AN ASSESSMENT OF MANAGEMENT AND
HUSBANDRY PRACTICES IN SOME DAIRY
FARMS IN KHARTOUM STATE

By
Babiker Abdel - Razig Elnazeir
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Supervisor:
Prof: ABDEL MONEIM MUKHTAR ABU NIKHAILA

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Dedication

To the soul of my father

To dear mother, brothers and sisters

To my dear wife

To my friends and colleagues

With love

Babiker
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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 100 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 100 herds surveyed was 9145 heads with an overall mean of 91.45 ± 107.43 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 3462 cow (37.86 % of the total herd) with an overall mean of 34.62± 46.38 cows / herd. The dry cows comprised 7.14 %, Heifers 11.85 % and calves and bulls accounted for 33.15 % of the herd. The average daily milk production per cow was found to be 18.95 ± 5.99 lbs. The average price of lb milk was 54.7 ± 7.5 SD. The average lactation length was 269 .85 ± 18.97 days, while the average dry period was 42.84 ± 28.56 days. The total amount of green fodder offered to a cow / day was 11.0 ± 4.4 kg DM and the supplementary feeding offered per cow per day was 5.23 ± 1.54 kg DM for the milking herds. Only 35 % of the farmers owned cultivable lands for growing their own roughages. Most of the pens were poorly designed; with an average area
of 1484.66 ± 1962.68 m². 20 % of which is shaded and 80 % unshaded area. Individual calf housing was adopted in 16 %, identification of calves was practiced in 30 % and dehorning was applied in 24 % of the total farms studied. 80 % of the total farms have no production records, 83 % with no health records, and 81 % with no feeding records and 78 % with no reproductive records. The most widely used method for insemination was natural mating and was adopted in 96 % of the farms and artificial insemination was used in combination with natural mating in 4 % of the farms. Only 23 % of the total farms were under veterinary supervision. The annual routine vaccination against Anthrax, Black Quarter, Contagious Bovine Pluero Pnemonia and Heamorahagic septicemia was practiced in 63 % of the total farms while vaccination for diseases such as Brucellosis and Foot and Mouth Disease were not practiced at all in the farms studied. Mastitis, Theileriosis, Foot and Mouth Disease and Contagious Abortion cases were recorded in 27 %, 17 %, 44 % and 17 % of the total studied farms respectively. 25 % of the total farms practiced testing for diseases while culling policies were practiced in only 20 % of the farms Disinfection was practiced in 59 % of the total farms. Deworming with anthelmintic drenching was applied in 58 % for internal parasites control, while 64 % used routine ticks spray for external parasite. Pregnancy diagnosis was practiced in 48 % of the total farms. The data revealed that 33 % of the owners were university graduates, 30 % were illiterates, 28 % were primary level and 9 % were high school level. The age of most owners ranged between 40 – 49 years (36 %). Most of the labors were illiterates (84 %) while 16 % were with primary level. The age of most labors ranged between 25 – 35 years (64 %).
ملخص الظروحة

في هذه الدراسة تم دراسة حجم القطيع، تغذية القطيع، السلالة، الحظائر وتجميع الأبقار حسب خصائصها الإنتاجية وأعمارها من أبقار حلوب، فاحظ، عجلات بكور وعجلات صغيرة وغيران. كما تمت دراسة مدى تطبيق وسائل الإدارة والرعاية الصحية والنظافة والوقاية من الأمراض المستخدمة في بعض مزارع الألبان بولاية الخرطوم. تم تسجيل مراقعة البان في مواقع مختلفة في ولاية الخرطوم واعتماد في هذه الدراسة أسلوب الاستبيان المكثف والمقابلات المباشرة مع ملاك المزارع خلال الزيارات الميدانية لرصد وسائل الإدارة والرعاية المطلوبة بمشاريع الألبان.

من التحليل الإحصائي الوصفي للبيانات التي تم جمعها اتضح الآتي:

- إجمالي القطيع 9145 رأس من الأبقار في 100 مزرعة بولاية الخرطوم بمتوسط 107.14 ± 43.43 رأس للقطيع.
- التضخم من الدراسة أن 100% من الدفاع الكلي للأبقار هجين بنسب دم أجنبي متفاوتة دون معرفة نسبة الدم الأجنبي وذلك لقلة السجلات المحتفظ بها في أغلب المزارع التي تم دراستها.
- بالنسبة لشكل والتكوين القطيع وجد أن هناك 3462 بقرة حلوب وتمثل حوالي 37.86% من إجمالي القطيع بمتوسط 46.38 ± 34.62 بقرة حلوب بالمزرعة الواحدة.
- بينما كانت نسبة الأبقار الجافة 17.14% ونسبة الأبقار (النُذور) 11.85% أما العجل (ذكور وإناث) والثيران نسبة 33.15%.
- رصدت الدراسة أن متوسط إنتاج البقرة اليومي 18.95 ± 7.5 رطل وأن سعر رطل اللبن 5.99 ± 43.10 دينار سوداني.
- متوسط طول فترة الحليب 18.97 ± 16.85 يوم بينما فترة الجفاف 28.56 ± 42.84 يوم.
- الكمية الكلوية المقدمة من العلف للبقرة يوميا رصدت 4.4 ± 11.0 كجم مادة جافة. أما الأعلاف المركزة فقد قدرت بواقع 1.54 ± 5.23 كجم مالفة للاسجاار الحلو.
- أغلب الحظائر صممت بشكل سبي وبمتوسط مساحة 1982.68 ± 100 متر مربع تمثل المساحات المظللة منها 20% والسقالات الغير مظللة 80%.
- ممارسة الإسكان الفردية للعجل طبقت في 16%، ترقيم العجل طبق في 30% وازالة القرون طبقت في 24% من مجموع المزارع التي تم دراستها.
 بالنسبة للسجلات 80% من مجموع المزارع لا يوجد بها سجلات إنتاج، 83% لا يوجد بها سجلات صحة، 81% لا يوجد بها سجلات تغذية و 78% لا يوجد بها سجلات تناسل.

التزاوج الطبيعى هو الطريقة الأكثر شيوعا حيث طبقت في 96% من المزارع بينما استعمل التحقوق الاصطناعي متمارسا مع التزاوج الطبيعي في 4% من المزارع التي تم دراستها.

اتضح من الدراسة أن الإشراف البيطرى يمارس فقط في 23% من المزارع الكلية. أما التعليم الروتيني السنوى ضد الجمرة الخبيثة، الربع الأسود، الإتهام الرئوى المزمن في الأبقار والتسمم الدموى النزفي طبق في 63% من المزارع الكلية بينما التعليم ضد الإجهاض المعدى ومرض الحمى القلاعية لم يمارس في أي مزرعة من المزارع التي تم دراستها.

التهاب الضرع، الحمى القرادية، مرض الحمى القلاعية وحالات الإجهاض المعدية سجلت في 27% و 17% و 17% و 17% من مجموع المزارع التي تمت دراستها على التوالي.

اجتماع من الدراسة أن 25% من المزارع الكلية مارست الاختبار ضد الأمراض بينما طبقت سياسات الإبعاد في 20% من المزارع فقط.

طبق التطهير في 59% من المزارع الكلية والتجريع ضد الديدان في 58% من المزارع للسيطرة على الطفيليات الداخلية بينما مورس الرش الدورى للقراد في 64% من المزارع الكلية للقضاء على الطفيليات الخارجية.

طبق كشف الحمل في 48% من المزارع الكلية.

وأوضح الدراسة أن 33% من مالك المزارع من خريجي الجامعات، 30% أمهين، 28% مستوى إبتدائي و 9% مستوى ثانوى وتراوحت اعمار معظم الملاك بين 49 – 40 سنة (36%). أغلب العمالة أمهين (84%) بينما 16% مستوى إبتدائي وتراوحت اعمار معظمهم بين 35 – 25 سنة (64%).

CHAPTER ONE
Introduction

Khartoum state is located in the semi arid zone that extends over an area of 20971 km², between latitude 15⁰N and 16.45⁰N and longitude 31⁰E and 34.4⁰E. The average rainfall is between 139 – 157 mm. The state human population is 5.7 million, increasing at an annual rate of about 4.04 %. The arable land in the state amounts to 1.8 million feddans; of which 460.000 feddans receive permanent system of irrigation. Water for irrigation is abundant from the White and Blue Niles which joint at Khartoum forming the River Nile. (Ministry of Agriculture, Animal Resources and Irrigation of Khartoum State, M.A.A.R.I. 2005).

Underground water reservoir is estimated to accommodate 7.7 million cubic meters. This is continually replenished from the Nile network and the annual rainfall. Livestock is a strategic element in food security. According to the annual report of M.A.A.R.I. (2005) estimated numbers of ruminants in Khartoum State were about 222.000 cattle, 445.000 sheep, 726.000 goats and 5500 camels. Some of the cattle (68.5 %) are actually contributing in the supply of liquid milk, to the state. The annual per capita consumption of milk in Khartoum State is estimated to be about 81.5 litters. This means that the need for fresh liquid milk could amount to 465.000 Tons (M.A.A.R.I. 2005). This would certainly increase with the steady increasing number of population. Another factor is that milk being an elastic commodity, one would imagine that, the demand would rise up dramatically; thus creating a sizeable gap between demand and supply. The only way to bridge this gap between demand and supply is by putting more efforts in improving ways and means of dairy production.

Now there are two systems of dairy production in Khartoum State: viz the traditional husbandry system where productivity is rather low. The other
type of production is symbolized by modern farming system. In this later one a little bit of more advanced animal husbandry is practiced. It is guided by the Ministry of Agriculture. About eleven holding areas are located around the three towns – capital. Each animal owner is given and inclusive where his cows are kept. But inspite of this endeavor, very little services are rendered to them. Productivity is not uniform, there is a lack of breeding system, records are lacking, veterinary service is very poor and housing system and other animal husbandry inputs are not adequate. Avery small number of modern devices is practicing high technology with a reasonable level of production. The milk in this sector is properly handled and delivered to the consumer in a pasteurized refrigerated form. 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. As the population is expanding, the consummation pattern is changing, and the milk is a vulnerable commodity; the gap is even more widening.

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. 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.
2.1 Classification of dairy farms

Abdalla (1995) reported that there are two major system of milk production in the Sudan, traditional grazing in western, central and Southern Sudan and modern sector around cities and urban centers. Williamson and Payne (1978) found at least three types of dairy management in the tropics, with the subsistence producer being dominant with low and poor standard of management, the specialized dairy farmers with relatively small farms and managerial skill are not usually very high, and the third is the large scale dairy farms, which are very few and possess high intensive well manged farms.

In Indonesia, Tjokohoesodo and Grossman (1975) classified dairy farms according to the wealth of the owner and the herd size as small, medium and large holders.

2.2 Dairy breeds in the Sudan: -

Genetic and environmental factors affect cattle production, and by improving them production can be increased to a great deal. The indigenous breed (Bos indicus) has higher level of over all adaptation to the environmental stresses than the introduced foreign ones (Bos taurus) (Simpson and Evangelou, 1983). In Sudan inspite of the large animal population still the dairy products do not satisfy what is really required. Atabani (1961) reported that Kenana dairy cow display great dairy and breed characters, while Dahab (1966) reported from Umbenen livestock center, that there were few Kenana cows that yield up to 50 lb of milk per day. Based on this Kenana and Butana cattle and their crosses constitute the major breeds for dairy production in
Sudan. Williamson and Payna (1978) reported that within the Sudanese breeds, the Kenana are considered as the best milkers in Africa.

First importation of exotic breeds in Sudan was faced by many constraints, environmental, managerial and health problems. All 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 (Bayoumi, 1964). Under nearly all conditions of climate and management throughout the world the milk yield of local cattle can be increased by crossing with an improved dairy breeds (Mason, 1977).

Badi (1988) studying dairy herd in Gezira scheme found that Kenana type of cattle is predominant (77.1 %) and crossbred cattle represent 3.5 % of total cattle.

In Kuku dairy project crossbred cows were found to be the highest (67.2 %) and that was due to the establishment of artificial insemination center at Kuku to upgrade the Kenana and Butana cattle (Tibin *et al.*, 1990). Hassan (1988) reported that acow with more than 50 % foreign blood yielded daily average of 25.7 lb /day while those with less than 50 % foreign blood yielded daily average of 20.3 lb / day. Ibrahim (1989) found the highest average production in cows with 62.5 % foreign blood when compared with cows of 25 %, 37.5 %, 50 % and 75 % and he concluded that might be attributed to the differences in management practices and length of lactation. Abdel-Mageed (1988) reported that the highest average daily production was reached in the fourth lactation in grade cattle (15.5 ±2.4 kg/cow/day), while in local cattle it was 7.6±2.2 kg/cow/day and it was reached at the third lactation.

Matthewman (1993) reported that in the tropics, exotic breeds do not perform better than local breeds; hence increased production by crossbreeding is most easily achieved. Mohammed (1995) stated that with regard to breed type in dairy herd in Khartoum state, foreign breeds represented 34 % of total,
grade cattle were 52.8 % and 13.2 % were local type. Habeeballa (1996) reported the percentage of crossbred cows in herds at Al-Kadro, Al-Halfaya, Shambat and Kuku, as 92.9 %, 88.5 % 67.0 %, and 99.2 % respectively with overall mean 86.9. Kenana cows represented 7.1 %, 11.5 %, 2.2 %, and 0.8 % respectively, with overall mean 5.4. Butana were found to be 0 %, 0 %, 1.1 % and 0 % respectively.

2.3 Herd size and structure:

Few studies were done on Sudanese cattle about herd size and structure Abdel- Mageed, (1988).

