



**Sudan University of Sciences and Technology**



**College of Graduate Studies**

**A study on Dairy Management Practices in Khartoum  
State**

**دراسة على الممارسات الادارية في مزارع الالبان بولاية الخرطوم**

**BY**

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## **Dedication**

To:

My Family;

My Supervisor;

To anyone who  
contributed

In conducting  
this Study

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## ABSTRACT

An extensive investigation of herd size, herd structure, breed type, lactation performance, feeding policies, housing, disease preventive measures and management practices were carried out in some dairy farms in Khartoum state. The Data was collected from 60 dairy farms, randomly selected from different localities within the Khartoum state. Information pertinent to dairy management, husbandry practices and preventive measure practices were secured through an extensive questionnaire and direct interview with the farm owners. A descriptive statistical analysis of the data indicated the following: - The total number of cattle in the 60 herds surveyed was 2690 heads with an overall mean of  $44.83 \pm 20.40$  head / herd. The breed used in these farms was 100% graded dairy cows of varying levels of exotic blood. The exact crossing percentage however was not identified because of lack of breeding records in the majority of the farms. The Herd structure was as follow: the number of milking cows was 1499 cow (55 % of the total herd) with an overall mean of  $24.98 \pm 13.00$  cows / herd. The dry cows comprised 9.6 %, Heifers 9.3 % and calves 23% and bulls 3.1% of the herd. The mean total daily milk production per cow was found to be  $188.64 \pm 77.28$  liter/day .The average price of milk was liter  $167.86 \pm 10.66$  SDG. The average lactation length was  $12.7 \pm 2.1$  month, while the average dry period was  $1.96 \pm .581$  month. Amount of concentrate fodder mean was  $4.40 \pm .806$  kg in day. Most of the pens were poorly designed; with an average area of  $700.53 \pm 193.5$  m<sup>2</sup> where as 20 % of which is shaded and 80 % unshaded area. Individual calf housing was adopted in 23.3 %, identification of calves was practiced in 18.3 % and dehorning was applied in 16.4. % of the total farms studied. 81.7 % of the total farms have no production records, 78.3 % with no health records, 83.6 % with no reproductive records and 81% with no feeding records. The most widely used method for insemination was natural mating and was adopted in 90.2 % of the farms and artificial insemination was used in combination with natural mating in 9.8 % of the farms. Only 16.7 % of the total farms were under veterinary supervision. The annual routine vaccination against diseases 40% of the total farms. The cases of Mastitis was found in 73.3%, Foot and Mouth Disease existed in 42.6% and brucellosis cases in 18% and CBPP in 59% and milk fever in



65.6.% of total farms. Culling policies were practiced in only 50.8% of the farms and Disinfection was practiced in 24.2 % of the total farms. Deworming with anthelmintic drenching was applied in 83.3 % for internal parasites control, while 77% used routine ticks spray for external parasite. Pregnancy diagnosis was practiced in 21.7% of the total farms.

The data revealed that 23 % of the owners were graduated 31.1% were illiterates 34.4 % were primary level and 11.5% were high school level. The age of most owners ranged between 49 – 59 years (32.8 %).

Most of the labors were 45.9% primary level while 39.3 % were with illiterates and 14.8% were high school. The age of most labors ranged between 25 – 35 years (42.6 %).

## المستخلص

في هذه الدراسة تم تنفيذ و دراسة حجم القطيع، تغذية القطيع، السلالة، الحظائر وتصنيف الأبقار حسب خصائصها الإنتاجية وأعمارها من أبقار حلوب وجافة وعجلات بكر وعجول صغيرة وثيران. كما تمت دراسة مدى تطبيق وسائل الإدارة والرعاية الصحية والنظافة والوقاية من الأمراض المستخدمة في بعض مزارع الألبان بولاية الخرطوم. تم جمع بيانات ستون مزرعة ألبان عشوائياً في مواقع مختلفة بولاية الخرطوم وإعتمد في هذه الدراسة أسلوب الإستبيان المكثف والمقابلات المباشرة مع ملاك المزارع خلال الزيارات الميدانية لرصد وسائل الإدارة والرعاية المثلى

من التحليل الإحصائي الوصفي للبيانات إتضح الآتي:- إجمالي القطيع 2690 رأس في 60 مزرعة بولاية الخرطوم بمتوسط 44.83 ± 20.40 رأس للقطيع .

إتضح من الدراسة أن 100% من العدد الكلي للأبقار هجين بنسب دم أجنبي متفاوت دون معرفة نسبة الدم الأجنبي وذلك نسبة لقلة السجلات المحفوظ بها في أغلب المزارع التي تمت دراستها

بالنسبة لشكل وتكوين القطيع وجد هناك 1499 بقرة حلوبة وتمثل حوالي 55% من إجمالي القطيع بمتوسط 24.98 ± 13.004 للقطيع. بينما كانت نسبة الأبقار الجافة 9.6% ونسبة الأبقار (الندف) 9.3% أما العجول (ذكور واناث) 23% والثيران بنسبة 3.1%. رصدت الدراسة أن متوسط إنتاج اللبن في المزرعة 188.64 ± 77.28 لتر في اليوم بمتوسط سعر اللبن 167.86 ± 10.66 جنيه للتر . متوسط طول فترة الحليب 12.7 ± 2.11 شهر بينما متوسط فترة الجفاف 1.96 ± 0.581 شهر. الأعلاف المركزة قدمت 4.46 ± 0.804 كجم في اليوم. أغلب المزارع صممت بشكل سيئ وبمتوسط مساحة 700.53 ± 193.5 متر مربع تمثل المساحة المظللة منها 20% والغير مظللة 80%. ممارسات الإسكان الفردي للعجول طبقت في 23.3%، ترقيم العجول طبقت في 18.3% وإزالة القرون طبقت في 6.4% من مجموع المزارع التي تمت دراستها. بالنسبة للسجلات 81.7% لا يوجد فيها سجلات إنتاج و 78.3% لا يوجد فيها سجلات صحة، و 83.6% لا يوجد فيها سجلات تناسل 81% لا يوجد فيها سجلات تغذية. التزاوج الطبيعي هو الطريقة الأكثر شيوعاً حيث طبقت في 90.2% بينما التلقيح الإصطناعي متمازجا مع الطبيعي طبقت في 9.8% من المزارع التي تمت دراستها. الإشراف البيطري يمارس فقط في 16.7% من عدد المزارع الكلية. أما التطعيم الروتيني السنوي طبق في 40% من المزارع الكلية. مارست سياسات الإبعاد في 50.8% من المزارع. إلتهاب الضرع سجلت في 73.3%، البروسيلا سجلت في 18%، الحمى القلاعية سجلت 42.6%، حمى اللبن سجلت في 65.6% من مجموع المزارع التي تمت دراستها. طبق التطهير في 21.2% والتجريع ضد الديدان في 83.3% من المزارع للسيطرة علي الطفيليات الداخلية بينما مورس الرش الدوري للقراد في 77% من المزارع الكلية للقضاء علي الطفيليات الخارجية. طبق كشف الحمل الروتيني في 21.7% من المزارع التي تمت دراستها. أوضحت الدراسة ان 23% من ملاك المزارع خريجي جامعات 31.1% اميين و 34.4% ابتدائي و 11.5% مستوى ثانوي ومعظمهم تتراوح أعمارهم بين 49 – 59 سنة (32.8%). أغلب العمال مستوي ابتدائي 45.9% والاميين 39.3% ومستوى ثانوي 14.8% أعمار معظم العمال تتراوح بين 25-35 سنة وتمثل 42.6%.

## Introduction

The agricultural sector is considered to be the leading sector of the national economy. It provides food for all population. Most important industries depend on agricultural products as raw materials. It also provides job opportunities' for more than 60% of Sudan population (World Bank, 2003).Sudan is the third largest country in Africa and sixteenth largest in the world .The livestock population of the Sudan was estimated in 2020 to be cattle 31,787,000, sheep 41,000,000, goats 32,218,000 and camels 6,888,000.The dairy cattle breeds comprise about **6,000,000** heads which represent about 20% of the cattle population (Ministry of, Animal Resources and Fisheries, 2020). More than 90% of the livestock in the country is owned by nomadic and semi nomadic tribes, with a regular system of seasonal migration mostly from north to south and vice versa (Food and Agriculture Organization, 2010).

Increased animal production would, however, not only improve the nutrition standards of Sudanese people but also could create a surplus for export. The local dairy breeds are characterized by high adaptive abilities to the prevailing environmental condition reflected mainly in high ambient temperature and feed resources shortage especially during the dry season. Moreover, the local breeds are of low milk production compared with exotic dairy breeds. Strategies practices to improve the productive and reproductive potentialities of local dairy herd were adopted by the government and private sector. First importation of exotic breeds in Sudan was faced by many constraints, environmental, managerial and health problems. Most of imported bulls died of Theileria leaving only few progeny living under most artificial conditions obtainable in one of the European managed dairy farm near Khartoum. From 1984 to 1989 large scale importation of Holstein-Friesian heifers-in-calf took place by the newly established modern dairy companies (El-Fagir, 2007). Most of these dairy companies and farms for pure exotic and crossbred cattle are located at Khartoum State. There are several factors affecting the production and productivity, thus affecting negatively the dairy sector in Sudan, whether traditional or industrial sector. These factors can generally be divided into environmental and management factors.

In the dairy sector, the most important environmental impact is the high temperature. Excessive heat and humidity causes heat stress on dairy cows with a markedly decrease in milk

production. Zebu breeds have been shown to be less sensitive to heat stress than *B.taurus* breeds (Srikandakumar and Johnson, 2004).

The development in the sector of milk production demands the direct involvement of the government so that it could bridge the gap between demand and supply. The population of greater Khartoum (all three towns) is estimated to be 6.27 million people (Central Bureau of Statistics, 2019); and thus this urban area has a great demand for food, including animal products. The average milk consumption per capita in Khartoum State (KS) is 62.9 kg/year; Khartoum state demanded 800,000 tons of milk/year and dairy product while the real production is estimated as 200,000 tons with gaps of 600,000 tons (Ministry of Agriculture Animal Resources and Irrigation, 2021). Livestock in Khartoum State is a strategic element in food security, according to the estimate of the (M.A.A.R.I, 2016) livestock population includes 304,025 cattle, 624,988 sheep, 792,850 goats and 7,950 camels. The average number of milking cows is 142,272 heads. The state contains 13 dairy associations authorized by the government with each association comprising mainly small holder dairy producers making about a 1468 dairy pens (M.A.A.R.I, 2018).

### **Objectives:**

1-The objective of this study is to envisage a descriptive road map for some of the management practices and the hygienic and preventive policies adopted in Khartoum State to highlight the problems.

2-This objective extends to suggest some solutions to the constraint facing the development of the dairy sector in Khartoum State. The parameters used in this study included almost all the general management and husbandry programs needed in a conventional ideal dairy farm.

