadogli however less of respondents said in winter and summer too this in Eldalanj and Kadogli also (Table 25) these results were not in agreement with those of Mohamed (2008) this might be due to most of nomads of camel came to these locality in summer season because of wet land and presences of flies which causes diseases and other epidemics diseases during Autumn which may causes slippery to camel .



The respondents said that main tribe of the camel owners in the area is ELhammar this in both Eldalanj and Kadogli while little of respondents said they are from Elshanablla tribe this in Kadogli and Eldalanj (table 26) this could be due to fact that the owners of camel herds were of nomads and came from near states as North Kordofan and Darfur, however, the respondent consumers said that the system of owners of camel is nomadism (table 27) these results were not in line with those of Zaied (2007).

Regarded price of camel milk most respondents consumers said that price per liter of camel milk was ( $3.55 \pm 0.5$  SDG ) this in Tlodi however less respondents said (  $2.35 \pm 0.49$  SDG ) this in Kadogli ( table 27) this possibly due to different cost of feeding and forages witch nomads used it to camel and also due to availability of camel milk in different areas .

Considered the quantity of camel milk consumed per day , major of respondents consumers said they consumed ( $0.55 \pm 0.25$  liter /day per individual ) this in Tlodi however less respondents said consumed ( $0.43 \pm 0.029$  liter/day per individual ) this in Kadogli ( table 28) ,this result not agree with Zaied (2007) ,this might be due to their preference to other milk more than camel milk or due to their palatability of camel milk and it is less available in area when comparing with other milk .

The data of the study concluded that the camel milk produced in the area mainly used for Mullah this was in Tlodi and Kadogli while in Eldalanj it was used for salad (table 33). The high percentage of the respondent in the area said the utilization of camel milk in Mullah probably could be due to traditional costumes of the people in the area and might be due to the palatability of the camel milk.

# Chapter Six

## Conclusion and Recommendation

### 6.1 Conclusion:

Based on the results and discussion the following conclusions were drawn:

- ❖ The high average quantity of milk she camel produced per day in three areas of south kordofan was over two liters this in Eldalanj, while it is two liters this in kadogli and less than two liters in Tlodi .
- ❖ Also the high percentage quantity of camel milk consumed by respondents in three areas of south kordofan was over half liters this in Tlodi, while is less than half liters this in Eldalanj, but is quarter of liter in kadogli.
- ❖ The most of respondent's consumers preferred camel milk was in Tlodi, Kadogli and Eldalanj, while the less of them were not preferred camel milk in three areas.
- ❖ The high percentage of respondents consumers said used camel milk as therapy for diabetes this in three areas ,while less percentage is jaundice in Tlodi and kadogli , but less is leshmaniasis this in Eldalanj
- ❖ The high percentage of respondents producers said the war affected camel milk yield this in three areas ,the less said drought ,high cost of feeding and medicine and epidemic diseases this in Tlodi, kadogli and ELldalanj respectively .
- ❖ The study showed that all respondent producers said that the water deprivation affected camel milk yield, and also founded that the milking intervals for she camel was twice per day, this in three areas.

## **6.2 Recommendation:**

- ❖ Further research will be required about the quality of camel milk also production and consumption of the camel milk is needed in the rest of the areas.
- ❖ Introduction of the intensive camel farms in the area is important.
- ❖ Establishment of veterinarian services for the camel herds.
- ❖ Camel research Centre will be required in the area.
- ❖ Establishment of camel milk collection points is necessary.

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