Atabani (1960) studied the herd size and structure at Umbenein livestock in herd size of 529; there were 66 (12.5%) milking cows, 152 (28.7%) dry cows, 12 old bulls, 170 (32.1%) heifers and 129 (24.4%) young calves. The same author-studied a herd in Nisheisheiba Research Station found that in a herd size of 281 heads, the herd structure was 63 (22.4%) milking cows, 70 (24.2%) dry cows, 8 old bulls, 68 (24.2%) heifers and 62 (25.6%) young bulls. Attia (1986) in his study of Kenana in Sudan reported that in total of 1339 heads, the lactating and dry cows were 450 (33.6%) and 889(66.4%) respectively, which indicated that the milking cows comprise only one third. In a different study the same author studied the herd size and structure, in a total of 2622 heads of Kenana cattle raised in villages located near Umbenein livestock Research Station. He found that the composition was 25.06% young females, 12.85% young male, 56.85% old female and 5.49% old males.

Wagenaar et al. (1986) studied the composition of Fulani herds in Niger delta in 1978, 1980 and 1982, and found that the total percentage of females was 67.7 %, 65.5% and 67.4% respectively and the total percentage of males was 32.4%, 34.4% and 32.6% respectively .The females comprised calves heifers and cows, while the males comprised calves, young bulls, bulls, bullocks and oxen.
Badi (1988) reported that in dairy herd in Gezira scheme, the milking cows were 35.7%, while the dry cows were 64.3% in a herd of grade cows. For local cattle he reported that 34.6 % were milking cows and 65.4% dry. For calves and heifers the reported percentages were 12.1% and 12.8% respectively. Abdel-Mageed (1988) reported that at Kuku Dairy Project, an average herd size of 69.7 ± 53.5 cows there were 35.0 % milking cows, 21.9% dry cows, 13.4% heifers, 28.3% calves and 1.2% breeding bulls.

Mohammed (1995) studied the herd size and structure in Khartoum state in herd size of 7014 (with overall mean herd size 82.5 ± 137 cows), found that 2327 (33.2%) milking cows, 1767 (25.2%) dry cows, 1210 (17.3%) heifers and 1710 (24.4%) calves. Habeeballa (1996) studied the herd size and structure at Al-Kadro, Al-Halfaya, Shambat and Kuku, (with overall mean 39.6 ± 20.7 cows), found that the average percent of lactating cows was 32.6 %, dry cows 11.85 %, heifers 21.7 %, calves 32.0 % and breeding bulls 1.7 %.

Elshotary (2000) in his study of the dairy herd in Belgravia Dairy Farm found that in a herd composed of 270 heads, 145 were milking and dry cows, 85 females heifers more than one year, 37 female heifers less than one year and three bulls.

2.4 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 (Wheeler, 2004).

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). Williamson and Payne (1978) reported that the Sudanese breeds are the best milker in African. Ageeb and Hillers (1991) reported that milk production of Sudanese cattle was lower than
that of exotic breeds but was higher than that of most African breeds. Abdalla (1995) reported that Kenana and Butana are the best dairy breeds of Sudan. Bayoumi and Danasoury (1962) reported milk yield of 442 ±140 gallons per lactation for Northern Sudanese zebu cattle at the University of Khartoum Farm. Alim (1962) found that the average milk production per lactation was 3129±170 lb at Atbara Dairy Farm Research Station for Butana cattle, while for Kenana cattle at Gezira Agricultural Research Station; Alim (1960) reported that the average yield was 338 ±152 gallons per lactation. Hassan (1968) reported that the average milk yield of local cattle vary according to the locality and type of cattle, the highest yield was reported for Kenana cattle with average of 7 lb/day in their natural habitat, that may be raised up to 15 lb/day under improved management conditions, while in southern parts of Sudan an average of 1 lb/cow/day was normal.

Milking potentials of the Butana cattle and a wide variability was documented among the different reports. Yields ranging from 1395.9 to 1807.0 Kg per lactation were documented by (Abdalla et al., 1990; El Habeeb, 1991 and Musa, 2001). Fanagaly (1980) found that the mean of 305 day of milk yield in Kenana cows at Um-Binein and Nisheshiba were 1872.5 kg and 1367.13 kg respectively, while in Butana cows he found that the 305 days milk yield was 2254.43 kg at Atbara Station. Osman (1972) reported 3.58 liters as mean daily yield of Sudanese indigenous cows at Gawazat Station. Sid Ahmed (1986) obtained mean lactation yield of crossbred cows in Sudan as 514. 66 ± 9.30 imperial gallon. Saeed et al. (1987) studied the performance of Kenana cattle at Um-Banein Station, and reported that the mean lactation yield was 1160 ± 17.8 Kg. El Amin (1969) showed that the average total milk yield per lactation in Northern Sudan indigenous dairy cattle was 4091 ± 1653 lb. Fawi (1994) showed that the average total milk yield of Friesian crossbred cows was found to increase from the first to eight lactation; he reported that the total yield increased with increase of lactation length,
being maximum for cows with a lactation length more than 13 months. Ishag (2000) showed that the mean milk yield per lactation in the first and overall calving were 5328.85 ± 152.62 and 5664.43 ± 72.24 lb respectively. Polaster et al. (1987) reported 2829 ± 80 kg for average lactation milk yield.

In Egypt, Gabar et al. (1985) reported 4615 kg for 305-day milk in Friesian × Domiatti cows. Abdalla (1987) in study on crossbred at Khartoum University Farm found that the average daily milk yield for crossbred having 25 %, 37.5% and 50 % or more Friesian blood was 8.5, 7.9 and 11.7 kg respectively. Abdel-Mageed (1988) reported that milk yield of local cows was 5.6 kg/day and 10.1 kg/day for crossbred. Wilson et al. (1987) at UmBanein livestock claimed 1597 kg for average lactation. Ali et al., (1988) showed that the mean daily yield for Friesian × Zebu (Kenana or Butana) crossbred cows having 50%, 62.5% and 75% Friesian inheritance were 13.2, 15.0 and 13.0 lb respectively.

Elabid (1992) studying dairy herd in the University farm, reported average production of 17.6 ± 404 lb/day for summer calvers grade cattle. Fadlel-Moula (1994) reported that the daily milk yield of crossbred in Khartoum University Farm was 7.94 ± 2.40 Kg with C.V 24.05 %. Mohammed (1995) found that the daily average production per cow was 16.2 ± 5.3 lb/cow/day for 85 crossbred herds studied at Khartoum state. Yousif et al. (1998) found that the average daily milk yield of crossbred was 7.94 ± 2.4 kegs with CV 24 % at Khartoum University. El-Amin (1994) found that the average daily milk yield for Holstein Friesian cattle in Bulgarvia was 20.2 ± 2.12 kg whereas for Butana cattle were 4.1 ± 0.68 kg. Habeeballa (1996) stated that the daily milk yield of dairy farms in Eastern Nile Khartoum state was as follows: Kenana cows 7.41 kg; Butana cows 5.0 kg, crossbred cows 7.58 kg and Friesian 12.48 kg. Mahomoud (1998) found that Holstein Friesian cows in Sudan produced 8.93 kg per day for winter calvers and 8.1kg per day for wet summer calvers and 7.83 kg per day for dry summer calvers. Kiwuwa et al. (1983) found that
average daily milk yield production of crossbred cows in Ethiopia was 2.7 to 6.3 kg. In Tanzania, Msange et al. (2000) studied the lactation performance of crossbred and reported that the least square means for first milk yield was 2332±283 lb. In Bangladesh, Rahman and Haque (2001) reported that an average daily milk in native cows ranged from 2.23 ±0.4 to 2.62 ± 0.43 liters.

2.5 Lactation length: -

Lactation length is defined as the period between two consecutive calving during which cows are capable of producing milk or lactation. The standard length of lactation has been taken as 305 days, which corresponds to the reproductive cycle of a cow. Lactation length was studied on dairy cattle of Sudan by several researchers. Alim (1960) reported a length of 224±85 days for Kenana at AlGazira Agricultural Research Station. However, Alim (1962) in another experiment estimated mean lactation length of Butana cattle in Atbara as 253 ± 103 days.

El-Amin (1969) reported mean lactation length of Northern Sudan Zebu at the University of Khartoum Farm as 294 days. Osman (1972) stated that the mean lactation length of Sudanese cattle at Ghazal Gawazat was 272.05 ± 4.8 days. Fangaly (1980) revealed that lactation length of Kenana cattle at Umbenein and Nesheshiba were 227.7± 90.8 and 198± 120.8 days respectively, while lactation length of Butana at Atbara Station was 240.3 ±102.15 days. Sid Ahmed (1986) found mean lactation length of Sudanese x European cattle at Ghurashi dairy farms as 45.77 ± 0.69 weeks. Mohammed et al. (1991) reported a minimum value of lactation length was 207.8 days compared to 317 days reported by Danasoury and Bayomi (1963) for the University of Khartoum herd. Ahmed and Sivarajasingam (1998) reported an average lactation length for the Sahiwal cattle of 270.7 days while Dahlin (1998) reported an average of 255 days for the same breed. El-Barbary et al. (1983) studied the economic characteristics of Friesian cattle in Iraq reported 316.92 ± 97.54 days as mean lactation length. Saeed et al. (1987) found that
the mean lactation length of all Kenana cows at Umbarnein Station was 198 ±2.4 days with a coefficient of variation of 59.3%. Gondhi and Gumani (1993) found that the mean lactation period of Sahiwal cows was 345.38 ± 4.49 days. Abdalla et al. (1990) reported that the mean lactation length for Kenana and Butana was 283 ±40 and 283 ±57 days respectively. Ibrahim (1983) noted that average lactation lengths of Friesian cattle in Dairy Land Farm in the first three lactation were 297.8, 266.8 and 240.3 days respectively. Mahomoud (1998) reported that the mean lactation length for Friesian cattle was found to be 241 ±0.5 days. Ali et al. (1988) found that the average of lactation length of Friesian x Kenana crossbred cows having 50, 62.5 and 75% Friesian inheritance were 306, 369 and 298 days respectively. Ageeb and Hiller, (1991) stated that the least square means for lactation length were 275 and 255 days for Friesian x Butana and Friesian x Kenana crossbred respectively. Fawi (1994) studied Friesian crossbred at Khartoum University Farm and found that the average lactation length was maximum in the first and eight lactations and the overall average lactation length was 374.63 ±39.2 days. Yousif et al. (1998) found that the mean lactation length was 344 ±94 days for crossbred dairy cows; Alim (1992) revealed that the lactation length of Egyptian cattle was found to be 260.7 days. In Cameron, Mbab et al. (1991) found that the average lactation length for Adamawa, Holstein, Holstein x Adamawa (F1) and Montbeliard x Admawa (F1) and (F2) crossbreds cow were 140, 298.5, 282.3, 258.3 and 256.8 days respectively. In Malawi, Agymang and Khonjera, (1986) observed that the mean lactation length for Friesian crossbred in smallholder farms was 390 ±150 days, with a coefficient of variation of 38%. However, the means for cows having 50% and 75% Friesian inheritance were 382 and 401 days respectively. Kiwuwa et al. (1983) demonstrated that the mean lactation length for indigenous and crossbred cows at Asela Station in Ethiopia was 364 ± 4 days.
In North-East Tanzania, Msanga et al. (2000) studied lactation length of crossbreds in small holder and reported that the least square means for first lactation length was 331±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±24.73, 256.31±24.31, 255.86±27.58 and 230.62±30.68 days respectively.

In China the length of lactation for Sanhe cow average about 300 days, but varies according to the feeding and management conditions, cows kept under good conditions have a lactation period of 300 -330 days (F.A.O.1984). In India Barhat et al. (1980) reported that the lactation length of Nogore herd was found to be 280.4 days; Misra and Basant (1982) reported that lactation length of Haryana cattle was found to be 270.05 day. On the other hand, Basu et al. (1979) stated that lactation length of Indian dairy breed was found to be 305 days. Fadeel-Moula (1994) found that the overall mean of lactation length in Khartoum University Farm was 346 ± 95 days. Ishag (2000) the mean lactation length in the Kenana Sugar Company Farm was 322.57 ± 5.88 and 291.34 ± 2.12 days in the first and overall calving respectively. DoKim (2001) studied the lactation performance of dairy cattle breed in Vietnam and reported lactation length of 281.8 days. Rahman and Haque (2001) found that the lactation length of native cows in Bangladesh ranged from 230.58 ±69.51 to 266.96 ±78.91 days. Rahmatalla (2002) reported that the average lactation length in Belgeravia, Khartoum University Farm and Judiciary farm were 366.69 ±107.51, 371.46 ±122.90 and 344.15 ± 188.11 days respectively.

2.6 Dry period: -

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). Deficient dry cow care many result in decreased milk yield, increased incidence of parturient health disorders and impaired fertility (Curtis et al., 1986). Schmidt and VanVleck (1974) reported that the dry period is important for replenishing body supplies if the cow is in poor body condition at calving. Alim (1962) showed mean dry period of Butana cows at Atbra to be 159 ± 104 days. El-Amin and Osman (1971) reported 114 days as mean dry period of Northern Sudan Zebu. Khalafalla (1977) in his study on Kenana cattle observed that the average dry period was 174 ± 5.1 days. Khalafalla (1988) reported that in Butana cattle the average dry period was 139 days and he concluded that the dry period was longest for summer calvers (155 days) and shorter for winter calvers and found first calves heifers had longer dry period than multiparous cows. Yousif et al. (1998) studied the dry period on crossbred dairy cattle at Khartoum University farm explained that the average dry period was 96 ± 60 days.

Funk et al. (1987) mentioned that cow dry period of 40 days or less produced markedly less in the following lactation. Cow dry period of approximately 60 days produced the highest milk in the following lactation. Dry period longer than 60 days were only moderately detrimental to subsequent lactation yield and also showed a sharper decrease in production for cows. Rahmatalla (2002) reported that the average dry period in Belgeravia, Khartoum University and Judiciary farms was 124.99 ±93.64, 108.90 ±81.13, and 75.38 ±65.82 days respectively.