## CHAPTER I

### Review1. Literature

#### 1.1. Cattle breed types in the Sudan:-

Kenana, Butana, White Nile, Western Sudan Baggara, Foja (Dar Al-Reeh cattle), Qash cattle (Baraka cattle), Arashi cattle, Red Um-Bororo, Ingessana cattle and Sudan Fulani are the main cattle eco-types in Sudan (Rahman, 2007). Within the overall type of Zebu breed, the Kenana and Butana breeds are most suitable for dairy production. Therefore in the last decade many herds of these eco-types have been crossbred with Holstein Friesian breed.

##### 1.1.1. Kenana and Butane:

The Kenana cattle breed is mainly kept by the Kenana tribe in the southern central plain of the country, between the Blue Nile and White Nile the cattle population size was 1.5 million head and that the status of the population was not at risk (Mohamed khair2006). The Kenana cattle habitat is a low rainfall savanna region (300 - 800 mm) with a dry season from November to April. This zone hosts some large scale irrigated agricultural schemes such as Gezira scheme which extends south into this zone, El-Suki, El-Rahad and Blue Nile Agricultural Corporation. Large scale commercial grain-fed cultivation is practiced, particularly towards the southern part of the zone. In general, the northern parts are utilized by herders as wet season grazing areas and during the dry season they move towards the southern parts, where water and pasture is available (Hiba *et al.* 2010).Butana cattle are found in the Buttana plain of central Sudan between the River Nile (Atbara River and Blue Nile), a typical semi-arid ecological zone (300 mm rainfall, 8months dry period) (Musa *et al.*.2006).This breed is also found in the Gezira between the Blue Nile and the White Nile and along the River Nile in the northern region. The population size as reported was one million head and thus, the breed is not at risk. However, the population shows a decreasing trend due to extensive crossbreeding with European cattle.

The estimated lactation milk yield for Butana cattle (538.26 kg) and for Kenana cattle (598.73 kg) showed that both breeds had a comparable milk performance under field condition which was much lower than their yield under station condition. However, Butana cattle in Atbara Livestock Research Station yielded  $1662.57 \pm 108.96$  kg/ lactation (Musa *et al.* .2006) and Kenana cattle in Um-Benin Livestock Research Station yielded  $1423.58 \pm 551.70$ / lactation (El-

Habeeb 1991). For both breeds the lactation period was also much shorter under field condition areas (Mohamed khair2006).

### **1.1.2. Cross breed:-**

According to Osman (1987), the exotic breed (*Bos-Taurus typicus*) was imported to Sudan in 1925 during colonization rule. These imported breeds were first owned by English army in a farm which was located on the east side of the Blue Nile at Khartoum North (Bulgravia Farm). Other activities in this line included importation of exotic cows (Friesians and Jerseys) in limited numbers by the private sector. This included the importation of 10 cows in 1976, 15 heifers in –calf in 1978 and 40 Jersey cows and heifers- in –calf in the early 1980s. From 1984 to 1989 large scale importation of Holstein –Friesian heifers –in-calf took place by the newly established modern dairy companies at the time ,like the Arab –Sudanese Dairy Company (1000 heifers –in-calf) and Khartoum Company for Milk Products (500 heifers –in- calf) Also the Islamic Development Company imported 750 heifers during the period 1986-1989 which were distributed to the farmers in Khartoum state .The aim of importing large numbers of this exotic breed was to supply the modern dairy farms with animals of high genetic potential for milk yield to produce milk for the market (El-Fagir 2007). Osman *et al.* (2011) found that crossbred cow's represent the highest number (97.5 %) among the breeds in the farm located at Omdurman.

### **1.2. Herd size and structure:**

Under traditional management system, the size and composition of the herds are influenced by a number of factors such as seasonal availability of water and feed, high market prices and infectious diseases (Yousif and Fadel – Moula 2006). Mohamed (1995) found that 33.1% of dairy herd in Khartoum state were lactating cows, 25.2% dry cows, 17.3% heifers and 24.4% calves. El-Shotary (2000) in his study of the dairy herd in Belgravia Dairy Farm, found that in a herd of 270 heads,145 were milking and dry cows,85 females heifers more than one year,37 females less than one year and three bulls. El-Nazeir *et al.*,(2004) reported that in a total of 9145 heads, the number of milking cows was 3462(37.86%),dry cows comprised 7.14%,heifers 11.85% and calves and bulls accounted for 33.15% of the herd. El Zubeir and Mahala (2011) also reported that cattle were found as the main milk producing animals and the predominant herds (60%) were cross dairy cows (Friesian and local herd). Ahmed and El Zubeir(2013) reported herd size and herd structure dairy herd numbers were  $170.25 \pm 72.83$ ,

123.10± 105.71 and 92.35± 29.23 in Khartoum North, Khartoum and Omdurman, respectively. Breed type revealed non-significant differences between the three cities.

Shima (2020) studied the dairy herd size and structure of dairy farms in 5 Sudanese states she reported that the total number of cattle in the farms was 13567 heads. It was found that there are big variations in cattle number of different states which ranged between 845 to 6484 heads / state. The lactating cows comprised more than one third of the total herd (36%) while the dry cows were about more than one sixth (17.9 %). Heifers about one fifth (20.9%). The results also indicated that bulls and calves were 1.8 % and 23.3%, respectively.

### **1.3. Feed requirements of dairy farms:**

Nutrition has been identified as a major contributing factor to animal health status as related to multifactor diseases. Muligan *et al.* (2007) summarized that the nutrition of early lactating cows has been an important influence on their fertility performance. In particular, the energy and protein balance of early lactating dairy cows are factors which are to be quite often implicated in poor fertility for Irish herds. Furthermore, when dairy cattle do not have a healthy transition period, this may directly or indirectly reduce fertility performance. Cheeke (2005) summarized factors affecting feed intake as energy level in diet, protein concentration, palatability, digestibility, live weight, fatness, breed, sex, age, environmental temperature and physiological state of animals. Regulation of intake of fibrous feeds such as straw is more complicated. The generally accepted theory is that cattle on high roughage rations limit their intake by physical means; they simply cannot add any more feed in the rumen.

The Agricultural Research Council (A.R.C., 1984) recommended a crude protein level of 16% in the diet of lactating cows, which can be reduced to 12% during advanced lactation. The cost of agricultural production in Sudan tended to be high due to lack of labours and high cost of mechanization. Dairy breeders are aware of the limitations in meeting the nutritional requirements of their animals. Many grow fodder under irrigation especially those whose animals are raised under zero-grazing and other purchase extra fodder. Many are aware of the advantages of feeding concentrates, but are constrained by the high costs and therefore resort to feed some molasses or just wheat bran. These concentrates include oilseed cake, dura and additives, which are usually salt-mixture and vitamins. These concentrates are imported from abroad at very high prices (Hussein, 2008).

### **1.3.1 .Agro-industrial by-products:**

#### **1.3.1.1. Molasses:**

Molasses is produced as a by –product of the manufacture of sugar by extracting boiling and re boiling of the juice of sugar cane or sugar beets. El Khidir and Ibrahim (1999) noted that the annual total production of molasses in the Sudan is 200,000 tons, only 5 % of which is used as animal feed. El Khidir and Ahmed (1998) considered molasses according to its chemical composition a good source of energy for ruminant feeding and a complete substitute for sorghum. However its viscosity hinder its transportation and storage and consequently its use at the level of traditional farming systems where there is lacking of infra structures needed. Microbes in the rumen break down the sugars in molasses quickly and extensively causing a rapid release of energy that makes molasses very useful for balancing other feeds in the dairy diet all year round. El Khidir and Ibrahim (1998) found that molasses could be used for feeding dairy cows at a percentage above 50 %. They showed that rations contained molasses with ratios between 20 – 35 % were used for feeding dairy cows in Gezira scheme. They also quoted that using molasses cubes in feeding dairy cattle in Khartoum state increased the milk yield at ratio from 25 – 50 %. Bakhiet (1995) compared the performance of two groups of dairy cows fed molasses or grain sorghum as source of energy, and his results indicated that molasses diets increased milk yield and improved the fertility. El-Shotary (2000) stated that in Bulgravia Dairy Farm green fodder was fed *adlibdum* whereas the concentrate composed of 25% cakes, 33 % dura and molasses, 28 % wheat bran, 13% groundnut husk and 1% salt, fed at rate of 8 kg per day.

#### **1.3.1.2. Bagasse:**

Bagasse is the fibrous portion remaining after the extraction of juice from sugar-cane (Ramli *et al.* 2005). It is an important by - product of sugar-cane industry and produced in large quantities. Bagasse is considered as a source of power for generation of electricity in many sugar factories. The sugar – cane bagasse contains about 60-70% carbohydrates mainly cell wall polysaccharides in form of cellulose and hemicelluloses bound with lignin (Firdos *et al.*, 1989). Raw bagasse is composed of about 51.9% cellulose, 25.7 % hemicellulose, 10.3 % lignin and 2.11 % crude protein (Atta Elmnan *et al.*, 2007).



(Hassoun *et al.*, 1990) found that chemical composition of raw bagasse was as follows: 96.62%, 2.70%, 88.85% and 53.88% of organic matter, crude protein, Neutral Detergent Fiber (NDF) and AD respectively and in vitro dry matter digestibility (IVDMD) was 31.17%.

#### **1.3.1.3. Urea:**

Urea is used as most common non – protein nitrogen feed source for ruminants, which contains 46.7 percent of nitrogen. It is fed as replacement for a part of the protein in a ration. The ability of microorganisms present in the rumen of ruminants, use of feeding urea reduces the need for imported protein supplements with no deleterious effects on the animal. McDonald *et al.*, (2011) reported that urea is hydrolyzed by urease activity of the rumenal microflora to produce ammonia and CO<sub>2</sub>.

#### **1.3.1.4. Wheat bran (WB):**

Wheat bran is one of the best milling industry by-products for feeding dairy cattle. It is palatable and bulky, containing 17% protein. It has relative diverse application in food, feed, medicine and fermentation industries due to its richness in carbohydrate (mostly fiber), protein and fats which makes it an important dietary element (Javed *et al.*, 2012). WB production is mainly dependent upon the nature of the soil (Safdar *et al.*, 2009) and water supply but the approximate yield of wheat bran is 14 to 19 % of wheat kernel (Safdar 2005). Slavin (2003) reported that WB is rich in carbohydrates (60%), protein (12%), fat (0.5%), minerals (2%), bioactive compounds and vitamins. McDonald *et al.*, (2011) reported that the WB contains about 58 – 120 g/kg crude fiber while the protein content ranges from 120 – 160 g/kg according to the variety of the grain. The net energy value of bran is low; however its popularity as feed for ruminants is mostly ascribed to its known physical properties.

#### **1.3.1.5. Groundnut cake (GNC):**

Groundnut cake (*Arachis hypogaea*) is of South America origin but has now spread throughout the tropical world and also warm temperature area to 40<sup>o</sup> and 45<sup>o</sup> N. It is an important crop grown for seeds, which are rich in oil and protein (Bogdan, 1977). Babiker *et al* (2009) reported that sorghum, groundnut cake, sesame cake and wheat bran are considered the

main source of protein and energy for poultry in Sudan. Although, groundnut meal is used commercially as the main source of protein in Sudan, it has anti nutritional properties and highly susceptible for aflatoxin contamination (Ali *et al.*,2011).Crude protein of groundnut meal ranged from 40.1 to 50.9% with mean 45.6 % whereas, nitrogen – corrected metabolizable energy ranged from 2273 to 3009 kcal / kg (Batal *et al.*, 2005). Babiker (2012) reported that the crude protein ,crude fiber , fat , ash , nitrogen free extract, and metabolizable energy (Mj /kg) of groundnut cake from ElObied city were 53.44%, 8.55%, 7.47%, 5.27%, 20.54% and 11.8%,respectively.

#### **1.4. Water sources:**

Higher environmental temperatures require higher water intake, since the water is needed for the ability to lose heat (Payne & Wilson, 1999). If the temperature of the drinking water is lower than that of the body, excessive heat will be lost by direct cooling at drinking. Animals in a tropical climate maintain the normal body temperature for example by decreasing production (indirectly by decreasing digestive metabolism) and exercise, increasing sweating and panting, excreting urine and faeces at body temperature, and seeking shadow.

Milk is composed of nearly 87% water and thus dairy cattle need plentiful water to achieve high milk production. Dry cows need 30 - 50 liters of water daily while lactating cows require between 50-100 liters daily depending on amount of milk production (ward, 2014).

#### **1.5. Milk production in Sudan:**

Sudan is endowed with large numbers of livestock resources, milk production is considered low due to genetic factors and poor grazing pastures. For these reasons it is difficult to establish a dairy industry with a suitable production capacity in the Sudan. Cattle is regarded as the main source of milk production in the Sudan as it produces about 80% of the total milk output in the country. The rest 20% is produced by goats, sheep and camels (Shima, 2020).

The profitability of a dairy enterprise is mainly related to obtaining as much milk as possible within the prevalent nutritional environment, relative to the maintenance cost of animals. Figures for the milk yield of cattle under traditional management were not available (Mohamed ahmed2008). Among the cattle population, Kenana and Butana are promising indigenous milk breeds, which under improved feeding and management in research stations yield more than 1500 kg milk per lactation relative to international standard (Mohamed ahmed2008). The

estimated milk yield per lactation for Butana cattle (538.26 kg) and for kenana cattle (598.73 kg) showed that both breeds had a comparable milk performance under field conditions which was much lower than their yield under research station condition. There are three broad cattle production sub-systems both in Gezira and Khartoum states depending on social structures under which the animals are kept; cultural/ human settlement-habits, animal type/ breed and availability of feed and support services (FAO, 2002).

(Mohamed 2008) reported Milk producers had kept improper herd structure composition with Low ratio of milking cows, usually less than the recommended ratio. Which had resulted in poor milk production rates. Usually there is a wide gap between milk demand and supply in Khartoum state, because the population growth rates are growing faster than the growth rates of domestic milk production. About 97.3% of the milk fresh milk produced was consumed as raw milk and the remainder was received by milk processing plants. High marketing cost and margins and large number of intermediaries were detected along the marketing channels, due to the lack of efficient marketing system. The middlemen share in consumers' prices was about 66.6% and the retail margin was about 33.4% which appear to be high. The producer's share of retail price were 70.8% and 76.5% in Khartoum and Gezira respectively.

## **1.6. Productive traits:**

### **1.6.1. Milk yield:**

Milk yield of a dairy cow depends on four factors including genetic ability, feeding program, herd management and health. As cows continue to be improved genetically, we must improve nutrition and management to allow the cow to produce her inherited potential (Hansen *et al.*, 2006). Milk yield is a complex character, which is affected by the interaction between genetic and environmental factors. The trait of milk yield is always expressed at advanced lactation, which renders direct selection for milk yield at a younger age less efficient (Fawi, 1994). Dechow *et al.*, (2001) have reported antagonistic relationship with respect to both phenotypes and genotypes between milk production and reproductive traits such as fertility, day's open and easy calving. However, others have reported genetic correlations that were close to zero (Raheja *et al.*, 1989) or low (Dong and VanVleck, 1989). Hagemam *et al.*, (1991) reported that high genetic lines had longer postpartum anestrous and subsequently longer times

to first breeding. Consequently, each of calving interval and days open were 10 days longer for high milk yield lines in the first and second parities.

### **1.6.2. Lactation length (LL):**

The standard length of lactation has been taken as 305 days. In North-East Tanzania, (Msanga *et al.* (2000) ) studied lactation length of crossbred in small holder and reported that the least square means for first lactation length was  $331 \pm 77$  day. Bulal (2000) observed that the overall mean of lactation length for crossbred in small holder farm in Ethiopia was 363.5 days at Bilalo and 383.7 days at Lemmu. In Bangladesh, Islam *et al.* (2002) reported that the lactation length of Friesian cross, Sahiwal cross Sindhi cross and indigenous dairy cows was  $253 \pm 24.73$ ,  $256.31 \pm 24.31$ ,  $255.86 \pm 27.58$  and  $230.62 \pm 30.68$  days respectively. (Ishag 2000) the mean lactation length in the Kenana Suger Company Farm was  $322.57 \pm 5.88$  and  $291.34 \pm 2.12$  days in the first and overall calving respectively.

### **1.6.3. Dry period (D.P):**

One of the managerial practices available to the dairy farmer to manipulate milk production is the dry period. The term refers to the period during which the cow is not milking. It is necessary that a dry period of at least six to eight weeks between lactation for regeneration of secretary tissue and to restore body condition and increase milk yield for the first three month of next lactation. Marginal quality of feed, imbalanced rations and inadequate housing all characterizes poor dry cow management practices (Yousif, 1995). Rahmatalla (2002) reported that the average dry period in Belgeravia, Khartoum University and Judiciary farms was  $124.99 \pm 93.64$ ,  $108.90 \pm 81.13$ , and  $75.38 \pm 65.82$  days respectively. Ishag (2000) reported a cows and 96.3 days for the overall calving. In cows given a 60 days dry period, mammary glands involution occur during the early dry period and is characterized by cell death (apoptosis), Bachman and Schairer (2003) reported that milk production was less than 10 to 38% in cows subjected to a shortened or omitted dry period. Suhail *et al.*, (2010) reported that the average dry period of Jersey was  $169.2 \pm 16.45$  days, with a coefficient of variation of 63.7 %, the effect of sire, season and year of calving on dry period was non – significant ( $P > 0.05$ ).

## **1.7. Reproductive management:**

There is antagonistic relationship between production and reproduction traits (Sewalem and Kistemaker, 2008). Fertility a component of reproductive performance defines the ability of the female to become pregnant. Fertilization rates in dairy cattle can be as high as 87-90% and accurate conceptions are probably above 70% (Humblot, 2001; Andersen – Ranberg *et al.*, 2005). Calving rates in Holsteins are below 40% in most cases (Royal *et al.*, 2000), and in some reports as low as 25% (Sorensen *et al.*, 2007; Sartori *et al.*, 2006).

### **1.7.1. Age at first calving (AFC):**

Age at first calving is one of the most important factors affecting the productive life of cows. The age at first calving is defined as the number of months from the date of birth to the date of first calving. Moreover, age at first calving is an important economic characteristic directly contributing to the life-time performance of a cow and is an important character to assess the reproductive and productive performance of dairy cattle (Faraji *et al.*, 2011). MacDonald (2005) reported recent review of UK dairy herd data showed that the average (mean) age at first calving (AFC) was 29 months (median 28 months). Eastham (2018) reported this seemed significantly greater than the target of 22–24 months that is often quoted in press. The optimum range of AFC varies according to paper, outcome studied and geographical region but a consensus can be seen in overlapping months.

### **1.7.2. Gestation period (GP):-**

Gestation length is affected by many of factors as age of cows, sex of calf, type of birth, feeding of cows etc. Effect of age at first calving of cow on gestation duration was found significant (Clicik 2009). The gestation length of Holstein cows between 273.5 and 279.5 days has been reported by Bakir *et al.*, (1994), Erdem *et al.*, (2007), Kopuzlu *et al.*, (2008). The mean gestation length of North Bangal Grey (NBG) cow is 281.8 days (Amin *et al.*, 2007). Islam *et al.*, (2011) reported that the gestation length was  $280.6 \pm 0.4$  days. Cows bearing twins, with a pregnancy loss of 3 to 7 times higher for twin pregnancies than single pregnancies (López-Gatius *et al.* 2002). Suboptimal concentrations of progesterone in blood related to high milk production could also explain some of these losses during the late embryonic/early fetal period (Ayad *et al.* 1969). *Neosporacanimis* is a protozoan parasite with a wide host range but with a preference for cattle since the description of *N. caninumas* a new genus and species in 1988, bovine neosporosis

has become a disease of international concern as it is among the main causes of abortion in cattle (Dubey and Schares, 2011).

### **1.7.3. Heat detection:-**

The estrus cycle, for cows is the average time from one heat period to the next, known as the estrus cycle, is 21 days, but it varies from 17 to 26 days and lasts from 6 to 36 hours, with an average duration of 18 hours for cows and 15 hr. for heifers (Diggins *et al.*, 1984). Ovulation occurs 10 to 14 hours after the end of the heat period (Blakely and Bade, 1982). Symptoms in dairy cattle at the early stage of heat are not pronounced, but they will show activities like smelling other cows, mounting other cows and bellowing, restless and moving around a great deal. The most definite signs of heat of the cow are start to be mounted by other cows or mount other cows herself, the vulva may be reddened, moist and swollen, mucus or bloody discharges may occur, nervousness, anorexia, and reduction in milk yield. Estrus usually last for 16 to 24 hours in cattle (Sastry and Thomas 1980). Some cows have silent heat periods. It is almost impossible to know when such cows are in heat unless a bull is present (Diggins *et al.* 1984). Interventions in existing management practices manifest estrus nicely. Manifestation of estrus is due to effect of estrogen on Central Nervous System (CNS). Cow is non seasonal poly estrous animal. The estrous behaviors are shown during September to January, with cycle is of, average  $21 \pm 3$  days (Boehmer, 2012). Heat detection aids are very important tools for skin, deep body, vagina and milk is measured as means efficient reproductive management if used in of detecting estrus in cattle. Radio telemetry based combination with expert eye. Visual observation with during time of estrus measured by sensor based intra tail paint is 98 % efficient as compared to heat watch ruminal electronic radio-telemetric bolus (Boehmer, 2012).

### **1.8. Milking practices:**

maximum milk let down requires 25 to 35 seconds of stimulation per cow, followed by attaching milkers 1 minute after preparation was started. Comparison of records of cows on official testing programs show that cows milked three times a day produce 15 to 25 % more milk than cows milked twice a day. Cows milked four times a day produce 5 to 10 % more milk than cows milked three times per day. El-Nazeir *et al.* (2004) studied milking practices in Khartoum state and found that cows were milked twice daily, early in the morning (5 –8 am) and late in the

evening (4 – 7 pm) and each milker milks 10 cows per milking time. However most milkers in the farms do not stay long in the farm and after 2 –6 months, they leave for better job.