Several hypotheses have been proposed to explain the requirement for the dry period, including replenishment of body condition, regeneration of
mammary tissue, and optimization of benefits from endocrine events near the time of parturition. (Annen et al. 2003; Annen et al., 2004) Nutritional status and endocrine hormones are not factors in reduced milk yield in continuously milked glands. Data from continuous lactation studies suggest that depressed milk yields are due to reduced functionality of mammary parenchyma (Annen et al., 2004). With respect to the crossbred cows Ishag (2000) reported a shortest dry period (90.1 days) for the first calvers of the Sudanese crossbred 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), increased intra mammary pressure and udder distention, regression of secretary function of mammary epithelial cells (MEC) and low level of MEC proliferation (Holst et al., 1987; Capuco and Akers 1999, Annen et al., 2004). Annen et al. (2003) indicated that primiparous but not multiparous cows experienced a decrease in milk production for the first 17 weeks postpartum following a shortened or no dry period. Days dry required for maximum milk yield was decreased when calving interval was increased, and the interaction was stronger as parity increased (Dias and Allaire, 1982). In an experiment by Smith et al. (1967) two quarters of two cows were dried for 10 weeks before the expected date of calving and the other two quarters were milked twice daily through pregnancy. In the first three months of the second lactation, the continuously milked quarters of the cows produced 56 to 62 % of the milk yields of quarters that were dried off. Singh and Tomar (1990) estimated mean dry period as 66 ± 1 day with C.V 57.78 % for Kenana – Friesian cows. Fadeel - Moula (1994) found that the dry period of crossbred in Khartoum University Farm was 96 ± 60 days. Habeeballa (1996) reported that the dry period for crossbred cows, local breeds and pure Friesian cows were 49.5 ± 19, 78.7 ± 15.5 and 30 days respectively.
Dry period of 40 - 60 days as a routine management practice in the dairy industry and provides a balance of maximum milk yield and profitability. There is an extensive list of reports that indicate reducing dry period below 50 to 60 days results in a reduction in milk yield the following lactation. (Sanders, 1928; Arnold et al., 1936; Dickerson and Chapman, 1939; Klein and Woodward, 1943; Swanson, 1965; Smith et al., 1967; Wilton et al., 1967; Schaeffer and Henderson, 1972; Coppock et al., 1974; Gill and Allaire, 1976; Pandey et al., 1978; Keown and Everett, 1986; Sorensen and Enevoldsen, 1991; Remond et al., 1992). A dry period less than 40 days reduce milk yield in the subsequent lactation by 5 to 15%. The subsequent lactation as a result of reduced mammary epithelial cell function rather than nutritional status or negative effect exposure to milking stimulus and galactopoietic's hormones during late gestation (Annen et al., 2003). Possible advantages of reducing length of dry period include increased income from milk production, simplified dry cow management, decreased metabolic disorders and alleviation of over crowded dry cow facilities (Grummer and Rastani, 2004). Bachman and Schairer (2003) reported that milk production was less than 10 to 38% in cows subjected to a shortened or omitted dry period.

2.7 Dairy feeding: -

Proper feeding is the cornerstone of a successful dairy operation because food costs account for over half of the total costs of milk production (Clark and Davis, 1980). The system and management of feeding and total feed intake of dairy cows account for at least 60% of the total intake of milk production (Broser, 1972). Russel (1972) indicated that food costs for dairy cattle could be reduced by controlled feeding to yield wise steaming up, balancing of concentrate to quality of bulk feed, and use of home grown cereals. Habeeballa (1996) found that the farmers of dairy cattle in Eastern Nile Khartoum fed their animals quantitatively and qualitatively according to availability and price of food in the market, and they did not offer any
concentrate to dry cows and heifers because of increasing prices of concentrate.

C.A.B. (1990) indicated that the intake in lactating cows was determined by cow size, milk yield, and stage of lactation and energy content of the diet. Habeeballa (1996) recommended for extension services by the government to make formulation of rations on economic basis and estimate the dairy cow requirements for feed and the intervention of the government to avail animal feeds to the farmers at reasonable prices through provision of improved seeds of fodder crops and provision of concentrate ingredients at a reasonable price by helping to store ingredients at the season of availability e.g. Sorghum and restrict export of some ingredients e.g. molasses, oil cakes and to encourage their production domestically. Vasilatos and Wangsness(1980) found that the cow consumed 24.2 kg dry matter to produce 32.3 kg of milk. While Dodo and Allon (1994) reported that a cow consumed 20.0 kg dry matter to produce 28.7 kg of milk.

Feeding high energy levels before calving and during early lactation was found to improve milk production (El Tahir, 2000).

Ali (1991) indicated that feeding high energy levels before calving and during early lactation improved the general condition of cows and their productive and reproductive performance. Hoogendroon and Griever (1970) fed dairy cows with three dietary energy levels, and reported that the cows offered the low energy ration lactated only for 24 weeks with low level of milk yield, whereas those offered medium or high energy rations completed 44 weeks of lactation, except for the cows with previous records of low productivity or low persistency levels. It has been indicated that the dietary energy requirements of the highly producing cow at early lactation can not be sufficiently met, and the cow will maintain its high milk production by utilizing its body reserves resulting in weight loss.
The Agricultural Research Council (A.R.C., 1984) estimated an energy requirement of milking cows, of 9.2 and 11.0 MJ/Kg DM at milk production level of 10 and 20 milk of 3.68 % fat content, per day respectively. Similarly the requirements of dietary protein depend on the stage of lactation, energy supply and quantity of forage consumed.

Wheeler (2004) found that a cow weighing 550 kg, giving 30 kg milk yield could eat 3.7 % of her body weight as dry matter (DM) daily or about 20.4 kg. A bigger cow (650 kg) at the same milk yield can eat 3.4 % of her weight as dry matter (22.1 kg per day). Bigger cows at higher milk yield can eat more feed dry matter.

The 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.

Arriaga et al. (1986) investigated the response to concentrate feeding of high milking dairy cows on intensive grazing, and reported an increase in milk yield with concentrate supplementation.

The basic nutrient requirements of high yielding dairy cows for protein, energy and minerals cannot be met with roughages feeding alone. It has been, therefore, indicated that supplementation of roughage with high energy, high protein concentrates is required in dairy cattle feeding, to balance the nutritional deficiencies in the roughage and to promote the activities of the rumen micro-flora. Concentrate supplementation to roughage has been found to result in an increase in energetic efficiency which is associated with the improvement in the production of fermentation end-products which constitute the main energy source for ruminants (Coppock et al., 1974).

Maximum dry matter intake depends on continuous access to fresh, clean, cool water. You should provide water in a well-lit area within 15 meters of the feed bunk. Cows drink about 5 liters for each kg milk (e.g., a cow producing 40 liters of milk will consume 200 liters of water). Cows are hungry immediately after milking. Decreasing water intake by 40 % results in a 16 to
24% decline in dry matter intake and a large decrease in milk yield. Cows need more water in hot weather (Wheeler, 2004). Habeeballa (1996) found that the average dry matter intake of lactating cows was 9.56, 8.38, 12.05 and 9.69 kg for AlKadaro, Alhalfaya, Shambat and Kuku areas respectively. Joseph (1967) found that the feed intake of cows was 2 – 4.6% as a percentage body weight.

In case of high yielding cows, it appeared that, although feeding more concentrate increased overall lactation yield, profits per cow decreased (Doyle, 1983). Milking cows can consume daily 1.8 to 2.2% of body weight as dry matter intake from average quality dry roughage. Roughage quality is partly determined by fiber levels. Fiber content increase as the forage crop matures. High fiber forage has lower patability; reduced protein levels and is less digestible than high quality material. Undigested feed content pass out of the rumen. The cow cannot consume more feed until the feed in the rumen is digested. High fiber forages reduce dry matter intake. A cow can eat 3% of body weight as dry matter from excellent hay only 1.5% from poor hay (Wheeler, 2004). William and Paul (1978) reported that forage could intake up 60 – 70% of the total dry matter intake of dairy cattle.

For high producing, early lactating cows, at least 40% of the ration dry matter should come from roughage. This gives as minimum forage to concentrate ratio of 40:60. When corn silage is above 45% of the roughage dry matter, a 45:55 ratio is appropriate. More roughage (less grain) can be fed to cows in late lactation or at low production levels. Forage concentrate ratios 80:20 can support 20 kg of milk yield if roughage quality is good (Wheeler, 2004). Tibin et al. (1990) assigned that total amount of green fodder fed per cow / day at Kuku dairy project was 16.0 kg and 15.5 kg and supplementary feeding offered per cow per day was 9.3 kg and 8.5 kg for different two groups in the project. Muffarih (1967) found that the highest level of concentrate used for Kenana cows grazed on green pasture was 4.09 kg. El-Amin (1994) revealed
that concentrate diet introduced to dairy cows in Bulgravia Dairy Farm in Khartoum was fed according to milk production at rate of 0.6 kg per kg milk production. He showed that the concentrate diet was offered on a group basis at an average amount of 10 kg per cow per day for the Friesian cows and 3 kg per cow per day for Butana cows. He found that green chopped pioneer was provided at an average amount 20 kg per cow per day. Elkhidir and Ibrahim (1998) found that molasses could be used for feeding dairy cows with 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 with ratio from 25 – 50 %. Bakheit (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 adlibitium 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. Idris (2000) concluded that concentrate supplements containing cane molasses were found to improve milk production. He indicated that molasses could be used to replace grain sorghum or sorghum brewery residues in the concentrate mixture. He considered it necessary to develop nutritional strategies using locally available concentrate feeds, which should consider the seasonal availability and nutritive quantity of the natural pasture and the cost effectiveness of concentrate supplementation. Ishag (2000) reported that there are three kinds of concentrate available in Kenana Sugar Company Farm. They included lactating cow concentrate (LCC), dry cow concentrate (DCC) and liquid molasses. He also described the composition of LCC and DCC in table (1).
Table (1). Composition of lactating cows concentrate and dry cow concentrate in Kenana Sugar Company Farm

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>LCC</th>
<th>DCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorghum (Dura)</td>
<td>7.0</td>
<td>12</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>36.0</td>
<td>8</td>
</tr>
<tr>
<td>Ground nut cake</td>
<td>36.0</td>
<td>23.9</td>
</tr>
<tr>
<td>Baggass</td>
<td>0</td>
<td>23.9</td>
</tr>
<tr>
<td>Molasses</td>
<td>20.0</td>
<td>31.9</td>
</tr>
<tr>
<td>Nacl</td>
<td>0.30</td>
<td>0</td>
</tr>
<tr>
<td>Urea</td>
<td>0.20</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

2.8 Housing: -

The management and design of animal housing inevitably involves compromise between the needs of animals and those of the owners. For low cost efficiency of operation, housing basic needs are to provide feed, protect against thermal and physical stress and protect against injury (Raw and Hill, 1989). It is also of great importance to consult veterinarians about building design to avoid faults that cause difficulty to operators.

Attention should be given to drainage, roof with guttering and basic essentials for dry floor and walls (Sanisbury, 1970). Sufficient shade is also of high importance and has a high significant effect on Friesian crosses in the tropics since it increases milk yield by 18.4 % (C.A.B. 1972). At Kuku dairy project the area of each pen (Zereaba) is 700 m² for small herd to 1000 m² for large herds. Most pens were only poorly designed with fences made of barbed wire, space requirement per cow were not observed, shade built at the centre with local materials that can hide ticks and only provide partial shade (Abdel-Mageed, 1988). Habeeballa (1996) found that the area of each pen is 200 m²
for small herds and 1500 m² for large herds. In the same study the author found that the average area of the farms was 5.95 ± 3.8 feddans, also he found that space requirement per cow was not observed and the pens are crowded with cows. Mohammed Kheir (2002) studied the housing in Port Sudan and found that the average area of the pens was 1463 ±4091 m² and the building material of the pens were zinc, wood, mats, iron miskeet stems (prospis julifora), cement block and asbestos. Also he revealed that the percentage of shaded areas was 12 %.

In practice two types of shade, trees as a natural shading source have the advantage of effective blockers of solar radiation, and aids in normal cooling by provision of moisture from leaves surface. The second shading type provides its blocking effects through the use of properly construction barns or sheds (Collier et al., 1981). Major design parameters for permanent shade structure include orientation, floor space, height, ventilation, roof construction, feed and water facilities and wasted management systems (Buffington, 1983).

Galton (1984) reported that the points which should be considered before the erection of dairy building are building at a high elevation than the surrounding ground to offer a good slope for rainfall and drainage for the wastes of the dairy to avoid stagnation within, fertile soil, exposure to the sun and protection from wind, water supply, electricity, available labor and marketing.

Although housing modified the effect of climate, but it also increases the density of pathogens and hence the disease occurrence, thus any stress that lower the resistance, will be magnified under housing conditions (Webster, 1981). So it is important that dairy cattle housing should be integrated with several other systems to provide cow comfort, good health, efficient waste handling, dry clean environment and good management practices are basic essentials (Galton, 1984). Metal building materials were better and easier to be cleaned and disinfected than wooden building materials (Winterholder et al.,
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 m², with only 225 m² shaded to protect animals from harmful direct sun rays and rain (Ishag, 2000).

2.9 Milking practices

Many studies indicate that milking cows three or four times per day causes an increase in milk production in comparison with twice daily milking. 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. All of the increase in the milk production of cows milked four times a day over that of cows milked three times a day probably results from better feeding and management (Schmidt and VanVleck, 1974). Abdel - Mageed (1988) found that the common milking practice is to allow the calf to suckle its dam for a short period to stimulate milk let-down and found the milkers milk the cows wearing dirty cloths and without wearing rubber gloves.