### **1.9. Housing and facility:**

Housing systems for dairy cows vary from housing cows throughout the year to housing cows in the winter months only. Outdoors grazing is allowed throughout the year in regions with the appropriate climate. Systems in which cows are housed throughout the year [referred to as zero-grazing, (ZG) systems] are used in areas where grazing the cattle is not the most efficient or cost-effective use of the land. Cows can be fed high levels of concentrate feed more easily when they are housed, so extended or continuous housing systems are more common in farms having cows with a high genetic potential for milk yield. It is hypothesized that the increased length of the housing period may have adverse effects on cow lameness and leg injury (Haskell *et al.*, 2006). Mohammed Kheir (2002) studied the housing in Port Sudan and found that the average area of the pens was  $1463 \pm 4091$  m<sup>2</sup> and the building material of the pens were zinc, wood, mats, iron misdeed stems (*prospisjulifora*), cement block and asbestos. Also he revealed that the percentage of shaded areas was 12 %. (Ishag, 2000) studied In Kenana Sugar Company Farm, traditional housing was adopted as the standard in this farm. It proved to be economical and suitable under Sudan environmental conditions. Houses were constructed of iron bars and the roofs were made of corrugated iron each pen area was about 800 m<sup>2</sup>, with only 225 m<sup>2</sup> shaded to protect animals from harmful direct sun rays and rain.

### **1.10. Recording system:**

Records are an indispensable component of modern farming; it is typical aspect of management where keen observation can avoid the need for unproductive animals. Bayemi *et al.*, (2005) reported that one area needing much attention in dairy farms is record keeping and farmer's need intensive training and follow up. There are many types of records: for Production, reproduction, nutritional, health, weighing, and financial administration records. Neglect of records keeping, computer use and management practice information is a mistake that can lead to long-term losses in herd performance and profitability (Rice *et al.*, 1993). Peters and Thorpe (1988) found that the importance of recording systems as a tool for genetic improvement is a rather one-dimensional approach. Performance recording should rather be a tool for collecting

information on production system and thus, provide data on the improvement of management practices. Hence, animal recording should be considered as multi-purpose tool and should be implemented with sustainable participation of dairy herd owners (Zumbach and Peters, 2002).

Veepro (2015) reported that materials regarding the farm operations, record keeping is documenting or writing those activities on a recording materials or machines. Becker (2001) reported that computer allows the dairy producer to have management reports available for an individual cow, a group of cows or the herd. These reports then allow the quality and effectiveness of management to be improved by using information in a condensed form. These management reports should cover all areas of herd management, including production, nutrition, reproduction, inventory, replacements, financial.

### **1.11. Animal health:**

#### **1.11.1. Farm biosecurity**

To reduce or to minimize the chance of contact between the host and the infective agent, adequate cleaning and disinfection is the most effective and cheapest way to prevent diseases and their spread (Nasri, 1966). For health supervision the dairy farmer builds shade which is easy to be cleaned and protect from winds and dust (Ibrahim, 1969). Daily removal of dung is known to be effective in prevention of nematode manifestation (Straat, 1979). Management practices adopted to reduce the exposure to mastitis include dipping teats of all cows in disinfectant after each milking which is the most effective part of the sanitation procedure, washing of milker's hands thoroughly with disinfectants, washing udder, cloth towel must be cleaned with warm water and disinfectant, the milking parlor must be sprayed after washing with detergent solution before and after milking, renewing the bedding materials frequently, healthy cows are milked first by separate milkers and culling of cows with repeated clinical mastitis (Tiwari *et al.*, 2013).

#### **1.11.2. Milking hygiene:-**

Milking is an art requiring experience and skill. Milking should be conducted gently, quietly, quickly, cleanly and completely. The act of milking should be finished within 5 to 7 minutes; so that the udder can be emptied completely so long as the effect of oxytocin is available raw milk may be contaminated by bacteria from several sources. These include: udder and udder flanks, milker, milking environment, milking equipment and vessels used for milk storage and



transportation (Khan *et al.*, 2008), Cleaning udder and teat was important to keep milk hygiene, to reduce odor and contamination there was need to give attention on manure disposal. There were farmers who processed dairy cow manure by drying or making compost but the other only disposed it close to the cow house. This condition caused contamination and odor, which easily absorbed in milk (Yuni *et al.* 2015). lencho *et al.*(2017) reported that most of the farmers (76%) washed their hands with water only and it was noted that only 24% used water and soap for washing their hands.

### **1.11.3. Manure handling:**

Manure is composed of animal feces and urine and may contain livestock bedding, additional water and wasted feed (Manitoba Agriculture Food and Rural Development, 2015). Pachepsky *et al.*, (2006) noted that many manure based pathogens exist, but the major manure based zoonotic bacteria, including *Salmonella spp.*, *Campylobacter spp.*, *Listeria monocytogenes*, *Yersinia enterocolitica*, *Escherichia coli*, protozoa viz, *Cryptosporidium parvum* and *Giardia lamblia*. All of these pathogens are present in manure, but not all of them pose an equal health risk. Some pathogens, such as *Cryptosporidium*, are difficult to treat. Some pathogens are potentially deadly, and some are easily communicable to human populations (FAO, 2010).Amira (2018) noticed that in Khartoum states most dairy producers (57.1%) collected manure from the barn once / week, while 35.7% collected manure once / week and only 7.1% collect manure once / month. This result indicates that the producers care about cleanness of the barn to avoid mal odorous, ticks and diseases a result that agrees with Kelly and Michael (2014) who found that accumulated manure can cause health problems, odor, and water quality problems if not properly dealt with. One option is to collect the waste daily.

### **1.11.4. Culling:**

Culling is the departure of cows from the herd due to sale, slaughter or death. One advantage of the retrospective screening of disease occurrences in a farm is to prioritize different disorders and allow farmers and veterinarians to design preventive measures which consequently may lead to the avoidance of economic losses associated with diseases (Thrusfield, 2005). This process is especially important where animal rearing and production are key economic activities. Livestock diseases are major constraint on profitable farming since many of them result into culling. The deterioration of animal health status (lameness, mastitis

and different metabolic disorders) can have a serious impact on cow productivity, causing pain and discomfort, production losses and might result in a decision to cull the animal (József 2017). The same author analyzed 7067 cows' data in Iranian dairy herds and found that 3904 (56.4%) were in the first and 3163 (43.6%) were in the second lactation. In total, 22.1% cows were culled; out of these 18.4 % was in first parity and 26.6% second parity. Radke *et al* .,(2000) reported that 9.0% of tested animals were culled before first lactation and 15.4% were culled during first lactation for a total culling risk previous to second lactation of 24.4%. When the lactation average yields are analyzed it can be seen an accelerating increase except thesecond lactation. In the second lactation theaverage yield is 3% less than the first one but thethird is 13% more while the fourth exceeds by19% the standardized production.

#### **1.11.5. Vaccination:**

In Sudan since 1900, when for the first time veterinary services efforts were made for disease control, disease prevention programs passed in certain development (Baasher, 1969). Mohammed (1995) noticed that vaccination against contagious diseases such as Rinder Pest, Anthrax, Black Quarter, Contagious Bovine PleuroPneumonia and Hemorrhagic Septicemia were reported by 92 % of the farms studied.

##### **1.11.5.1. Veterinary services in Sudan**

Health depends on proper feeding and access to enough water of good quality as well as protection against environmental factors (such as heat) and health hazards. On the other hand, an animal in good condition is more resistant to disease than a weak one, so the health situation depends, to a large extent, on other factors. Disease prevention has to be adjusted to the management system and the disease pattern in the herd (Payne & Wilson, 1999). The ways available to protect livestock from infectious diseases are by increasing the host's defense and by preventing the animals from being infected. Through breeding regimes, animals have become more tolerant or even resistant to some diseases. An example of this is the resistance of some indigenous cattle breeds to negative effects due tick infestation. The costs for veterinary services are generally low for the animal owners (Kulneff, 2006). When consulting a governmental veterinarian, the animal owner has to pay only for the medicines and the cost for these is relatively low. Also the cost for a consultation by a private veterinarian is low. Unfortunately, the understanding among animal owners is limited regarding the advantages of consulting a

veterinarian about sick animals, so many of them choose to treat the cases by themselves or not at all. A study carried out in Khartoum State, Sudan, revealed that 50% of the farm owners purchased their drugs directly from drug stores, 30% were neither dealt with clinics nor purchased drugs to treat their sick animals, 10% purchased their drugs from drug stores and treat their animals by themselves and 10% preferred to deal with veterinary clinics to treat their animals (Mustafa, 2008).

## **1.12. Diseases**

Cattle in Sudan are under risk of many diseases, Bacterial, Viral and parasitic diseases in additions to metabolic problems in the nomadic areas. The production diseases of the dairy cow are a manifestation of the cow's inability to cope with the metabolic demands of high production, and they continue to be a cause of economic loss to the dairy industry and an animal welfare concern (Mulligan and Doherty, 2008). The production diseases comprised of diseases associated with an imbalance between the rate of input of essential dietary nutrients and the output of the production such as milk fever, ketosis, hypomagnesemia and mastitis etc. (Radostits *et al.*, 2000).

### **1.12.1. Milk fever:**

Milk fever is an important production disease occurring most commonly in adult cows within 48-72 hours after parturition, which is characterized clinically by hypocalcemia, general muscular weakness, circulatory collapse and depression of consciousness (Radostits *et al.*, 2000). Rajala-Schultz *et al.*, (1999) found that milk fever alone caused a milk loss of between 1.1 and 2.9 kg/d during the first 4 to 6 weeks following parturition. It can also reduce the productive life of the cow by as much as 3-4 years. The average cost per case of milk fever has been estimated at \$334, based on direct treatment cost and estimated production losses (Horst *et al.*, 1997). Karm *et al.*, (2005) reported normal blood plasma ca concentration is lightly regulated and generally kept between 8.5 to 10mg/dl. The incidence rate was 5.3% among the examined dairy cows. The incidence ranged was 2.5%, 4.0% and 9.1% among dairy cows of 1-2, 3-4, and >5 years the incidence rates were 3.3%, 2.0% and 10.5% respectively. Cows elder than 6 years constituted 72.7% of the positive cases. Among the milk yield groups the incidence was significantly higher (19.5%) among dairy cow producing 12-25 liters per day, whereas no milk fever case was

reported in dairy cows producing 10 liters or less per day. Rectal temperature and rumen motility were significantly low ( $37.0+0.5c$  and  $0.25+0.2$  per minute respectively). Heart rate was significantly increased ( $103.5+6.9$  beat per minute).

### **1.12.2. Foot and Mouth disease (FMD)**

Foot – and –Mouth Disease is severing, highly communicable disease of cattle, pigs, sheep, goats and deer. It is caused by one of the smallest disease producing virus known “locally known as "Abu lisan” it infects all breeds but is more deleterious to crossbred and imported breeds and in some cases mortality rate in calves reaches up to 45 % (Abdalla, 1995).