Swedish workers have extended the concept of unequal milking intervals to determine the effect of milking cows only once daily. They found those milking first-calf heifers once rather than twice a day resulted in 50 % reduction in milk production, and that milking older cows once daily resulted in 40 % reduction. They also eliminated one milking per week for groups of cows in their first and second lactation and found that their milk production was 89.2 % and 95.4 respectively, of that of group of similar cows milked fourteen times per weeks (Schmidt and VanVleck, 1974).
2.10 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 oxtocin is available. (Sastry and Thomas, 1980). The milk secreted into an uninfected cow's udder is sterile. Invariably it becomes contaminated during milking, cooling and storage, and milk is an excellent medium for bacteria, yeast and moulds that are the common contaminants. Their rapid growth particularly at high ambient temperatures can cause marked deterioration, spoiling the milk for liquid consumption or processed into dairy products. This can be avoided by adopting the simple, basic rules of clean milk production (FAO, 1989).

Tropical countries suffer from problems of keeping raw milk fresh for long period of time. In such countries milk souring is due to high ambient temperature, poor transportation facilities and high bacterial count of raw milk that result from unsanitary methods of milk production. High quality of milk start with a healthy cow in clean sanitary environment, which demand, overall good management program (Provan, 1961; Galton, 1984). Visible dirt from the udder must be removed before milking using clean water with disinfectant (sodium chloride) because cows udder's external surface were usually contaminated even when they appear clean (Sharpe and Barmley, 1977; Natzke, 1981). Dirar (1975) reported that under normal conditions milk is contaminated with microorganisms from various sources.

2.11 Calf management

In the tropics high calf mortality was thought to be partially due to environmental conditions and partly to management practices (Alim. 1960; Wakeem and Danasury, 1962). When calves were newly born they were often housed in areas contaminated by older calves and cattle, under those condition
the mortality rate were frequently very high, often high losses may occur in herds where even better standards of management and housing facilities are available (Weaver et al., 1949). Morbidity and mortality rates are highly dependent on type of housing, efficiency of management, environmental stress and the susceptibility of the animal to diseases (Friend et al., 1987). Roy (1980) found that mortality of calves housed in-group pens was higher than those singly penned and that was also true for mortality caused by pneumonia. Ensminger (1980) found that there was no consensus on how to provide colostrums: the calf can nurse the cow for 4 days. After initial nursing or hand-feeding, the cow and calf can be separated within 24 to 48 hours and colostrums can be bucket-fed (Bath et al., 1985). Suckled Friesians weaned at 7 months and transported to new housing required longer to habituate to the new environment than did artificially reared Friesians (4 vs. 2 days). However, previous rearing did not appear to have any long-term effects on behavior (Veissier et al., 1989). Abdel-Mageed (1988) reported that natural calf rearing was practiced where farmers allowed calf with dam for 3–7 days after birth to consume all milk, then left with dam all night for 15 days. Later, calves were kept in collective pens for all ages and only left suckle after milking. The same author reported that the calf was weaned partially from the dam at 3–4 months, the actual weaning age, but let-down stimulation before milking and for stripping after milking until the cow was dry.

Bedding makes up important part of calf environment for calf comfort, floor fall and ventilation is also important to drain down under the bedding material otherwise humidity will increase leading to severe disease outbreaks (Bourne, 1972; Sainsbury, 1970). Bath et al. (1985) reported that it is necessary to put enough bedding to keep the calf dry, but bedding materials may be eaten by calves and cause digestive upset, manure should be removed regularly. Gooder and Theodore (1986) reported that calf management
practices such as identification and registration help researcher to identify calf management practices that are related to calf health and calf mortality, and then compare current practices with ideal practices to measure their efficiency. Mohammed (1995) in his study found that the individual calf housing was used in six farms (7.06 %). The same author found that bedding practices in 3 farms (3.5 %).

2.11.1 Dehorning

Dehorning is a generally recommended practice that reduces injuries to both animals and handlers, bruising during transport, and aggressive behavior in grouped cattle (Tarrant, 1990). Horned animal watered and fed in troughs need as much as three times spaces as dehorned, so all registered female calves must be dehorned (McNitt, 1983; Bath et al., 1985). Dehorning is done properly when horn buttons are very small (Sastry and Thomas, 1980). Suitable age for dehorning is three weeks of age, because the operation would become harder with age (Russel, 1985).

Use of commercial electric iron for dehorning of calves under 30 days of age is the most popular method (Bath et al., 1985), and presents no long-term stress (Ladon et al., 1985). Caustic potash works well on calves up to 45 days of age. Saws, dehorning clippers, and barns dehorners are commonly used to dehorn older cattle (Ensminger, 1980; Sastry and Thomas, 1980; Blakely and Bade, 1982; Etegen et al., 1987). Calves age at 7 to 16 weeks apparently did not benefit from alidocaine block before dehorning (Boandl et al., 1989). A veterinarian should anesthetize the base of the horn before dehorning adult animals. In one study, adult cattle (18 to 22 month old heifers) dehorned using either electro-immobilization a local anesthetic, or no anesthetic compared to control (non-dehorned group). Serum cortisol levels attained significant differences by type of dehorning (Carter et al., 1983).
2.11.2 Identification and recording system

Many methods are used to dehorn cattle. The one that should be used will depend upon the age of the animal to be dehorned and the experience of the person doing the dehornning. Young calves are often dehorned by use of a strong chemical paste (Postassium or Sodium hydroxide). The paste is placed around the horn button during the first week of age, destroying the growth or development of the horn. The horn button can also be taken off by the use of a spoon or electric dehorners (Blakely and Bade 1982; Ewbank, 1988).

In Kuku Dairy Project, Abdel-Mageed (1988) reported that the farmer does not keep records for his herd. Only two or three farmers keep the AI record or service record which is incomplete.

An important function of a dairy records program is identification of the animals in the herd. Daily management decisions concerning breeding, feeding, selection, calving and culling depend on accurate identification of animals. Proper identification is necessary for registration of animals with the purebred cattle associations and for keeping records of cows on official production testing programs. (Schmidt and VanVleck, 1974). In UK owners identify their animals for day – to day farm management purposes such as breeding, feeding and milk yield records. More recently, national policies on disease control have led to a succession of record – keeping and animal identification requirements for farmers to implement. (Bovine Spodiforrence Phalopathy Inquiry (BSEI), 2000; Warwickshire Country Council (W.C.C), 2005).

2.12 Heat detection

The heat period varies from 17 to 26 days and lasts from 6 to 36 hours, with an average duration of 18 hours for cows and 15 for heifer. Ovulation occurs 10 to 14 hours after the end of the heat period (Blakely and Bade, 1982). In dairy cattle, symptoms at the early stage of heat are not pronounced, but they will show activities like smelling other cows, attempting to mount.
other cows and bellowing. They will rest- less and their vulva moist, red and slightly swollen. After a time lapse of six to eight hours the heat will become more pronounced, this period is termed as standing heat. This extends for 14-16 hours and shows other symptoms like bellowing, nervousness, anorexia, reduction in milk yield, moist and red vulva, riding other cows, clear mucous discharge and dilated pupil of the eye. Estrus usually last for 16 to 24 hours in cattle (Sastry and Thomas 1980).

2.13 Natural and artificial insemination

Natural breeding consists of direct service of the cow during her heat period by a bull. In some localities this is only means by which a cow may be bred. Artificial insemination service is not available in all localities. (Blakely and Bade, 1982). Artificial insemination is a practice in which the semen of the bull is transferred to the cows by a person generally known as an inseminator or technician (Schmidt and VanVleck, 1974; Blakely and Bade, 1982).

2.14 Pregnancy diagnosis

Pregnancy diagnosis is important for the dairy farmer to know as soon as possible if this cow is pregnant. Examination per rectum by an experienced veterinarian will revealed whether conception has occurred. (Arthur 1975; Ewer, 1982). The facility or otherwise with which a diagnosis can be made will depend on several factors, the most important of which are: the stage in gestation at which examination is made, the degree of resistance, voluntary or involuntary, offered by the animal to examination, the degree of parity of the animal. (Arthur, 1975).

An early diagnosis of pregnancy is essential for reproductive management as well as economic production. In general an early diagnosis of pregnancy is required to identify non pregnant animals soon after mating or insemination so that production time lost from infertility may be reduced by appropriate
treatment or culling, to certify animals for sale or insurance purposes, to reduce waste inbreeding programs using expensive hormonal techniques, and to assist in the economic management of livestock. (Jainudeen and Hafez, 2000).

2.15 Preventive measure practices

2.14.1 Sanitation

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), also other pathogens in urine and faeces may be reduced from animal environment through the removal of cattle excreta (Jone 1980). Management practices adopted to reduce the exposure to mastitis include dipping teats of all cow in disinfectant after each milking which is the most effective part of the sanitation procedure, washing of milker's hand thoroughly with disinfectants, washingudder externally before milking running water and disinfectant, udder cloth towel must cleaned with warm water and disinfectant, the milking parlour must be sprayed after thorough washing with detergent solution before and after milking, renewing the bedding materials frequently, healthy cows were milked first by separate milkers and culling of cows with repeated clinical mastitis.(Schmidt and Vanvleck 1974; Mustafa et al 1977;Ibrahim and Habeeballa 1978 ;FAO 1989, Rodenburg 2002).

In Khartoum state dairy farms, Mohammed (1995) reported that for cleaning and sanitation, daily and weekly dung removal was practiced in 29.6 % and 35.2 % respectively; also he found that 35.2 have no program for dung removal.
215.2 Diseases testing

Dairy farms must have access to either visiting or permanent veterinaries for testing diseases such as tuberculosis and brucellosis (Karib, 1962). It is also important that milkers and milk vendors should be medically tested and should be free of diseases such as typhoid and tuberculosis (Ibrahim, 1969). Mastitis routine testing is very important because most of mastitis infection persist as subclinical, which will not be detected by stockmen (FAO, 1978). Due to the lack of diagnostic laboratories is most of tropical countries diagnosis was made depending on clinical signs (Pharo, 1987).

Mohammed (1995) found that testing for disease was practiced by only 25.9 % of Khartoum dairy farms in his study.

2.15.3 Vaccination

Since 1900, when for the first time veterinary services efforts were made for disease control, disease prevention programs passed certain development changes (Baasher, 1969).

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. 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.

2.15.4 Culling

The number of dairy cows culled from dairy herd increased with lactation number, the main reason being low milk yield and udder diseases (Gartener, 1983; Shatava, 1990). Culling due to reasons other than low milk yield cause major losses for dairy farmer (Allaire, 1981). The fifth lactation was reported as the age of maximum production (Khalifa and Shafei, 1965).
Culling and slaughter are practiced for brucella control when less than 10 % of herds and less than 3 % of the individuals are positively infected (FAO / WHO, 1959; Mustafa and Fawi, 1966). Positive cases and suspected cows in Khartoum dairy farms tested for john's disease were killed and burnt (Abu baker and Elsanousi, 1976).

2.16 Health and Veterinary supervision

In Sudan where people are not sufficiently enlightened on importance of reporting diseases, it is not surprising to discover how misleading the available records as a guide for prevalence of diseases, it is only when systemic research is done that true picture becomes clear (Karib, 1962). However prevention and control of disease in Sudan present many difficulties pitfalls and disappointment. In general owing to economic exigencies, veterinary medicine in proportion is more preventive and far less curative than human medicine (Baasher, 1969).

Veterinarians in cooperation with dairy farmers must detect and treat all subclinical diseases and conditions that interfere with maximum production and herd health (Cole, 1976). however continuous and readiness of farmer to seek the help of veterinarian for their sick cattle is still low in the tropics, because of the use of traditional (flocks) medicine or farmers assume that modern medicine is very expensive (Tjkohoesodo and Grossman, 1975). 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.
2.17 Diseases control
2.17.1 Mastitis

Mastitis is one of the most common and costly diseases of dairy cattle (Rodenburg, 2002). Several surveys were conducted in Sudan to study the incidence, causative agent and significance of bovine mastitis (Wakeem and Eltayeb, 1962; Bagadi, 1970, 1974; Bagadi and Razig, 1976, Mustafa et al 1977, Adlan et al 1980, Shallali et al., 1982; 1988). Those surveys have shown that the incidence of bovine mastitis was high, \textit{Staphylococcus aureas} was the most frequently isolated udder pathogen and the economical losses were tremendous. Mustafa et al., (1977) studying mastitis in Atbara dairy herd found that 20 out of 35 cows were infected with mastitis. Rodrigues (1988) found that in 10 dairy herds in Savanah 47 % of cows were affected by mastitis, while existing treatment and preventive measures were poorly applied. Mohammed (1995) in his study in Khartoum State found that the incidence of mastitis ranged between 13.3 % to 46.7 %.

Management practices adopted to reduce the exposure to mastitis require understanding of the period when teats are exposed to pathogens and the primary source of pathogens (Eberhart and Buckaiew, 1972). Rodenburg (2002) reported that keeping cattle on their feet for the first hour after milking will reduce the exposure of the teat end to bacteria during a period when the risk of infection is greater after milking because the sphincter muscle at the end of the teat is relaxed permitting easier bacterial invasion. While providing fresh feed during and after milking is a simple way to keep cows standing and allow proper fly control, both on the cows and in the stable, is also important. Flies cause stress and also carry mastitis causing bacteria from teat end to teat end.

No single management procedure effectively prevent environmental mastitis under controlled conditions (Hongans and Smith, 1989), however post milking
teat dipping with disinfectant, is one of the most effective procedure in reducing the rate of clinical mastitis, together with cleaning with flushing running water, udder cloth towel soaked in warm water with disinfectant and milkers, hands dip in disinfectant (Pankey and Philpot, 1974; Philpot, 1975; Helir and Bec, 1979; Oliver et al., 1989; FAO, 1989). Pontral et al. (1990) reported that experimental teat dipping reduces the number of new infections by 18% and sub clinical mastitis by 33.3%. It was noticed by Lwajock (1992) that in some of Khartoum dairy farms, farmers continue to maintain cow with one functional teat and some chronic cases without culling. Herd with excellent mastitis control had large milking parlors and greater efficiency (cows milked / man / hour) than herd with fair mastitis control (Fox and Hutton, 1990). Mechanism and automation have allowed dairy producers to pay more attention to management practices such as teat dipping (pre – and post – milking) and dry cow therapy for mastitis control effectively reducing mastitis to about 7 percent of quarters (Natzke, 1981).

Dry cow therapy is highly recommended for effective control and elimination of pathogens of both contagious and environmental mastitis (Eberhart and Buckaiew, 1972; Dehart et al., 1976; Ovadia et al., 1978; Bennet, 1982). Research in the US, from as early as 1943 has implicated the dry period as being the time of greatest risk for the acquisition of new Gram – negative intramammary infections. (Eberhart and Bukalew, 1972; Oliver and Mitchell, 1983; Smith et al., 1985; Todhunter et al. 1991; Bradely and Green, 2000). Mastitis is prevailing in Sudan among all breeds. The infection rate reached 97 % in Kenana cows, 45 % in Butana cows and 32 % in crossbred cows (Abdalla, 1995).

2.17.2 Brucellosis control

Brucellosis is caused by the bacterium Brucella abortus and it is spread via infected placentas, vaginal discharge and aborted fetuses. Milk from an
infected cow also may harbor B. abortus. The infected milk creates a public health problem because B. abortus causes brucellosis ("undulant fever") in human (Rice and Rogers, 1996; Centers of Disease Control and Prevention (CDC), 2005; A2Media group (A2GAY), 2005). The main symptoms of brucellosis are abortion after 4 months and retained placenta. (Dailey, 1992). The global incidence is estimated to be around 500,000 cases / year, but brucellosis is underreported at a ratio of about 1 : 26 (one reported to 26 unreported) (Araj, 1999).

In some part of Sudan the incidence of brucellosis ranged from 6.7 % to 28.5 % in dairy farms, while incidence up to 36 % was reported in livestock center in Gazira (Habeeballa 1977). In Sudan the second largest animal population is found in Kordofan state and the prevalence of bovine brucellosis was reported to range between 21 – 53.9 % (Kalafalla et al., 1985). Shallali et al. (1982) studied a dairy herd in Sinnar and found that 9.9 % of herd tested were positive. Abdalla (1966) found that 3 % of tested cows in Wadi Halfa were positive.

Gameel (1983) reported that on management of bovine brucellosis immunological problems arise because infected cows with titer below the reactor level are usually left in herd and constitute a continuous reservoir and serves as a source of further transmission.

Efficient brucella control is by elimination through slaughter or segregation of infected cows and vaccination of clean ones (FAO /WHO, 1959; Mustafa and Fawi, 1966; Mustaffa and Nur, 1968; Mustafa and Hassan, 1969; AlKhalaf et al., 1992). Bakhiet (1998) suggested that a national brucellosis control program should be formulated and special attention should be given to co-operation and co-ordination between public health and veterinary sectors.

2.17.3 Internal parasites:

Young dairy cattle are very sensitive to parasites and their ill effects. Because of the easily recognizable symptoms of parasitism that often develop
in dairy replacement heifers including diarrhea, rough hair, weight loss, slowed growth, delay of puberty, breeding and calving. (DQU, 1998). Management can be an important part of parasite control by reducing probability of infection, avoids overstocking, separate young from adult and clean drinking water and feeds in troughs (Yakstes et al., 1985). Cows treated for the first tow months post calving show reduced worm egg count and the daily milk production was higher by 1.24 kg/ cow/ day (Black et al., 1987). Deworming reduce egg count by 83 – 93 % in treated herds and increase production by 1 – 2 kg/ day (Black and Pierre, 1986). Investigators from major dairy regions throughout the world have examined the economic importance of gastrointestinal parasitism in lactating cows. Most of the studies were field trials on commercial dairy farm and involved determining the effects of a wide range of dewormer regimens on milk production although the results of the studies widely vary, treatment timed during the first 100 days of lactation was key for maximum parasite control. Treatment of cows after 100 days of lactation or during the dry period appears to be a waste of time, money and resources. (DQU, 1998).

2.17.4 Theileriosis

One of the reasons that restraint importations of exotic breeds in Sudan, till 1945 was infection and deaths due to *Theileria annulata* (Bayoumi, 1964). *Theileria parva* is the most important tick-borne protozoan disease in Eastern, Central and Southern African countries including Southern Sudan. The disease is transmitted by its efficient tick vectors *Rhipicephalus appendiculatus* and *R. zambeziensis* (Julla, 2003). The main effects of theileriosis are reflected in reduction of production, loss of weight and death of substantial proportion of the affected animals. (Salih et al., 2003). The effects of Theileriosis in cattle in Sudan from December 1995 to April 1996 studied by Siddig et al., (2003), estimated losses due to mortality from the disease as (1.333.33 US$). The total losses in milk yield were amounted to 32373 liters,
representing a financial loss of (5.755.2 US$). The cost of drug used (758.22 US$) and the cost of veterinary care, diagnosis and additional labour were (515.56 US$). Hence the total cost of the disease in this farm was (62.320.98 US$).

Control by immunization against Theileriosis was more profitable owing to the lower mortality and high performance than un immunized cattle. Spraying with Acaricides twice a week maximized the benefit (Mukhebi et al., 1988; Aziz, 2003). Genetic improvement in tropical countries through introduction of foreign cattle breeds impose danger of increasing susceptibility to tick borne diseases (Springell, 1983).

2.17.5 Foot and Mouth disease (F& M. Disease)

Foot and mouth disease "locally known as abu lisan" 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).

2. 18 Farm's labor

Labor management is important for a diary farm business and demand for diary employees has been increasing relative to supply. The average dairy production in Virginia spends 15 % of receipts or about 300 $ per cow each year for herd labor. Managing labor is one of the most difficult management problems as involves recruitment, training, organization and supervision of manger and herd or family employees part-time and full- time (Ligro -Toro et al., 1990). Dairy farm workers perform a variety of tasks. On modern dairy farm, workers care for herd as well as keeping up structure and equipment. On small farms, workers mix additives in feed water in troughs. On large farms, farm workers operate machines and other automated equipment mix feed batches. They herds animals into holding pens and attach automatic milking machines to the animals. Dairy farm worker have other duties, such as washing and spraying cows with water, insecticides and repellents, they clean
barns and cow pen to prevent infestations. They clean and sterilize milk containers and equipment and operate automatic cleaning pumps that clean the milk pipelines (California Occupational Guide Number 225 (C.O.G), 1998). Workers skills are very poor in Southern America, the educational level of workers in general is too low and most of them have never attended a specific course on neither milk production nor processing. So they do not have technical knowledge to develop or to improve milking practice or processing steps in order to obtain higher quality of milk and traditional products made from it (FAO, 1990). In Ireland, Hopps ((2005) reported that the average number of cows, per parlour point was nine, for example, a six point milking parlour facilitate milking of 54 cows on average. Fangaly (1980) found that untrained herdsmen constitute a constraint at Umbenien Dairy Production Research Station.

The average age of labor in Virginia for herd person, milker, cow feeder, field workers and calf person were 33.5 ± 12.1, 35.3 ± 13.8, 35.7 ± 14.3, 40.2 ± 14.8 and 31.4 ± 16.1 years (Ligro - Toro et al., 1990). Habeeballa (1996) reported that labor do not stay long time in the farm, and the maximum of stay was about 2 –5 month and claimed that this situation affects milk yield because cows are accustomed to be milked by a certain milker, and changing milkers lead to decrease in milk yield. In addition, the transference of milker from one farm to another transmutes diseases such as brucellosis and tuberculosis. Mohammed Kheir (2002) reported that 77 % of the hired labors in Port Sudan were found to be illiterate.

2.19 Farm's Owner

The main problem in milk production in all the countries of Latin America, especially in the small producers group which is the most numerous, is the unsuitable system for feeding cows. This problem is due to inadequate general management of the farm business and limited economic resources of
the farms. Nevertheless, the general low educational level of farmers and particularly the farmer's poor knowledge of specific matters such as dairy production, cow feeding, economic farm management, etc, have contributed to the problem as well. (FAO, 1990). Habeeballa (1996) reported that the education status of farm owner did not significantly affect the milk yield per day ($p > 0.05$). However higher yield was observed when the owner was a university graduate, while the lowest yield was observed when the owner was illiterate. Abdel-Mageed (1988) reported that the farmers at Kuku need more competencies and more extension on dairy farming practices feeding, housing, milking hygiene, foot care, proper sanitary practices and culling technique. The effect of education of the dairyman especially regarding preventive measures is very important in 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 %.
CHAPTER THREE
MATERIALS AND METHODS

3.1 Experimental site

The present research assignment was conducted during the summer season 2004 (March to October) in selected farms in Khartoum state. The state lies within the semi desert ecological zone between latitude 15° and 16.45° North longitude 31° and 34 4° East (Ministry of Agriculture, Animal Resources and Irrigation of Khartoum State, 2005).

The prevailing climatic condition in the state according to the Sudan Meteorological Authority Monthly Weather Report (2004) showed that maximum temperature (43.9°C) and minimum temperature (31.8°C) were recorded during May and January respectively. The maximum rainfall in the region was witnessed during August (88.8mm) and only sporadic shower were recorded during June (2.6 mm), September (9.6 mm) and October (5.0 mm). Temperature (maximum and minimum), relative humidity and rainfall in Khartoum State are shown in table (1).

3.2 Experimental herds

Hundred milking herds of varying sizes, adopting traditional management systems were chosen to cover the three localities affiliated to Khartoum state. In the locality of Khartoum, herds from Soba, Geriaif, Lamab, Shigra, Buri, Ozozab, Manashia, Dekhainat and Tabia were chosen. In the Khartoum north locality herds from Kuku, Mygoma, Samarab, Halfaya, Kadro, Kafori, Shambat, Gadisia and Eltibna were
Table 2. Average maximum and minimum temperature, relative humidity and total rainfall during 2004 in Khartoum State.

<table>
<thead>
<tr>
<th>Month</th>
<th>Temperature (°C)</th>
<th>Relative humidity %</th>
<th>Total rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max</td>
<td>Min</td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>31.8</td>
<td>17</td>
<td>34</td>
</tr>
<tr>
<td>February</td>
<td>32.5</td>
<td>17</td>
<td>34</td>
</tr>
<tr>
<td>March</td>
<td>37.4</td>
<td>20.6</td>
<td>21</td>
</tr>
<tr>
<td>April</td>
<td>40.9</td>
<td>24.5</td>
<td>16</td>
</tr>
<tr>
<td>May</td>
<td>43.9</td>
<td>27.7</td>
<td>27</td>
</tr>
<tr>
<td>June</td>
<td>41.2</td>
<td>26.0</td>
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<tr>
<td>July</td>
<td>40.3</td>
<td>27.4</td>
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<tr>
<td>August</td>
<td>38.7</td>
<td>26.2</td>
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<tr>
<td>September</td>
<td>40.1</td>
<td>27.3</td>
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<td>October</td>
<td>39.9</td>
<td>26.5</td>
<td>24</td>
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<tr>
<td>November</td>
<td>36.5</td>
<td>22.3</td>
<td>32</td>
</tr>
<tr>
<td>December</td>
<td>31.9</td>
<td>17.3</td>
<td>34</td>
</tr>
</tbody>
</table>

targeted. From Omdurman locality herds located at Umbda, Karari and Elradowan were investigated.

These farms were chosen on basis of willingness of the herd owner to cooperate and release information needed by the researcher and included in the extensive questionnaire (Appendix 1). The questionnaire includes detailed queries pertinent to the following aspects:

(i) Particulars of the farm owner including his age, job, education, other income source.

(ii) The farm total area, areas allotted to fodder cropping, buildings and herd facilities

(iii) Herd structure details including total number of lactating cows, dry cows, males and female calves, replacing heifers, breeding bulls. Also detailed information concerning total milk yield, average cow production, and maximum and minimum milk produced, lactation length and dry period.

(iv) Systems of feeding adopted in the different farms including concentrate feeding levels and ingredients of concentrate mixes, roughages and type, source and amount offered.

(v) Management: all management aspects concerning calf rearing practices, recorded keeping, heat detection and system of breeding, and pregnancy diagnosis and milking practices were addressed.

(vi) Veterinary services including regularity of veterinary supervision, vaccination, diseases control, cleaning and sanitation were screened.

3.3 Collection of data

From the preliminary visits to the selected farms, it was obvious that the majority of them lack records. The collection of data depended entirely on an extensive questionnaire was prepared as described earlier, and
the personal contacts and interviewing of the farm owners through field visit to check the validity of the answers.

The sole criteria adopted for the selection of farms were the willingness of the farm owner to respond to the questions in the questionnaire. Moreover during the field visits the author was allowed to check the owner's answers to the questionnaire concerning the total number of cows and their followers, their age groups, sex, daily feed amounts of roughages and concentrates, housing facilities, types and building materials beside the general herd management policies adopted in each farm.

3.4 Statistical analysis

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

4.1 Farms location, owners and labors:

Farms location, education and age of owners and labors are shown in table (3). The distribution of the dairy farm in Khartoum State indicated that 53% of the farms were located in Khartoum, while 37% were from Khartoum North locality and only 10% were from Omdurman locality. The data revealed that 33% of the owners were University graduates, while 30% of the owners were illiterates. 28% of the owners have primary level and only 9% of the owners secured high school level. Also the data indicated that the age of most owners ranged between 40 – 49 years (36%). Most of the labors were illiterates (84%) and only 16% were with primary level. The age of most labors ranged between 25-35 years (64%).