### **1.12.3. Anthrax**

Anthrax is an acute, febrile disease of warm blooded animals, including humans. Anthrax is caused by *Bacillus anthracis*, a gram-positive, non-motile, spore-forming bacterium (Aiello, 1998). The name of the bacterium is derived from “anthrakis” the Greek word for coal, because anthrax in humans causes black, coal like lesions on the skin at the site of inoculation (Inglesby *et al.*, 1999). In 1946, it was decided to vaccinate all export animals; hence the disease was controlled in quarantines where it was predominant. Mass vaccination of animals in the field was started in 1951; however, the disease is still sporadically occurring throughout the country. Similarly, it was found widely spread in West Africa (Musa *et al.*, 1993).

### **1.12.4. Hemorrhagic septicemia (HS):-**

Classical hemorrhagic septicaemia is a particular form of pasteurellosis caused by *Pasteurella multocida* and manifested by an acute and highly fatal septicaemia in susceptible cattle and water buffaloes. The name hemorrhagic septicaemia is used rather loosely in some countries to include pneumonic pasteurellosis (shipping or transport fever), a disease caused mainly by *P. hemolytica*, although various serotypes of *P. multocida* are occasionally involved. Although the morbidity of pneumonic pasteurellosis of cattle can be high, the mortality rate is much less than that of hemorrhagic septicemia (Saad, 2004).

#### **1.12.5. Contagious Bovine Pleuro Pneumonia (CBPP):-**

Contagious bovine Pleuropneumonia (CBPP) is a highly contagious acute, subacute, or chronic infection primarily of cattle caused by *Mycoplasma mycoides*(small colony type).The disease is characterized by *sero-fibrinouspleuritis*, pulmonary interlobular septa thickened by oedema and/or connective tissue and consolidation and necrosis in the lung. The first record of CBPP was in Germany in 1693. From Germany, the disease spread over all Europe. In 1843, it was introduced into the United States via a dairy cow that was purchased off a ship from England. By 1884 it had become wide spread. Mageed (2003) pointed out that the disease is present in certain areas in Khartoum State. In the Sudan the disease was first observed in 1875 in Darfur Province and later spread to Khartoum Province where it caused great losses among cattle. The disease was not reported in the northern Sudan (River Nile and Northern and Red Sea States) for more than 15 year. Also the disease was not reported in northern Kordofan, North and west Darfur and Kassala in the last 10 years (Mageed, 2003).

#### **1.12.6. Brucellosis**

Brucellosis of cattle, also known as contagious abortion and Bangs disease; it is caused by the infection with the bacterium *Brucella abortus*, which can also cause a disease of humans known as undulant fever. Brucellosis infection of cattle causes abortion or premature calving of recently infected animals most often between the fifth and eighth month of pregnancy. Infected cows frequently suffer from retained placenta after birth is difficult to get rebreed and sometimes become sterile. Brucellosis is spread from the vaginal discharge of an infected cow or from an aborted fetus. The organism has an affinity for the reproductive tract, weak calves and infertility frequently occur. DFRA, (2002) reported that brucella infection in pregnant cows can cause abortion or premature calving. Furthermore, brucella infection can lead to temporary sterility death from acute metritis and decreased milk production large quantities of the bacteria are excreted with the foetus, the placenta and the uterine fluid, mainly at the time of calving. After abortion or parturition, the organism continues to be excreted mainly via the milk of infected cows. (DFRA, 2002) The estimated most likely brucellosis sero-prevalence, using a test from the RBT-group, was 16.2% for the cattle population as a whole and 40.2% for the cow population.. Nielsen (2002) recently produced a comprehensive review of the serological tests for brucellosis that are in common use. Therefore, within this section the most commonly used serological tests

are only briefly summarized. Tests that are comparable similar specificity and sensitivity as well as similar other characteristics) are grouped together.

#### **1.12.7. Mastitis:**

Mastitis is considered the main disease in dairy herds (Kaneen and Bandhard, 1990). Mastitis is the inflammation of the mammary gland due to the injury of any type. Reem, (2015) Reported that the total number of dairy cows, which were examined in 34 investigated farms, equals 500. The result as follows: 55% acute mastitis, 44% chronic mastitis and 1% gangrenous mastitis. The isolated genera were as follows: 74% *Bacillus* spp., 24% *Staphylococcus* spp., 1% *Corynebacterium*spp. And 1% *Klebsiella*spp..

#### **1.13. Owners and labours:**

The dairy farmers of the developed countries have achieved a high degree of competency in both physical and mental abilities in the science of dairying. Such achievement did not occur as a result of a magic phenomenon or by chance, but from the combined efforts of the agricultural and extension educators, the researchers and the farmer themselves. Education is assumed to have positive impact on improving both the managerial and decision making abilities of the milk producers and ultimately the improvement of the overall milk production. Amira (2018) Reported that 58.5% of dairy farmers in Khartoum state were with secondary level, graduate level and post graduate level, while illiterate and primary education level represented a percentage of 41.4%. This result shows that dairy farming is an attractive and good investment for educated people. Fawi and Osman (2013) indicated that dairy production appears to be an attractive investment for educated people with ownership, management and supervision being in the hands of the farmer. El Zubeir *et al.*, (2014) showed that the education level of farms in Eastern Nile, Khartoum state was (16.67, 6.67, 30, 16.67, 21.67 and 8.33) % of illiteracy, khalwa, primary, secondary, graduate and post graduate respectively. This result was better when compared to the previous reports by El Zubeir and Mahala (2011) and Ahmed and El Zubeir (2013) who reported that the illiteracy among the dairy farms owners were 36% and 26.67%, respectively.

## CHAPTER II

### Materials and Methods

#### 2.1 Study area

This study was an extensive survey done in different dairy farms in Khartoum state to evaluate dairy farm management. 60 dairy farms were selected to conduct the investigation concerning the issue (Khartoum, Khartoum North and Omdurman). The study period was conducted during February to march 2021.

##### 2.1.1. Khartoum State (KS)

Located in the center of Sudan and it resemble the capital, it contains two rivers which are united to form the River Nile. Khartoum consists of three large towns; Khartoum, Khartoum North (Bahry) and Omdurman. Most of Khartoum state lies in the semi-desert climatic zone, where desert climate dominate in northern areas. Summer is season isdivided into dry and wet summer; wet summer is characterized by rainfall ranges between 50.4 - 178.8 millimeters. Temperature ranges between 25 - 40 °C in the summer. Temperature continue to drop in winter between (November to March) with arrange of 15 - 25 °C (C.B.S, 2020).. The estimated total Human population of Khartoum state was (7,188,000) (M.A.A.R.I, 2020). The average milk consumption per capita in Khartoum State (KS) is 62.9 kg/year; Khartoum state demanded 700.000 tons of milk/year and dairy product while the real production is estimated as 500.000 tons with gaps of 200.000 tons (M.A.A.R.I, 2020). Livestock in Khartoum State is a strategic element in food security, according to the estimate of the (M.A.A.R.I, 2020). Livestock population includes 260653 cattle, 463431 sheep, 680209 goats and 6888 camels. The average number of milking cows is 142,272 heads. The state contains 13 dairy associations authorized by the government with each association comprising mainly small holder dairy producers making about a 1468 dairy pens (M.A.A.R.I, 2020). This study concentrated on the largest dairy compound according to the ministry statistics (M.A.A.R.I, 2018). The study includes three dairy farms association as follows:

### **2.1.1.1 Hilat Kuku dairy association**

Located in Eastern Nile locality and lies within the semi desert ecological zone between latitude 15° and 16.45° North, longitude 31° and 34.4° East -Sharg Elneel locality - in Mahlab (2) and Mahlab (3). Mahlab(in Arabic) mean parlor and it stand for collection point for milk that produced by the small holders in the project administration and the dairy producer to supply a certain amount of milk to be processed in the dairy processing plant. Kuku dairy project was established since (1960), as the largest milk producing and dairy cattle marketing area in Khartoum State and regarded as a semi-intensive system (small holders) of milk production. The farms previously belonged to Hillat Kuku dairy project, consist of 3 barns distributed in vast area; each barn composed of small units (about 235 and 103 pens in Mahlab (2) and Mahlab (3) respectively) (Mansour *at el*, 2014). The total number of cows in Mahlab (2) and Mahlab (3) is about 16 thousand heads which yield about 500,000 liters of milk daily (M.A.A.R.I, 2020).

### **2.1.1.2. Al-Sayg dairy association**

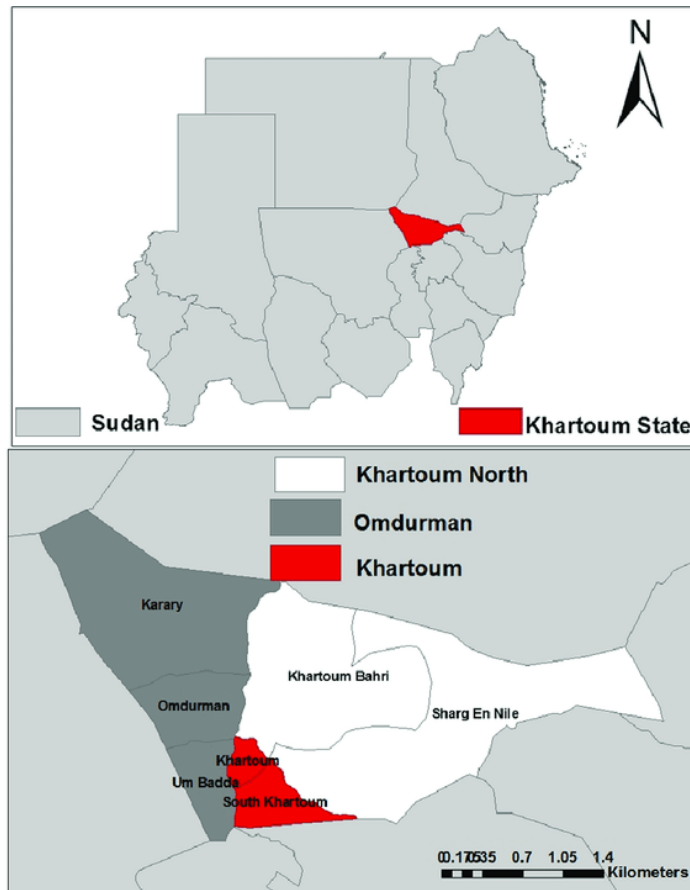
The campus was established on the basis of prior agreement between five association such as Jabra breeders, Alsabil Breeders, Azhari breeders, Ministry of Urban Planning and Ministry of Agriculture (KS).At the beginning of 2007 the five dairy associations cattle were transferred to one location in the south of Khartoum. That occupied an area of 155 feddans in Soba agricultural Scheme with a total dairy cattle of 17,495 heads and total daily milk yield about 338,400 liters in 577 pens (M.A.A.R.I, 2020).