4.2 Cattle breeds

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 herds more than 50% exotic blood.

4.3 Herd size and structure

The Dairy herd size and structure of the investigated dairy farms in Khartoum state is shown in table (4). The results indicated that the total number of cattle in the farms was 9145 heads.
Table (3). Farms location, education and age of owners and labors

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Farms location</td>
<td></td>
</tr>
<tr>
<td>A – Khartoum</td>
<td>53</td>
</tr>
<tr>
<td>B – Khartoum North</td>
<td>37</td>
</tr>
<tr>
<td>C – Omdurman</td>
<td>10</td>
</tr>
<tr>
<td>2 – Owners education</td>
<td></td>
</tr>
<tr>
<td>A – Illiterate</td>
<td>30</td>
</tr>
<tr>
<td>B – Primary</td>
<td>28</td>
</tr>
<tr>
<td>C – Secondary</td>
<td>9</td>
</tr>
<tr>
<td>D – University</td>
<td>33</td>
</tr>
<tr>
<td>3 – Owners age (years)</td>
<td></td>
</tr>
<tr>
<td>A – 1 – 29</td>
<td>9</td>
</tr>
<tr>
<td>B – 29 – 39</td>
<td>21</td>
</tr>
<tr>
<td>C – 39 – 49</td>
<td>36</td>
</tr>
<tr>
<td>D – 49 – 59</td>
<td>29</td>
</tr>
<tr>
<td>F – ≥ 60</td>
<td>5</td>
</tr>
<tr>
<td>4 – Labors education</td>
<td></td>
</tr>
<tr>
<td>A – Illiterate</td>
<td>84</td>
</tr>
<tr>
<td>B – Primary</td>
<td>16</td>
</tr>
<tr>
<td>5 – Labors age (years)</td>
<td></td>
</tr>
<tr>
<td>A – 1 – 24</td>
<td>21</td>
</tr>
<tr>
<td>B – 25 – 35</td>
<td>64</td>
</tr>
<tr>
<td>C – 35 – 45</td>
<td>15</td>
</tr>
</tbody>
</table>
It was found that there were big variations in cattle number of different farms which ranged between 22 – 735 heads with a mean of 91.45 ± 107.43 heads / herd. The lactating cows comprised more than one third of the total herd (37.86 %), while the dry cows were about one sixth (17.14 %). Female calves were found in higher percentage than other stock (breeding bulls, and male calves). The result also indicated that bulls and male calves were kept entirely in 13 and 7 farms respectively, indicating that in these farm the owners get rid of male calves

4.4 Lactation performance

The lactation performance of the investigated herds is portrayed in table (5). The data showed that the mean total milk yield (TMY) was 674.06 ± 1041.24 lb / herd. A wide variation between the farms was evident. The maximum TMY was 6976 lbs while the minimum TMY recorded was 248 lbs / herd.

The average milk yields (AMY) / cow / day amounted to 18.95 ± 5.99 lbs with a wide range of 36 lb / day as the maximum and only 6 lb / day as the minimum. The average lactation length (L.L) in the studied herds lasted for 269.85 ± 18.97 days. The maximum lactation length recorded was 300 days while the shortest L.L. was 190 days.

The dry period (D.P) averaged 42.84 ± 28.56 days with a wide range of 150 days as maximum and 10 days as minimum.

The data in table (5) also indicated that on average a high lactating cow (H.L.C) produced 39.69 ± 12.98 lbs/day with 70 lbs as the maximum and 8 lbs as the minimum. On the other hand low producing cow (L.P.C) yielded an average of 13.13 ± 5.57 lbs of daily milk with 32 lbs as maximum and 2 lbs as minimum.
Table 4. The Dairy herd size and structure in dairy farms in Khartoum state.

<table>
<thead>
<tr>
<th>Item</th>
<th>No of cows</th>
<th>Mean ± SD</th>
<th>Range</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>9145</td>
<td>91.45±107.43</td>
<td>22 - 735</td>
<td></td>
</tr>
<tr>
<td>Lactating cows</td>
<td>3462</td>
<td>34.62 ± 46.38</td>
<td>7 – 300</td>
<td>37.86</td>
</tr>
<tr>
<td>Dry cows</td>
<td>1567</td>
<td>15.67 ± 15.53</td>
<td>0 – 100</td>
<td>17.14</td>
</tr>
<tr>
<td>Heifers</td>
<td>1084</td>
<td>10.84 ± 11.89</td>
<td>0 – 57</td>
<td>11.85</td>
</tr>
<tr>
<td>Breeding bulls</td>
<td>147</td>
<td>1.47 ± 1.49</td>
<td>0 – 11</td>
<td>1.61</td>
</tr>
<tr>
<td>Female calves*</td>
<td>2232</td>
<td>22.32 ± 34.58</td>
<td>3 – 250</td>
<td>24.41</td>
</tr>
<tr>
<td>Male calves**</td>
<td>653</td>
<td>6.53 ± 7.86</td>
<td>0 – 56</td>
<td>7.14</td>
</tr>
</tbody>
</table>

* Female calves < 9 month  
** Male calves < 6 month
Table (5). The Lactation performance particular of the studied herds

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SD</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>T M Y</td>
<td>674.06 ±1041.24</td>
<td>6976</td>
<td>248</td>
</tr>
<tr>
<td>H L C</td>
<td>39.69 ±12.98</td>
<td>70</td>
<td>8</td>
</tr>
<tr>
<td>L L C</td>
<td>13.13 ± 5.57</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>A M Y</td>
<td>18.95 ±5.99</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>L L</td>
<td>269.85±18.97</td>
<td>300</td>
<td>190</td>
</tr>
<tr>
<td>D P</td>
<td>42.84 ± 28.56</td>
<td>150</td>
<td>10</td>
</tr>
<tr>
<td>Price of milk (lb)</td>
<td>54.7 ±7.5SD</td>
<td>75.0 SD</td>
<td>47.5 SD</td>
</tr>
</tbody>
</table>

TMY    Total milk yield  
H LC   High lactating cow  
L LC   Low lactating cow  
A MY   Average milk yield  
L L    Lactation length  
D P    Dry period
4.5 Price of milk
From table (5) the data indicated that the average price of selling milk (lb) was $54.7 \pm 7.5$ SD, with a range between $47.5 - 75.0$ SD.

4.6 Feeding:
The fed ingredients of both the concentrate mix and roughages traditionally used and daily consumption are presented in table (6). It was evident from the table that concentrate mixes were formulated from four major ingredients that included Sorghum grains (Dura), Wheat bran (W.B), Ground nut hulls (G.N.H) and Molasses in addition to Salt licks. The data revealed that Wheat bran was the most widely used ingredient in concentrate mixes, where 96 % of the farms utilized it. Groundnut hulls ranked second since 94 % of the herds incorporated it in the concentrate mix. 64 % of the farms relied on Sorghum grain and only 48 % utilized Molasses in the offered concentrate mix. On the other hand 62 % of the farms availed salt licks to their herds.
The percentage inclusions of these ingredients however were not identified because the farmers were reluctant to disseminate such information. The average daily consumption of the concentrate mix was about $5.23 \pm 1.45$ Kg DM/cow/day irrespective of the milk yield of the cow.
The roughages were comprised mainly of *Sorghum vulgare* (Abu 70) and *Medicago sativa* (Berseem). The average daily allowance was $11.0 \pm 4.4$ Kg DM /cow. It is worth mentioning that most of the farmers depended on purchase of roughages from the market since the field visits revealed that only 35 % of the farmers owned cultivable lands for growing their own roughages. A wide variation was noticed in the areas available for growing roughages, which
Table (6). The Feed ingredients commonly used in the studied farms and daily consumption

<table>
<thead>
<tr>
<th>Concentrate ingredients</th>
<th>Roughage ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Sorghum Grain (Dura) *</td>
<td>Sorghum vulgare (Abu 70)</td>
</tr>
<tr>
<td>2- Wheat Bran**</td>
<td>Medicago sativa (Berseem)</td>
</tr>
<tr>
<td>3- Ground Nut Hulls***</td>
<td></td>
</tr>
<tr>
<td>4- Molasses -</td>
<td></td>
</tr>
<tr>
<td>5- Salt lick--</td>
<td></td>
</tr>
<tr>
<td>Daily consumption</td>
<td>Daily consumption</td>
</tr>
<tr>
<td>5.23 ± 1.54 Kg DM /cow</td>
<td>11.0 ± 404 Kg DM /cow</td>
</tr>
</tbody>
</table>

- Used by 64 % of the investigated farms

** Used by 96 % of the investigated farms

*** Used by 94 % of the investigated farms

- Used by 48 % of the investigated farms

-- Used by 62 % of the investigated farms
ranged between 3 – 621 feddan (feddan = 4200 m²). Most of them grow *Sorghum vulgara* (Abu 70), and few farmers grow green barseem (*Medicago sativa*).

4.6 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.

4.7 Building materials

The building materials used for pens of the cows are shown in table (7). The result showed that the average area of the pen (Zereba) was 1484.66- ±1962.68 m². A wide variation was noticed in the pens areas, which ranged from 250-8400 m². Most of the pens were poorly designed; the fences were made of pipes barbed wire, red bricks, zinc and Miskeet stems (*Prospis Julifora*). The data revealed that pipes were the most widely used (42 %), red bricks ranked second 39 %. 11 % of the farms depended on barbed wire in pens building, 6 % of the farmers used zinc for building and only 2 % used Miskeet stems in pens building. It was noticed that in most of the farms space requirement per cow was not considered since overstocking was observed in the majority of the studied farms. The yards were divided into several partitions for lactating cows, dry cows, growing heifers, female and male calves, and breeding bulls. In most farms, lactating and dry cows are kept together, while in others, dry cows and heifers are penned together. The data revealed that most of the pens are with primitive floors, which is made of either soil or roughly cemented floors. 97 % of the farms were of soil type floors while only 3 % of the farms had roughly cemented floors.
In the center of most pens, there is shade (Rakoba) constructed mainly from local thatches, bamboo and zinc. The data revealed that the local thatches were the most widely used in shade making since 74% of the farmers used it. Zinc ranked second with 16%, while 2% of the farmers used bamboo. On the other hand 8% of the farms have no shade facilities. It was obvious from the results that the percentage of the shaded area was about 20% compared to unshaded areas.

4.7  Herd management
4.7.1 Calf rearing practices

Calf rearing practices in the farms under study are shown in table (8). The farms that adopt individual housing, identification and dehorning were recorded as percentage from total number of farms surveyed. 16% of the farms adopted individual calf housing; identification of calves was practiced in 30% and dehorning was applied in 24%. It was noticed that ideal calf rearing system that included application of the three practices was not available.

4.7.2 Records:

Recording system practices in the farms are shown in table (8). Few farmers keep records for their herds. The analysis of the questioner data indicated that 20% of the studied farms kept production records, 17% health records, 19% nutrition records and 22% reproduction records. These informations suggest that 80% of the studied farms have no production records, 83% with no health records, 81% with no nutrition records and
Table (7). The building material used in Khartoum dairy farms.

<table>
<thead>
<tr>
<th>Building materials</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Fence</td>
<td></td>
</tr>
<tr>
<td>1- pipes</td>
<td>42</td>
</tr>
<tr>
<td>2- red bricks</td>
<td>39</td>
</tr>
<tr>
<td>3- Barbed wire</td>
<td>11</td>
</tr>
<tr>
<td>4- Miskeet stems</td>
<td>2</td>
</tr>
<tr>
<td>5- Zinc</td>
<td>6</td>
</tr>
<tr>
<td>(B) Floor</td>
<td></td>
</tr>
<tr>
<td>1- Soil</td>
<td>97</td>
</tr>
<tr>
<td>2- Blocks</td>
<td>3</td>
</tr>
<tr>
<td>© Roof</td>
<td></td>
</tr>
<tr>
<td>1- Local thatches</td>
<td>74</td>
</tr>
<tr>
<td>2- Zinc</td>
<td>16</td>
</tr>
<tr>
<td>3- Bamboo</td>
<td>2</td>
</tr>
<tr>
<td>4- Not roof</td>
<td>8</td>
</tr>
<tr>
<td>Average area of the pen</td>
<td>1484.66 ± 1962.68 m²</td>
</tr>
</tbody>
</table>
78% with no 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.

**4.7.3 Heat detection and type of insemination:**

Heat detection and type of insemination practices in Khartoum dairy farms are shown in table (9). For heat detection knowledgeable stockmen for observing behavior heat signs were used in only 15% of the farms, while in 50% heat was detected by the bulls and in 35% by the combination of bulls and visual observation. The most widely used method for services was the natural mating since it was adopted in 96% of the farms. Artificial insemination was not used solely but was used in combination with natural mating in 4 farms.

**4.7.4 Veterinary supervision and preventive measure practices:**

The Veterinary services offered in Khartoum dairy farms are shown in table (10). The disease control management is not satisfactory; only 23% of the farms were under veterinary supervision, 14% of the farms have resident veterinarians and 9% with visiting veterinarians on weekly basis.

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 63% of the annual routine vaccination the targeted diseases included Contagious Bovine PleuroPneumonia (CBPP), Anthrax, Black quarter (Black leg) and Haemorrhagic Septicemia (HS).
Mastitis, Theileriosis, Foot and Mouth Disease (FMD) and contagious abortion cases were recorded in 27 %, 17%, 44 % and 17 % of the studied farms respectively, but vaccination against foot and mouth disease and
Table (8) Current calf management and recording system practice in Khartoum dairy farms.