### **2.1.1.3. Al-Rudwan dairy association**

Located in West Omdurman (Western River Nile) with 75 feddan total area and 250 dairy units including over 11,500 heads of dairy cows. The housing system adopted at Alrudwan Campus with average 27 cows ownership raised in an area of 700-1000 sq.m. Pens shades at high of 3 – 3.5m, made of bamboo with an extended yard in front of the shade, each is provided by a feed through either build of concrete or portable trough made of steel.Clean water is available all the day in water troughs (Babiker, 2007). Total milk yield production is 396,000 liters of milk per day (M.A.A.R.I, 2018). Al-Rudwan campus is one of the 13 dairy campus in Khartoum state constructed under the supervision of the state Ministry of Agriculture, Animal Resources and Irrigation. The main objectives of these dairy campus were to ensure sustainable



fresh milk supply and to offer a package of veterinary and extension services to boost the awareness of rural cattle herders (Babiker, 2007)



**Figur 2.1: Khartoum north including Sharg Alneel (kuku Diary association)**

**West Omdurman (Al-Rudwan Diary association) and South Khartoum (Sayg Diary association)**

## **2.2 Study design**

This study includes husbandry practices and general hygienic measurement in 60 dairy farms at different locations in Khartoum, Khartoum North and Omdurman of Khartoum State (Sudan). Twenty farms from each town were selected to evaluate the different practices of dairy farming during the period from February to March 2021. Information about management was collected by questionnaire and direct interview with farms' owners' in order to describe the constraints and to identify the weakness that need correction.

## **2.3. Data collection**

The following procedure was adopted to investigate the dairy production management practices in different districts (states) in Sudan. The data was collected through:

1. An extensive questionnaire.
2. Contact interview.
3. Direct visits to farms

The farms were chosen on the basis of willingness of herd owners to cooperate and release information included in the extensive questionnaire. The questionnaire as an instrument has direct and open-ended questions. In open-ended questions, respondents can express their own ideas and views in a freeway from multiple-choices direct questions.

Appendix show the questionnaire which was designed to cover all administrative and technical aspects related to farm management as much as possible to determine their impact on productivity (whether negative or positive).

## **2.4 Statistical analysis**

The collected data was statistically analyzed (Descriptive) by Statistical Package for Social Science (SPSS) computer program to lay out a descriptive map for the traditional dairy sector in Khartoum state.

## CHAPTER III

### Results

#### **3.1. Farms location, owners and labors: -**

Farms location, education and age of owners and labors are shown in table (3.1).

The distribution of the dairy farm in Khartoum State indicated that 33.33% in Khartoum and 33.33% in Khartoum North and 33.33% in Omdurman. The data revealed that 23 % of the owners were University graduates, while 31.1 % of the owners were illiterates and primary level is 34.4% and high school level is 11.5%. Also the data indicated that the age of most owners ranged between 49 – 59 years (32.8 %). Most of the labors were primary level (45.9 %) and 39.3 % were with illiterates and 14.8% high school level. The age of labors ranged between 1-25year (42.6%) and 25-35 year (42.6%) and 35-45year (14.8).

#### **3.2 .Cattle breed**

The collected information revealed that all the farms investigated owned crossbred dairy farms. The levels of exotic blood however could not be determined in these farms due to lack of records and the owners themselves did not bother to identify the level of crossing. The author however, documented that in a majority of the herd's more than 50 % exotic blood.

#### **3.3. Herd size and structure**

The Dairy herd size and structure of the investigated dairy farms in Khartoum state is shown in table (3.2). The results indicated that the total number of cattle in the farms was 2690 heads.

With a mean of  $44.83 \pm 20.403$  heads / herd. The lactating cows comprised 1499 of the total herd (55 %), while the dry cows were about 247 heads (9.6 %) and heifers 219 (9.3%) Female calves were found 411heads (15%) in higher percentage than other stock breeding bulls 87heads (3.1%), and male calves 224 (8%). indicating that in these farm the owners get rid of male calves.

#### **3.4. Lactation performance**

The lactation performance of the investigated herds is portrayed in table (3.3). The data showed that the mean total milk yield (TMY) was  $188.64 \pm 77.28$  liter / herd. A wide variation between the farms was evident. The maximum TMY was 44.5 liter while the minimum TMY recorded was 9 liter / herd. The average milk yields (AMY) / cow / day amounted to  $7.72 \pm 1.8$  liter with a wide range of 1.6 liter /day as the maximum and only 0.6 liter / day as the minimum. The

average lactation length (L.L) in the studied herds lasted for  $12.73 \pm 2.11$  month. The maximum lactation length recorded was 18 month, while the shortest L.L. was 9 month. The dry period (D.P) averaged  $1.96 \pm .581$  month with a wide range of 3 months as maximum and 1 month as minimum. The data in table (3.3) also indicated that on average a high lactating cow (H.L.C) produced  $1.64 \pm .32$  liter/day with 2.5 liter as the maximum and 1 liter as the minimum. On the other hand low lactating cow (L.L.C) yielded an average of  $0.62 \pm 0.24$  liter of daily milk with 1 liter as maximum and 0.25 liter as minimum.

### **3.5. Price of milk**

From table (3.3) the data indicated that the average price of selling milk (liter) was  $167.86 \pm 10.66$  SDG, with a range between 150 – 180 SDG.

### **3.6. Feeding: -**

The average daily consumption of the concentrate mix was About  $4.40 \pm .80$  Kg DM/cow/day irrespective of the milk yield of the cow. The roughages were comprised mainly of *Sorghum* and Berseem. The system of feeding individual feeding in 28.9% while collectivity feeding in 71.1% from total farms.

### **3.7. Milking practice**

Cows are hand – milked twice daily, early in the morning (5 –8 am) and late in the evening (4 – 7 pm). From the survey, it was evident that each milker milks 10 cows per milking time. However most milkers in the farms do not stay long in the farm and after 2 –6 months, they leave for better jobs.

**Table 3.1. Farms location, education and age of owners and labors**

Item	Percentage
1 – Farms location	
A – Khartoum	33.3
B – Khartoum North	33.3
C- Omdurman	33.3
2 - Owners education	
A – Illiterate	31.3
B –Primary	34.4
C –Secondary	11.5
D – University	23
3 – Owners age (years)	
A – 39-49	31.3
B – 49-59	32.8
C –59-69	24.6
D >70	11.5
4-labor education	
A-illiterate	39.3
B-primary	45.9
C-secondary	14.8
5-labor age(years)	
A-15-25	42.6
B-25-35	42.6
C-35-45	14.8

**Table 3.2. The Dairy herd size and structure in dairy farms in Khartoum state.**

Item	No of cows	Mean $\pm$ SD	Range	Percentage
Total	2690	44.83 $\pm$ 20.40	19 -103	
Lactating cows	1499	24.98 $\pm$ 13.007	9 – 63	55
Dry cows	247	4.11 $\pm$ 2.71	0 – 15	9.18
Heifers	219	3.65 $\pm$ 1.82	0 – 10	9.1
Breeding bulls	87	1.45 $\pm$ .50	1 –2	3
Female calves*	411	6.85 $\pm$ 3.16	2 – 17	15.72
Male calves**	224	3.73 $\pm$ 2.106	0 - 10	8.32

\* Female calves < 9 month

\*\* Male calves < 6 mont<sup>l</sup>

**Table 3.3. The Lactation performance particular of the studied herds**

Variables	Mean $\pm$ SD	Maximum	Minimum
Total milk yield (T M Y) /liter	188.64 $\pm$ 77.28	44.5	9
High lactating cow ( H L C) /liter	1.64 $\pm$ 0.32	2.5	1
Low lactating cow ( L L C)/ liter	0.62 $\pm$ 0.24	1	0.25
Average milk yield (A M Y)/liter	7.72 $\pm$ 1.8	1.6	0.6
Lactation length (LL)/month	12.73 $\pm$ 2.11	18	9
dry period (DP)/month	1.96 $\pm$ .581	3	1
Price of milk /SDG /(liter)	167.86 $\pm$ 10.66	180	150

### **3.8. Building material**

The building materials used for pens of the cows are shown in table (3.4). The result showed that the average area of the pen (Zereba) was  $700.53 \pm 193.51 \text{ m}^2$ . A wide variation was noticed in the pens areas, which ranged from 500 to 1000  $\text{m}^2$ . Most of the pens were poorly designed; the fences were made of red bricks 37.7%, green bricks 24.6%, and blocks 37.7%. The floors made of mud 56.7, sand 33.3%, stony 10%. The roof were made zink 27.9%, local thatchers 72.1%. It was obvious from the results that the percentage of the shaded area was about 20 % compared to unshaded areas 80%.

### **3. 9.Herd management**

#### **3 .9.1. Calf rearing practices**

The farms that adopt individual housing, identification and dehorning in table(3.5) were recorded as percentage from total number of farms surveyed 23.3 % of the farms adopted individual calf housing; while identification of calves was practiced in 18.3 % and dehorning was applied in 16.4% .It was noticed that ideal calf rearing system that included application of the three practices was not available.

#### **3.9.2.Records: -**

Few farmers keep records for their herds. The analysis of the questioner data indicated that 18.3 % of the studied farms kept production records, 21.7 % health records, 19 % nutrition records and 16.4 % reproduction records. It was noticed that even in the farms which kept records. The records are not well organized and unreliable since a lot of missing data is encountered.

#### **3.9. 3. Heat detection and type of insemination:**

-Heat detection and type of insemination practices in Khartoum dairy farms are shown in table (3.6). For heat detection knowledgeable stockmen for Observing behavior heat signs were used in only 11.7 % of the farms, while in 60 % of farms heat was detected by the bulls and in 28.3 % of farms by the combination of bulls and visual observation. The most widely used method for services was the natural mating since it was adopted in 90.2% of the farms. Artificial insemination was not used solely but was used in combination with natural mating 9.8% of farms.



### **3.9.4. Veterinary supervision and preventive measure practices-**

The Veterinary services offered in Khartoum dairy farms are shown in table (3.7). The disease control management is not satisfactory resident 16.7% of the farms were under veterinary supervision veterinarians and 28.3% with visiting veterinarians on weekly basis and 55% on call. It is clear that with the exception of vaccines provided by veterinary authorities, for control of contagious diseases, other management and preventive measures were not common. In 40 % of the annual routine vaccination, 60% is not vaccination in tow last year. Mastitis, CBPP, Foot and Mouth Disease (FMD) and contagious abortion cases were recorded in 73.3 %, 59 %, 42.6 % and 18 % of the studied farms respectively. Disinfections were practiced in 21.2% while it was not practiced in 78.8% farms. Culling measures were practiced in 50.8 %. Concerning deworming in 83.3 % were using anthelmintic drenching for internal parasites control while 77 % were using routine ticks spray for external parasites. Pregnancy diagnosis was practiced on call (78.3 %,) while 21.7% of routine pregnancy diagnosis.

**Table 3.4. The building material used in Khartoum dairy farms.**

Building materials	Percentage
(A) Fence	
1- red bricks	37.7
2- green bricks	24.6
3- blocks	37.7
(B)-floor	
1-mud	56.7
2-Sand	33.3
3-Stony	10
(C)Roof	
1-Local thatches	72.1
2-Zinc	27.9

**Table 3.5. Current calf management and recording system practice in Khartoum dairy farms.**

Item	Percentage
1-Calf management	
A-Individual housing	23.3
B-Identification	18.3
C-Dehorning	16.4
2- Records	
A- Production	18.3
B-Health	21.7
C-Nutrition	19
D-Reproduction	16.4

**Table 3.6. Heat detection and type of insemination practices in Khartoum dairy farms**

Item	Percentage
1- Heat detection	
A – Skillful labors observation	11.7
B – Bulls	60
C- Skillful labors observation +bulls	28.3
2 –Type of insemination	
A – natural insemination	90.2
B- Artificial insemination	0
C- natural + artificial insemination	9.8

**Table 3.7. The Veterinary supervision practices in Khartoum dairy farms**

Item	Percentage
1- Veterinary supervision	
A – Resident veterinarians	16.7
B – Weekly visit veterinarians	28.3
C –When needed	55
2- Annual routine vaccination	40
3- Diseases	
A- Cases of foot and mouth disease	42.6
B – Cases of brucellosis	18
C-cases of mastitis	73.3
D-cases of CBPP	59
8- Culling	50.8
9 – Deworming drenching	83.3
10 –spry ticks	77
11 – Pregnancy diagnosis	
A- Routine pregnancy diagnosis	21.7
B – When needed	78.3

## CHAPTER IV

### Discussion

This study is carried out to give an approximate map of the present status of the management and husbandry practices in some dairy farms Khartoum state. The extensive survey of selected farms within the different localities in Khartoum state include a broad spectrum of all particulars concerning the dairy herd in the Khartoum state as demonstrated by the miscellaneous questions included in the questionnaire. All other studies in the literature did not cover the range of information secured in this study. Some studies dealt with specific herds and covered limited information. Abdel- Mageed (1988) investigated the dairy husbandry practices in Kuku Dairy Project, Badi (1988) studied the dairy herd type, structure and management practices in the Gezira scheme, Mohamed Kheir (2002) surveyed the dairy herd in Port Sudan, El-Nazeir *et al.* (2004) studied the management and husbandry practices in Khartoum state and Hamza *et al.* (2015) investigated the dairy husbandry practices in South Darfur.

From table (3.1), the results indicated that that the age of most owners and labours ranged between 40 -60 years (64.1 %) and 20-35 years (85.2%), respectively. El-Nazeir *et al.* (2004) found that most of the labours in Khartoum state were illiterate (84%) and only 16 % were of primary school level. The ages of most labours (60%) ranged between 25–35 years. Hamza *et al.*(2015) studied management and husbandry practices in South Darfur (Mossay), he found that The age of the majority of dairy farm owners ranges between 30-40 years (45%), then 41-56 years old (40%) and only (5%) was above 60 years old .Graduated persons among dairy farm owners in (Mossay) district represent the majority (35%) then those of higher secondary certificate (25%) and those only passing the intermediate school were (10%) where the rest of the producers were received Khalwa education (5%) or illiterate (5%) . Fangaly (1980) found that untrained herdsmen constitute a constraint at Umbenien Dairy Production Research Station. The data in table (3.1) revealed that 34.4% of the owners have primary level, while 31.3% of the owners were illiterates. 11.5 % of the owners have secondary level and only 23% of the owners were university graduates. Amira (2018) reported that 58.5% of dairy farmers in Khartoum state were with secondary level, graduate level and post graduate level, while illiterate and primary

education level represented a percentage of 41.4%. This result shows that dairy farming is an attractive and good investment for educated people. El Zubeir, *et al.*, (2014) showed that the education level of farms in Eastern Nile, Khartoum state was (16.67, 6.67, 30, 16.67, 21.67 and 8.33) % of illiteracy, khalwa, primary, secondary, graduate and post graduate, respectively. El Zubeir and Mahala (2011) and Ahmed and El Zubeir (2013) reported that the illiteracy among the dairy farms owners were 36% and 26.67%, respectively. The effect of education of the dairyman especially regarding preventive measures is very important of disease control (Cole, 1976). Mohammed Kheir (2002) studied the stockowner in Port Sudan and found that the educational standard of the owners were, illiterate 48 %, khalwa 22 %, primary 17 %, secondary 4 % and university 9 %. Habeebballa (1996) reported that the education status of farm owner did not significantly affect the milk yield per day ( $p > 0.05$ ), but in this study the education affected significantly ( $p < 0.01$ ) the milk yield (L / cow) per day which was  $6.8 \pm 0.3$  compared by  $5.6 \pm 0.4$  when the farmer uneducated. However higher yield was observed when the owner was a university graduate, while the lowest yield was observed when the owner was illiterate. The present results comply with those of El-Nazeir *et al.* (2004) who reported that 30% of stockowners in Khartoum State were found to be illiterate. From table (3.2), it was noticed that the overall mean herd size of the studied farms in Khartoum state was  $44.83 \pm 20.4$  head per herd, which less than the herd size reported by Abdel - Mageed (1988) in Kuku Dairy Project and that of Mohammed (1995) those authors reported  $69.7 \pm 53.5$  and  $82.5 \pm 137$ , respectively and greater than  $39.6 \pm 20.7$  reported by Habeebballa (1996). These variations may be due to a variety of factors including the number of herds studied by the different authors, goals and objectives of studies, dates of surveys and sites and cooperation of stock owners and other unidentified factors. The lactating cows in this study represented 55% of the total herd and the dry cows represented 9.6 % of total herd (table 3.2). The lactating cows are greater than 38.9% reported by El-Nazeir (2014) in his study of dairy herd in El Seleit. Also these results greater than results reported by Atabani (1960) studying dairy herd at Umbenien and Nisheisheiba Research Station, where he found that milking cows at Umbenein were very low (12.5%) and dry cows were 28.7%, while in Nesheisheiba, milking cows were 22.4 % and dry cows were 24.2% of the herd size. Badi (1988) reported that at Gezira Scheme dairy herd, the milking cows represented 35.7% while the dry cows 64.3% in a herd of cross cows. For local cattle he reported that 34.6% were milking cows and 65.4% dry cows. While in Kuku Dairy Project, an average herd size of  $69.7 \pm 53.5$  cows there

were 35.0% milking cows, 21.9% dry cows, 13.4% heifers, 28.3% calves and 1.2% breeding bulls (Abdel-Mageed, 1988). The current results revealed that heifers represented 9.3 % of the total herd while male and female calves represented 23.00 %. Badi (1988) reported different percent for heifers (12.8%) and for calves (12.1%). The majority of farm owners care only for herd size without any considerations for reproductive and fertility management. This was the same as what reported by Sumberge (1992), in his study of livestock development in Gambia. He reported that herds may contain many uneconomic and infertile animals. The average daily milk yield / cow amounted to  $15.44 \pm 3.6$  lbs (table, 3), which was less than the  $18.95 \pm 5.99$  lb which reported by El-Nazeir *et al.*, (2004) and  $20.2 \pm 10.2$  reported by Abdel – Mageed (1988). The variations in the different studies may be due to the effect of environmental conditions namely combined of temperature and humidity, types of breed and farm management level. The dry period is defining as the period during which the cow is not milking; that means the term refers to the period of off- milking. Ideal dry period are at least six to eight weeks (60 days) between lactations for regeneration of secretory tissues and to restore body condition and increase milk yield for the first three month of next lactation. The average dry period  $1.96 \pm 0.6$  months (table 3.3). The Lactation length (L.L) found in this study averaged  $12.7 \pm 2.1$  months. El –Nazeir *et al.*, (2004) reported a shorter lactation length 269.85+85 days. That indicates the wide variability experienced in these farms suggesting that lactation length is a management controlled factor. The discrepancy between the results in the different farms also highlights the different management policies adopted in the dairy farms in Khartoum State. The results concluded that the average price of selling milk ( liter) was  $167.93 \pm 10.66$  SDG, , which was more than 40 SDG in Khartoum state claimed by Statistical Bulletin for Animal Resources ( 2000), These variations in prices may be due to differences in prices of fodder, supply and demand and time factor. In the present study, the average daily consumption of the concentrate mix was about  $4.40 \pm .806$  kg, which was less than that reported by El- Nazeir *et al.*, ( 2004)  $5.2+1.45$  These variations can be safely attributed to milk yield, availability of green fodder, prices, energy content of the diet and different nutritional management systems in the different farms. The present study indicated that the average area of the pen (Zereba)  $700.533 \pm 193.5$  m<sup>2</sup> Rang 500-1000m<sup>2</sup>.while El-Nazeir *et al.*, (2004) found average area was  $1484.66 \pm 1962.68$  m<sup>2</sup>

Mohamed Kheir (2002) found that the average area of the pens were  $1463 \pm 4091$  m<sup>2</sup> in Port Sudan. These variations may be due to differences in climate, availability of building materials



and purpose and wealth of the owner. Also some extension advices are highly recommended in this area. In this study cows are hand – milked twice daily, early in the morning (5 – 8 am) and late in the evening. Each milker milks 10 cows. While found that many studies indicate the milking cows three or four times per day causes an increase in milk production in comparison with twice daily milking. The present study revealed that 23.3 % of the farms adopted individual calf housing, identification of calves was practiced in 18.3% and dehorning was applied in 16.4% of the total farms. El-Nazeir et al., (2004) found that individual housing, identification and dehorning were practiced in 16 %, 30 % and 24 % of the total herd respectively in Khartoum dairy farms. From the present results it was noticed that ideal calf rearing system that included application of the individual housing, identification and dehorning practices was not available. The information's from the analysis of Questioners in this study suggest that 81.7 % of the studied farms have no production records, 78.3 % with no health records, 81 % with no nutrition records and 83.6 % with no reproduction records. From the present results it was noticed that even in the farms which kept records, however the records are not well organized and unreliable since a lot of missing data is encountered. This may be due to the unawareness of owners to the importance of records keeping. Bayemi *et al.* (2005) reported that one area needing much attention in dairy farms is record keeping and farmers need intensive training and follow up. El Zubeir and Mahala (2011) reported that lack of records and marketing of milk were also among management factors that need correction in dairy farms located in Khartoum State. Shima (2020) reported that from the analysis of 80 % of the studied farms have no any type of records. Records for animal breeding 89.47%, followed by 60.53% records for milk production and then 23.68 % of records kept by the companies that supervise the farms. Records for herd health 21.05% and then the records of nutrition and sales have same proportion (18.42%). El-Nazeir (2014) in El-Seleit Project who found that 70% of the studied farms have no production records, 82.7 % with no health records, 90 % with no nutrition records and 43.3 % with no reproduction records. The heat interval varies from 17 to 26 days and lasts from 6 to 36 hours, with an average duration of 18 hours for cows and 15 hours for heifers. Ovulation occurs 10 to 14 hours after the end of the heat period (Blakely and Bade, 1982). From the current data it was obvious that knowledgeable stockmen for observing behavioral heat signs were used in only 11.7 % of the farms, while in 60 % heat was detected by the Bulls and in 23.3% by the combination of bulls and visual observation. Shima (2020) reported that heat detection knowledgeable stockmen for observing