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Calf management</td>
<td></td>
</tr>
<tr>
<td>A-Individual housing</td>
<td>16</td>
</tr>
<tr>
<td>B-Identification</td>
<td>30</td>
</tr>
<tr>
<td>C-Dehorning</td>
<td>24</td>
</tr>
<tr>
<td>2- Records</td>
<td></td>
</tr>
<tr>
<td>A- Production</td>
<td>20</td>
</tr>
<tr>
<td>B-Health</td>
<td>17</td>
</tr>
<tr>
<td>C-Nutrition</td>
<td>19</td>
</tr>
<tr>
<td>D-Reproduction</td>
<td>22</td>
</tr>
</tbody>
</table>
Table (9). Heat detection and type of insemination practices in Khartoum dairy farms

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Heat detection</td>
<td></td>
</tr>
<tr>
<td>A – Skillful labors observation</td>
<td>15</td>
</tr>
<tr>
<td>B – Bulls</td>
<td>50</td>
</tr>
<tr>
<td>C- Skillful labors observation +bulls</td>
<td>35</td>
</tr>
<tr>
<td>2 – Type of insemination</td>
<td></td>
</tr>
<tr>
<td>A – natural insemination</td>
<td>96</td>
</tr>
<tr>
<td>B- Artificial insemination</td>
<td>0</td>
</tr>
<tr>
<td>C- natural + artificial insemination</td>
<td>4</td>
</tr>
</tbody>
</table>
contagious abortion was not used. For cleaning and sanitation, daily dung removal was practiced in 22% of the total farms. Weekly dung removal was practiced in 33 % of the total while 45% of the farms have no program for dung removal. Disinfections were practiced in 59 % while it was not practiced in 41% farms. 25 % practiced testing for disease and culling measures were practiced in 20 %. Concerning deworming, 58 % were using anthelmintic drenching for internal parasites control while 64 % were using routine ticks spray for external parasites. Pregnancy diagnosis was practiced in 48 %, 13% of them have routine pregnancy diagnosis practice while 35 % practiced it when needed. The results revealed that 16 % of the farms have their own small clinics.
Table (10). The Veterinary supervision practices in Khartoum dairy farms

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Veterinary supervision</td>
<td>23</td>
</tr>
<tr>
<td>A – Resident veterinarians</td>
<td>14</td>
</tr>
<tr>
<td>B – Weekly visit veterinarians</td>
<td>9</td>
</tr>
<tr>
<td>C – When needed</td>
<td>77</td>
</tr>
<tr>
<td>2- Annual routine vaccination</td>
<td>63</td>
</tr>
<tr>
<td>3- Cases of foot and mouth disease</td>
<td>44</td>
</tr>
<tr>
<td>4 – Cases of brucellosis</td>
<td>17</td>
</tr>
<tr>
<td>5- Dung removal</td>
<td>55</td>
</tr>
<tr>
<td>A – daily dung removal</td>
<td>22</td>
</tr>
<tr>
<td>B – Weekly dung removal</td>
<td>33</td>
</tr>
<tr>
<td>C- No program for dung removal</td>
<td>45</td>
</tr>
<tr>
<td>6 – Testing for disease</td>
<td>25</td>
</tr>
<tr>
<td>7- Disinfections</td>
<td>59</td>
</tr>
<tr>
<td>8 – Culling</td>
<td>20</td>
</tr>
<tr>
<td>9 – Deworming drenching</td>
<td>58</td>
</tr>
<tr>
<td>10 – Pregnancy diagnosis</td>
<td>48</td>
</tr>
<tr>
<td>A- Routine pregnancy diagnosis</td>
<td>13</td>
</tr>
<tr>
<td>B – When needed</td>
<td>35</td>
</tr>
<tr>
<td>11 – Small clinics</td>
<td>16</td>
</tr>
</tbody>
</table>
CHAPTER FIVE

DISCUSSION

This study was unique in its nature and goals since the objective layed out was to give an approximate map of the present status of the management and husbandry practices in some dairy farms in Khartoum state. The extensive survey of selected farms within the different localities in Khartoum state included abroad spectrum of all particulars concerning the dairy herd in the state as demonstrated by the miscellaneous questions included in the questionnaire. All other studies in the literature reviewed did not cover the range of information secured in the present study. Some studies dealt with specific herds and covered limited information. (Alim, 1960) reported on reproduction rate and milk yield in Kenana cattle, 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 and Mohammed Kheir (2002) surveyed the dairy herd in Port Sudan district. The wide array of information collected in the study as one independent unit can not be matched with other sited studies as mentioned earlier because those other studies dealt with few dairying parameters in a specific farm or specific breed.

This inevitable situation dictated that the discussion chapter attempted to compare and contrast between the present results and bits and pieces of cited literature where in applicable.

The analysis of the investigated farms sites revealed that 53 % of the farms were within Khartoum locality, 37% in Khartoum North locality and the remaining 10% were from Omdurman locality. This distribution
however has no bearing on the total number of dairy farms in the three localities so it is used only to comprehend the guard situation of the survey area.

5.1 Education level of herd owners

The results indicated that 30 % of the stockowners and 84 % of the herd labors were found to be illiterate. Habeeballa (1996) indicated that in Eastern Nile Khartoum state education status of the owners did not affect milk production. Pagot (1993) on the other hand declared that one of the limitations of milk production in the tropics was the sociological factor. According to the report of Administration of Animal Resources Algadaref State (2001) the unawareness and poor economical sense of the herd's owners limited dairy production in the state. Moreover Fangaly (1980) found that untrained herdsmen were a constraint at UmBenien Dairy Production Research Station. The present results comply with those of Mohammed Kheir (2002) who reported that 77 % of the hired labors in Port Sudan were illiterate.

5.2 Cattle breeds:

The present study revealed that all the investigated dairy farms owned grade cows with more than 50 % exotic blood. Other studies indicated that the grade cows comprised 67 % of the herds while 27.8 % were local dairy (Tibin et al., 1990). In another study in Port Sudan Mohammed Kheir (2002) found that 92.4 % of the dairy herd was composed of local dairy breed. These variations clearly indicate that the dairy sector in Khartoum is far well developed and the AI programs are established compared to other regions in the country. Establishment of modern dairy farms with exotic dairy breed in Khartoum State also might have contributed to the spread of grade dairy
cows in Khartoum state and hence might have increased the amount of milk produced in Khartoum State by the milking cows.

**5.3 Herd size**

From table (4), it was noticed that the overall mean herd size of the studied farms in Khartoum state was 91.45 ± 107.43 head per herd, which was less than 1339 and 2622 heads reported by Attia (1986) in two separate studies, and 529 and 281 heads stated by Atabani (1960). The herd size in the present study however was greater than the herd size reported by Abdel-Mageed (1988) in Kuku Dairy Project and that of Mohammed (1995) and Habeeballa (1996) those authors reported 69.7 ± 53.5, 82.5 ± 137 and 39.6 ± 20.7 as average herd size respectively. 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.

**5.4 Herd structure**

The lactating cows in this study represented 37.86 % of the total herds and the dry cows represented 17.14 % of the total herd. These results differ from what was 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 %.

From this study the lactating cows represent 66.8 % of adult cows while the dry cows were 31.2 %. The present results comply with the 66% reported by Mohammed (1995). This might indicate an improvement in the management system. Badi (1988) in his study of dairy herd in Gezira Scheme reported that milking cows were 65.4 % of the total herd.
The current results revealed that heifers represented 11.85% of the total herd while calves represented 31.55. Badi (1988) reported comparable data for heifers (12.8%) and different percent 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.

5.5 Milk yield

The average daily milk yield / cow amounted to 18.95 ± 5.99 lbs, which was less than the 20.2 ± 10.2 lb was reported by Abdel-Mageed (1988), and 20.2 lb reported by Tibin et al. (1990) for grade dairy cows in Kuku Dairy Project. The average daily milk yield found in this study is however greater than values reported by Habeeballa (1996) in Eastern Nile Khartoum State and Mohammed (1995) in some dairy farms in Khartoum State who reported average daily milk as 15 and 16.9 lb respectively.

These variations may be due to the different feeding and management practices in the different studies.

5.6 Lactation length (L.L)

Lactation length (L.L) found in this study averaged 269.85 ± 18.97 days. Ahmed et al. (1986) reported a shorter lactation length of 207 days in grade cows belonging to the Rahad Scheme. The present results however comply with the data presented by Ageeb and Hiller (1991) in their study of this trait in a herd of crossbred between Frisian and Butana, but was shorter when compared to the lactation length of graded cows in Bulgravia, University of Khartoum Farm and Judiciary Farm as stated by Rahmatalla (2002). The author claimed that the lactation length in the
three farms for graded dairy cows were 366.69 ± 107.51, 371.46 ± 122.90 and 344.15 ± 188.11 days respectively. The wide range of standard deviation witnessed in these figures clearly indicate 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.

5.7 Dry period

In the present study the data revealed that the average dry period was 42.48 ± 28.56 days. The results are comparable to that reported by Habeeballa for crossbred cows in Eastern Khartoum State (49.5 ± 19). Fadel - Moula (1994) however reported a longer dry period for crossbred cows in Khartoum University Farm (96± 60 days).the dry period length in this study was also shorter than that reported by Singh and Tomar (1990) for Kenana X Frisian crossbred (66 ± 1 day).

The variations in the length of this trait suggest the effect of different management policies adopted in the different farms on dry period length.

5.8 Price of milk

The results concluded that the average price of selling milk ( lb) was 54.7 ± 7.5 SD, with a range between 47.5 – 75.0 SD, which was more than 40 SD in Khartoum state claimed by Statistical Bulletin for Animal Resources (2000), but less than 62 ± 7 SD reported by Mohammed Kheir (2002) in Port Sudan. These variations in prices may be due to differences in prices of fodder, supply and demand and time factor.

5.9 Feeding

In the present study, the average daily consumption of the concentrate mix was about 5.2 ± 1.45 kg, which was less than that reported by Elshatory (2000) in Bulgravia Dairy Farm and Tibin et al (1990) in Kuku
Dairy Project who stated that the average daily consumption of the concentrate mix for grade cows were 8 and 8.5 kg respectively while the average daily consumption of roughage was 11.0 ± 4.4 kg DM / cow, which was less than that reported by Tibin et al. (1990) in Kuku Dairy Project and ElAmin (1994) in Bulgravia Dairy farm who stated that the average daily consumption of roughage were for grade cows were 16.0 and 20 kg respectively.

The results indicated that only 35 % of the farmers owned cultivable lands for growing their own roughages. Habeeballa (1996) found that 50 % from the owners leave their land uncultivated and therefore they purchased green fodder from the market.

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.

5.10 Housing

The present study indicated that the average area of the pen (Zereba) was 1484.66 ± 1962.68 m². Abdel - Mageed (1988) at Kuku Dairy Project found that the area of each pen (Zerba) is 700 m² for small herd to 1000 m² for large herd. Habeeballa (1996) found that the area of each pen is 200 m² for small herds and 1500 m² for large herds; in the same study he found that the average area of farms was 5.95 ± 3.8 feddans. Mohamed Kheir (2002) found that the average area of the pens were 1463 ± 4091 m² in Port Sudan.

Winterholder et al. (1984) reported that metal building materials were better and easier to be cleaned and disinfected than wooden building materials. The present results indicated that in the center of most pens, there is shade (Rakoba) constructed mainly from local thatches (74 %), bamboo (2 %) and zinc (16 %), on the other hand 8 % of the farms have no shade facilities. Also it was obvious from the present results that the
percentage of the shaded area was about 20 % compared to un shaded areas which is more than the 12 % reported by Mohammed Kheir (2002) in Port Sudan but less than 35 % reported by Ishag (2000) in Kenana Sugar Company Farm. Abdel - Mageed (1988) reported that at Kuku Dairy Project, the shade built at the center with local materials and can only provide partial shade and they are borne ticks. C.A.B (1972) reported that sufficient shade is also of high importance and has a high significant effect on Friesian crosses in the tropics increasing milk yield by 18.4 %.

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.

5.11 Milking practice

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 per milking time. The results revealed that most milkers in the farms do not stay long in the farm and after 2 – 6 months, they leave for better jobs. This result was in agreement with the findings reported by Abdel - Mageed (1988) and Habeeballa (1996) such situation may have it is negative impact on the farm management and animals performance or production since Schmidt and VanVleck (1976) 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.

5.12 Calf management

The present study revealed that 16 % of the farms adopted individual calf housing, identification of calves was practiced in 30 % and dehorning was applied in 24 % of the total farms. Mohammed (1995) found that individual housing, identification and dehorning were
practiced in 7.06 %, 9.4 % and 11.8 % of the total herd respectively in Khartoum dairy farms such findings might highlight the importance of the finding of Alim (1960) and Wakeem and Dansoury (1962) reported that current standard of calf management and environmental condition were the most reasons for calf mortality in the tropics.

Natural calf rearing is the most dominant in dairy farm under study, farmers believe that restricted suckling and natural calf rearing is superior to artificial management and they also believe that cows could not yield without their calves, that was also reported by Matthewman (1993) studying milk production in the tropics, that the best method to rear calves is to leaves them with dams for six months, but that method seems to be unsuitable for cows reared for milk production.

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.

5.13 Records

The information's from the analysis of Questioners in this study suggest that 80 % of the studied farms have no production records, 83 % with no health records, 81 % with no nutrition records and 78 % with no reproduction records. Abdel - Mageed (1988) reported that the farmer at Kuku Dairy Project does not keep records for his herd. Only two or three farmers keep the AI record or service record which is incomplete. Schmidt and VanVleck (1974) reported that an important function of a dairy records program is identification of the animals in the herd. Daily management decisions concerning breeding, feeding, selection, calving and culling depending on accurate identification of animals. From the present results it was noticed that even in the farms which kept records, however the records are not well organized and
irreliable since a lot of missing data is encountered. This may be due to the unawareness of owners to the importance of records keeping.