behavior heat signs were used in 39.9% of the farms, while in 34.3% heat was detected by the bulls and in 24.4 % by the combination of bulls and visual observation. And 1.4% of the labor has no idea about heat. El-Nazeir (2014) found that the knowledgeable stockmen for observing behavioral heat signs were used in only 30 % of the farms, while in 61.7 % heat was detected by the bulls and in 8.3 % by the combination of bulls and visual observation. The most widely used methods` for insemination was the natural one since it was adopted in 90.2 % of the farms. Artificial insemination (AI) was not used solely but was used in combination with natural mating in 9.8% farms. Decreased percentage of using (AI) may be due to the lack of trained inseminator, unavailability of liquid nitrogen and the low quality of imported semen or the knowledge and general awareness of the stockmen. Vaccination against contagious diseases such as, C.B.P.P hemorrhagic septicemia and FMD was practiced in 40 % of the total dairy farms studied. Other vaccines such as brucella vaccines were not used. The vaccination programmers were provided by the veterinary Dept. in the majority of the dairy farms visited. brucella vaccination is not common or possible, so farmers have to tolerate the disease in their herds. Practices such as , culling, deworming, ticks spray and disinfection were practiced in , 50.8 %, 83.3%, , 77% and 21.2% of the farms respectively. Habeeballa (1996) noticed that vaccination against contagious diseases such as Rinder Pest, Anthrax, Black Quarter, Contagious Bovine Pleuro Pneumonia and Hemorrhagic Septicemia were reported by 72 % of the farms studied. Mohammed (1995) noticed that vaccination against contagious diseases such as Rinder Pest, Anthrax, Black Quarter, Contagious Bovine Pleuro Pneumonia and Hemorrhagic Septicemia were reported by 92 % of farms studied. Claimed that preventive measures in Sudan face many difficulties, pitfalls and disappointments, owing to economic exigencies. Management practices and preventive measures are not adequate and practices such as isolation and quarantine facilities were not common. Animals must be given veterinary care to reduce their susceptibility to disease and decrease mortality. The results of the present study revealed resident 16.7 % and 28.3 % with visiting veterinaries on weekly basis and 55% on call. Veterinary care was noticed to be better in the past compared to the present situation, because of the availability of drugs in veterinary center with reasonable prices. However, at present the drugs are only available in private veterinary pharmacies with unaffordable prices. . Elzubier *et al.* (2014) found highly significant ( $p < 0.001$ ) variations were obtained regarding the role of veterinarians in the studied farms, which as follows: (18.33%) resident, (16.67%) visited the farm at regular intervals and (65.00%) on call.

Mohammed (1995) found that in more than 66 % of farms, the disease control management was not satisfactory. Only 27.0 % of the farms are under veterinary supervision, 20 % of the farms have resident veterinary supervision and 7.06 % has veterinary supervision at least a weekly visit. Habeeballa (1996) noticed that only 10 % of farms were under veterinary supervision. Kulneff (2006) stated that the availability of veterinarians in Sudan is very good in urban areas, but in rural areas it is poor. In the present study, the most common diseases recorded at the farm studied were mastitis (73.3 %), foot and mouth disease (42.6%), brucellosis (18%) and CBPP (59 %). These diseases in Sudan were common among all breeds and especially in dairy cattle. Saeed *et al.* (2015) reported that the percentage of the infectious diseases such as Mastitis, Foot and Mouth disease, Contagious Bovine Pox and Pleuro-pneumonia that frequently occurred in the milk herd in both small and large scale livestock keepers were 99%, 51%, 13% and 11%, respectively. Other diseases of importance were Bloats (4%), hoof problems (3%) due to bad management and milk fever (1%). Mustafa (2008) found that infectious diseases such as Foot and Mouth diseases, Contagious Bovine Pleuro-pneumonia had frequently occurred in the herd with a percentage of 60%. He also found Mastitis with a percentage of 35.6% and Diarrheas and Bloats with a percentage of 24.4%. Musa *et al.* (2006) also found the incidences of infectious diseases in cows in Butana cattle area at a rate of 24% for Foot and Mouth diseases and 40% for Contagious Bovine Pleuro-pneumonia. Elzubier *et al.* (2014) in Khartoum State, found that Hemorrhagic septicemia (40%), contagious bovine Pleuro-pneumonia (43.33%), foot and mouth disease (25%), brucellosis (1.67%), rinderpest (5%), black leg (5%), anthrax (11.67%), pox (15%) and hepatitis virus A (1.67%) were the most common diseases that received vaccination. El-Sammani *et al.* (1996) reported that the high incidence of infectious diseases and the high cost of veterinary drugs could be attributed to the liberalization of the economy and the sudden shift from completely government subsidized to privatized veterinary services provided at market price.

## **Conclusion:**

The critical survey done in this study revealed a lot of malpractices adopted by investigated dairy farms in Khartoum State. The conclusions drawn out should highlight these malpractices and attempts of alleviate them are worthy:

The data revealed that 23 % of the owners were university graduates, 11.5 % with high school level, 31.1 % of the owner were completely illiterates and 34.4 % with primary level. And the age of most owners ranged between 49 – 59 years (32.8%). Most of labors were primary level (45.9 %) and (39.3) % were with illiterates and 14.8% high school. The age of most labors between 25 – 35 years (42.6%).

The average herd structure for all farms was as follows: -The lactating cows were 55 %, while the dry cows were 9.6%. The average daily milk yield per cow was  $7.72 \pm 1.8$  liter. And the average price of milk (liter) was  $167.86 \pm 10.66$  SDG.

The average lactation length recorded was  $12.44 \pm 2.11$  month. And the average dry period was  $1.96 \pm .581$  month. The average daily consumption of concentrate was about  $4.40 \pm .806$  kg / DM / cow irrespective of milk yield of the cow.

Individual calf housing was adopted in 23.3 %, identification of calves was practiced in 18.3 % and dehorning was applied in 16.4 %. 17 – 81.7 % of the total farms have no production records, 78.3 % with no health records, 81 % with no nutrition records and 83.6 % with no reproduction records. The most widely used method for insemination was the natural one, it was adopted in 90.2 % of the farms and artificial insemination was used in combination with natural mating in 9.8% of the total farms. Only 16.7% of the farms were under veterinary supervision.

The annual routine vaccination against anthrax, C, B. P.P., FMD and HS was practiced in 40 % of the total farms. Mastitis, CBPP, foot and mouth disease and contagious Abortion cases were recorded in 73.3 %, 59 %, 42.6% and 18 % of the studied farms respectively. Concerning deworming, 83.8% were using anthelmintic drenching for internal parasites control while 77 % were using routine tick spray for external parasites. And Pregnancy diagnosis was practiced in 21.7 % of the total farms.

**Recommendation:**

The average daily milk production in the dairy farms under study was low, that is mainly attributed to the low management and nutrition standards provided in most of the farms. Increased level of milk production is of high importance to increase the profitability gained by farmers. The study also revealed that many problems face dairy development in Khartoum state. The following recommendations are expected to solve most of these constraints.

The farmers at Khartoum state need more competencies and more extension on dairy farming practices including feeding, housing, milking hygiene, proper sanitary practices, culling policies, disease prevention measures. Proper records and records keeping. Effectively information about health management transferred to dairy operators through extension and training of the stockmen cannot be over emphasized.

Intervention of government to avail animal feeds to the farmers at reasonable prices.

Through provision of improved seeds and fertilize to Farmers to grow their own fodder crops in the farm. And Provision of concentrate ingredients at reasonable price. And helping to store ingredients at the season of availability e.g. Sorghum. And to restrict export of some ingredients e.g. molasses, oil Cakes and to encourage their use domestically.

Establishment of units for research in fodder production and Encouragement of establishment of feed factories. Formulation of rations on economic basis and also estimation on dairy cows requirements for feeds. Governmental supervision on breeding programs in the dairy farms. This could be done by: - Building of effective artificial insemination centers in the state by providing sustainable infra structural facilities. And Distribution of improved imported or local breeding bulls. That could be also done by an office to coordinate exchange of bulls between farmers.

Creation of milk marketing policies for the benefit of both the producer and consumer.

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**APPENDIX.1.** Questionnaire on farm management and husbandry practices in some dairy farms in Khartoum state.

**The stock owners**

Name of owner	Age	Education level	Job	Source of income	Phone No.

(1) The farm:-

Location	Area	Percentage of shaded area	Cultivated lands area

(2) Building materials:-

Building	Fence	Floor	Roof	Separate yards
Area				
Material				

(3) Stock:-

No. of cows	No. of lactating cows	No. of dry cows	No. of heifers	No. of male calves	No. of female calves	No. of breeding bulls

(4) Lactation performance:-

Total milk yield	Average milk yield	High lactating cow	Low lactating cow	Lactation length	Dry period	Price of milk(lb)

(5) Feeding system:-

Type	Contents and percentage	Source	System of feeding	Daily consumption
Concentrate				
Roughage				

(6) Farm management:-

(A) Calf rearing practices:-

Individual housing	Identification	Dehorning	Bedding

(B) Records:-

Production	Health	Reproduction	Nutrition	Others

(C) Heat detection:-

By labors	By bulls	By labors + bulls	Others

(D) Type of insemination:-

Natural	Artificial	Natural + Artificial

(E) Pregnancy Diagnosis:

Routine	On call	Others

(F) Sanitation:-

Disinfection of building	Removal of dug interval	Hooves trimming

(G) Vaccination:-

Vaccine	H. S	Anthrax	C.B.P.P	B.Q	F and M	Brucella

(H) Milking process:-

Machine milking	Hand milking	Clean udder	Clean milkers	Equipment clean

(8) Noninfectious diseases:-

Diseases	No. of cases	Treatment	Notes	
Edema				
Ketosis				
Milk fever				
Others				

(9) Contagious diseases:-

Diseases	No. of cases	Treatment	Preventive measures
Anthrax			
F and M			
C.B.P.P			
H.S			
Foot rot			
Rinder pest			
Others			

(10) Mastitis:-

No. of cases	Treatment	Sanitation	Preventive measures

(11) Brucellosis:-

Brucellosis	Notes
Abortion at late pregnancy	
Is the herd tested before	
Is the herd vaccinated	
Number of cows culled	

(12) Internal parasites:-

No. of cases	Previous testing	Strategic drenching	Treatment

(13) External parasites:-

Presence	Spraying	Dipping	Chemical used	others

(14) General principles of disease control:-

Preventive measures	Notes
Sanitation	
Isolation	
Vaccination	
Testing	
Culling	
Treatment	
Nutrition	

(15) Veterinary supervision:-

Resident veterinarians	Visitor veterinarians	On call



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(16) Farm labors:-

Number	Age	Education	Salary	Notes

(17) General notes:

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