5.14 Heat detection and type of insemination

From the current data it was obvious that knowledgeable stockmen for observing behavioural heat signs were used in only 15 % of the farms, while in 5 % heat was detected by the bulls and in 35 % by the combination of bulls and visual observation. Blakely and Bade (1982) reported that the heat period varies from 17 to 26 days and last from 6 to 36 hours, with an average duration of 18 hours for cow and 15 hours for heifer. The most widely used method for insemination was the natural one since it was adopted in 96 % of the farms. Artificial insemination (AI) was not used solely but was used in combination with natural mating in 4 farms. Habeeballa (1996) reported that the 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.

5.16 Health and preventive measures practices

Vaccination against contagious diseases such as anthrax, C.B.P.P, haemorrhagic septicaemia and black quarter was practiced in 63 % of the total dairy farms studied. Other vaccines such as brucella and foot and mouth vaccines were not used. The vaccination programmers were provided by the veterinary Dept in the majority of the dairy farms visited. Mohammed (1995) reported that vaccination against contagious diseases was practiced in 92.9 % of total farms, while that against brucella and foot and mouth diseases were rarely used in only 3.5% of farms. Habeeballa (1996) noticed that vaccination against contagious diseases was adopted in 72 % of the farms studied.
Williamson and Payne (1978) reported that in herds kept in subsistence level in the tropics, brucella vaccination is not common or possible, so farmers have to tolerate the disease in their herds. Practices such as testing, culling, deworming, ticks spray and disinfection were practiced in 25 %, 20 %, 58 %, 64% and 59% of the farms respectively. Mohammed (1995) reported that practices such as testing, isolation, culling and deworming were practiced in 25.8 %, 38.8 %, 25.9 % and 18.8 % of the total farms respectively. Baasher (1969) claimed that preventive measures in Sudan face many difficulties, pitfalls and disappointments, owing to economic exigencies. Also FAO documents (1989) reported that in tropical countries management practices and preventive measures are not adequate and practices such as isolation and quarantine facilities were not common. Culling was also not common and the same was noticed by Lwajock (1992) who reported that in some dairy farms in Khartoum state, farmers continue to maintain cows with only one functional teat without culling.

5.17 Veterinary supervision

Animals must be given veterinary care to reduce their susceptibility to disease and decrease mortality. The results of the present study revealed that only 23 % of the farms were under veterinary supervision, 14 % of the farms have resident veterinarians and 9 % with visiting veterinaries on weekly basic. Mohammed (1995) found that in more than 66 % of farms, the disease control was not satisfactory and only 27.06 % of the farms is under veterinary supervision, 20% of the farms have resident veterinary supervision and 7.06 % has veterinary supervision at least a weekly visit. 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. In the present study, the most common diseases recorded at the farm studied were mastitis (27 %), foot and mouth disease (44%), brucellosis (17 %) and theileriosis (17 %). Mohammed (1995) reported that the incidence of mastitis ranged between 13.3 % to 46.7 %. Abdalla (1995) reported that mastitis in Sudan was common among all breeds and especially in high milkers. The infection rate reached 97 % in Kenana cows, 45 % in Butana cows and 32 % in crossbred.
CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 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:

1- The data revealed that 33 % of the owners were university graduates, 9 % with high school level, 30 % of the owner were completely illiterates and 28 % with primary level. Thus 58 % of the dairy herd owners were below high school level.
2 – The age of most owners ranged between 40 – 49 years (36 %).
3 – Most of labors were illiterates (84 %) and only 16 % were with primary level.
4 – The age of most labors ranged between 25 – 35 years (64 %).
5 – All the farms investigated owned crossbred dairy farms but the levels of exotic blood could not be determined in these farms due to lack of records.
6 – The overall mean herd size in the area under investigation was 91.45 ± 107.43 heads / herd.
7 – The average herd structure for all farms was as follows: -
   The lactating cows were 37.86 %, while the dry cows were 17.14 %.
8 - The average daily milk yield per cow was 18.95 ± 5.99 lbs. This production level is however considered lower than crossbred production level in well managed herds.
9. The average price of milk (lb) was $54.7 \pm 7.5$ SD, which is shorter than standard lactation length which is 305 days.

10. The average lactation length recorded was $269.85 \pm 18.97$ days.

11. The average dry period was $42.84 \pm 28.56$ days, which was shorter than recommended dry period of 60 days which is proved to increase the milk yield of subsequent lactation.

12. The average daily consumption of concentrate was about $5.23 \pm 1.45$ kg/DM/cow irrespective of milk yield of the cow, while the average daily allowance of roughages was $11.0 \pm 4.4$ kg/cow.

13. Only 35% of the farmers owned cultivable lands for growing their own roughages, a situation which subject 35% of the farms to depend on unreliable sources for their feed supply either by availability of feed or their high priced dictated by producers.

14. Cows are hand-milked twice daily and each milkers manager 10 cows per milking time.

15. Most milkers do not stay long in the farm and after 2–6 months, they leave for better jobs which lead to decrease in milk yield due to the change of milkers.

16. The average area of the pen was $1484.66 \pm 1962.68$ m².

17. Most of pens were poorly designed and do not cater for the animal welfare. This may be reflected negatively on animal behavior and productivity.

18. The percentage of shaded area was about 20% compared to unshaded areas. Thus lactating cows are mostly subjected to heat stress which is known to affect significantly the level of milk production.

19. Individual calf housing was adopted in 16%, identification of calves was practiced in 30% and dehorning was applied in 24%.

20. 80% of the total farms have no production records, 83% with no health records, 81% with no nutrition records and 78% with no
reproduction records, the importance of record keeping in dairy farms need not to be emphasized.

21 – the most widely used method for insemination was the natural one, it was adopted in 96 % of the farms and artificial insemination was used in combination with natural mating in 4 % of the total farms.

22 – Only 23 % of the farms were under veterinary supervision, the need for veterinary care in production of the dairy industry need not to be emphasized.

23 – The annual routine vaccination against anthrax, C, B. P.P., B.Q and HS was practiced in 63 % of the total farms.

24 – Vaccination for diseases such as brucellosis and foot and mouth disease was not practiced in the farms studied.

25 – Mastitis, theileriosis, foot and mouth disease and contagious abortion cases were recorded in 27 %, 17 %, 44 % and 17 % of the studied farms respectively.

26 – Daily dung removal was practiced in 22 % of the total farms and weekly dung removal was practiced in 33 % of the total farms, while 45 % of the farms have no program for dung removal.

27 – Disinfection was practiced in 59 % of the total farms.

28 – 25 % practiced testing for diseases and culling measure was practiced in 20 % of the total farms.

29 – concerning deworming, 58 % were using anthelmintic drenching for internal parasites control while 64 % were using routine tick spray for external parasites.

30 – Pregnancy diagnosis was practiced in 48 % of the total farms.

31 – 16 % of the total farms have their own small clinics.

6.2 Recommendations

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.

1 - 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 can not be over emphasized.

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

   (a) Through provision of improved seeds and fertilizers to farmers to grow their own fodder crops in the farm.

   (b) Provision of concentrate ingredients at reasonable price:

   (I) Helping to store ingredients at the season of availability e.g. sorghum.

   (II) To restrict export of some ingredients e.g. molasses, oil cakes and to encourage their use domestically.

3 – Establishment of units for research in fodder production and encouragement of establishment of feed factories.

4 – Formulation of rations on economic basis and also estimation on dairy cows requirements for feeds.

5– Governmental supervision on breeding programs in the dairy farms. This could be done by:

   (a) Building of effective artificial insemination centers in the state by providing sustainable infra structural facilities.
(b) Distribution of improved imported or local breeding bulls. That could be also done by an office to coordinate exchange of bulls between farmers.

6 – Activation of veterinary services in localities with intensive dairy farms by establishment of well equipped veterinary clinics.

7 – Establishment of milk collection centers and co-operative units.

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

9 – It is important to have educated and well trained labors to improve the profession of dairy production.

10 – Encouragement of annual fairs and workshops establishment which deals with the dairy sector in Khartoum State.
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Dickerson, G.E., and A.B. Chapman. (1939). The effects of different levels of production at different levels of producing ability. Pages 73 – 76 in the annual proceeding of the American Society of Animal production. (Now the American Society of Animal Society, Savoy, IL).


Reproduction in farm animals (7th Ed.). Lippincott Williams and Wilkins.


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

(1) The stock owners

<table>
<thead>
<tr>
<th>Name of owner</th>
<th>Age</th>
<th>Education level</th>
<th>Job</th>
<th>Source of income</th>
<th>Phone No.</th>
</tr>
</thead>
<tbody>
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</table>

(2) The farm:-

<table>
<thead>
<tr>
<th>Location</th>
<th>Area</th>
<th>Percentage of shaded area</th>
<th>Cultivated lands area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

(3) Building materials:-

<table>
<thead>
<tr>
<th>Building</th>
<th>Fence</th>
<th>Floor</th>
<th>Roof</th>
<th>Separate yards</th>
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</thead>
<tbody>
<tr>
<td>Area</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

(4) Stock:-

<table>
<thead>
<tr>
<th>No. of cows</th>
<th>No. of lactating cows</th>
<th>No. of dry cows</th>
<th>No. of heifers</th>
<th>No. of male calves</th>
<th>No. of female calves</th>
<th>No. of breeding bulls</th>
</tr>
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<tbody>
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</table>

(5) Lactation performance:-

<table>
<thead>
<tr>
<th>Total milk yield</th>
<th>Average milk yield</th>
<th>High lactating cow</th>
<th>Low lactating cow</th>
<th>Lactation length</th>
<th>Dry period</th>
<th>Price of milk(lb)</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

(6) Feeding system:-

<table>
<thead>
<tr>
<th>Type</th>
<th>Contents and percentage</th>
<th>Source</th>
<th>System of feeding</th>
<th>Daily consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentrate</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Roughage</td>
<td></td>
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</tbody>
</table>
(7) Farm management:-

(A) Calf rearing practices:-

<table>
<thead>
<tr>
<th>Individual housing</th>
<th>Identification</th>
<th>Dehorning</th>
<th>Bedding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

(B) Records:-

<table>
<thead>
<tr>
<th>Production</th>
<th>Health</th>
<th>Reproduction</th>
<th>Nutrition</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

(C) Heat detection:-

<table>
<thead>
<tr>
<th>By labors</th>
<th>By bulls</th>
<th>By labors + bulls</th>
<th>Others</th>
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<tbody>
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(D) Type of insemination:-

<table>
<thead>
<tr>
<th>Natural</th>
<th>Artificial</th>
<th>Natural + Artificial</th>
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<tbody>
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</table>

(E) Pregnancy Diagnosis:

<table>
<thead>
<tr>
<th>Routine</th>
<th>On call</th>
<th>Others</th>
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<tbody>
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(F) Sanitation:-

<table>
<thead>
<tr>
<th>Disinfection of building</th>
<th>Removal of dug interval</th>
<th>Hooves trimming</th>
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</table>

(G) Vaccination:-

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>H. S</th>
<th>Anthrax</th>
<th>C.B.P.P</th>
<th>B.Q</th>
<th>F and M</th>
<th>Brucella</th>
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</thead>
<tbody>
<tr>
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</table>
(H) Milking process:-

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Machine milking</th>
<th>Hand milking</th>
<th>Clean udder</th>
<th>Clean milkers</th>
<th>Equipment clean</th>
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(8) Noninfectious diseases:-

<table>
<thead>
<tr>
<th>Diseases</th>
<th>No. of cases</th>
<th>Treatment</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edema</td>
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<tr>
<td>Ketosis</td>
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<tr>
<td>Milk fever</td>
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<td></td>
<td></td>
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<tr>
<td>Others</td>
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(9) Contagious diseases:-

<table>
<thead>
<tr>
<th>Diseases</th>
<th>No. of cases</th>
<th>Treatment</th>
<th>Preventive measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthrax</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>F and M</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>C.B.P.P</td>
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<tr>
<td>H.S</td>
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<td></td>
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<tr>
<td>Foot rot</td>
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<td></td>
<td></td>
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<tr>
<td>Rinder pest</td>
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<tr>
<td>Others</td>
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(10) Mastitis:-

<table>
<thead>
<tr>
<th>No. of cases</th>
<th>Treatment</th>
<th>Sanitation</th>
<th>Preventive measures</th>
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</thead>
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(11) Brucellosis:-

<table>
<thead>
<tr>
<th>Brucellosis</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Abortion at late pregnancy</td>
<td></td>
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<tr>
<td>Is the herd tested before</td>
<td></td>
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<tr>
<td>Is the herd vaccinated</td>
<td></td>
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<tr>
<td>Number of cows culled</td>
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(12) Internal parasites:-

<table>
<thead>
<tr>
<th>No. of cases</th>
<th>Previous testing</th>
<th>Strategic drenching</th>
<th>Treatment</th>
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(13) External parasites:-

<table>
<thead>
<tr>
<th>Presence</th>
<th>Spraying</th>
<th>Dipping</th>
<th>Chemical used</th>
<th>others</th>
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<tr>
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(14) General principles of disease control:-

<table>
<thead>
<tr>
<th>Preventive measures</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitation</td>
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<tr>
<td>Isolation</td>
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<tr>
<td>Vaccination</td>
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<tr>
<td>Testing</td>
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<tr>
<td>Culling</td>
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<tr>
<td>Treatment</td>
<td></td>
</tr>
<tr>
<td>Nutrition</td>
<td></td>
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(15) Veterinary supervision:-

<table>
<thead>
<tr>
<th>Resident veterinarians</th>
<th>Visitor veterinarians</th>
<th>On call</th>
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</thead>
<tbody>
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(16) Farm labors:-

<table>
<thead>
<tr>
<th>Number</th>
<th>Age</th>
<th>Education</th>
<th>Salary</th>
<th>Notes</th>
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(17) General notes:

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