Sudan University of Science and Technology

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The Effects of Management System on the Reproductive Efficiency, Calf mortality and Embryonic losses in Sudanese Camel

أثر التظام الرعوي علي الكفاءة التناسلية ونفوق الحيران وإهلاك الأجنة في الإبل السودانية

By

EglalSiddegElkhiderAbdAllah

B.Sc.(Honor) (2003) Animal Production –Agric (SUST)
M.Sc (2006) Animal Production –Agric (SUST)

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Supervisor:
Prof.Dr. A.AzizMakkawyAbdelrahman
College of Agricultural Studies
Sudan University of Science and Technology

Co. Supervisor:
Dr. SalaheldeenSidAhmed Ahmed
College of Agricultural Studies
Sudan University of Science and Technology

Ex.Co.supervisor:
Prof.Dr. Ahmed SubreeAbdoon
Veterinary Research Division

National Research Center, El Behoos St., Dokki 12622, Cairo-Egypt

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آية قرآنية

Koranic Verse

(أَفَلَا يَنْظُرُونَ إِلَى الْإِبِلِ كَيْفَ خُلِقَتْ)

سورة الغاشية (الآية 17)

(Will they not regard the camels, how they are created)

[Surat Al-Ghashiya 17]

DEDICATION

To My parent

In recognition of their Care and abundant love

,,,,,,,

To my family

Appreciation to them

,,,,,,,

To Soul of my brother Mohammed

Loving and longing

,,,,,,,

To My Supervisors

In Recognition of them

,,,,,,,

To My friends

Honest to their feelings

With love and respect

Eglal

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Abstract

This research has been conducted to investigate the effects of management system on production and reproductive efficiency, calf mortality & embryonic losses in some Sudanese camel's breeds and assess the difference of some biochemical blood parameters under their natural nomadic management system at El Butana region, south eastern Sudan and intensive management systems in Khartoum state center of Sudan. Results of reproduction and reproduction traits were as follow:

For reproduction no significant differences ($P \geq 0.05$) between the two systems in puberty age of the male and female, number of services per conception and Gestation period. On the other hand there were significant differences ($p \leq 0.05$) between the two systems in Age of camel (male and female) at first mating, Age of female at first calving, Days open and also there were high significant differences ($p \leq 0.01$) in Reproductive age of camel (male and female), Duration of estrus period, first estrous after parturition and Calving Interval all in favour of the Intensive system.

For production traits there were no significant differences ($P \geq 0.05$) between the two systems in number of milking /day and milk production per day while there was significant differences ($p \leq 0.05$) between the two systems in lactation length in favour of Intensive system.

The results of the current study revealed that nomadic system recorded higher percentage in abortion more than in intensive system ($P \leq 0.05$) and the biggest problem causing embryonic losses in Sudanese camel are slaughtering of pregnant females as found in the Slaughterhouse at Tumboul area, also many reasons play a role in the incidence of abortion in she-camels.

Calves mortality rate was higher ($p \leq 0.01$) in nomadic system (more than 5% of herd ratio) than intensive system (1-5% of herd ratio). The majority of mortality occurs at small ages. Calves mortality is obvious as the most serious problem for the farmer.

Serum samples of Sudanese camel were analyzed for concentrations of steroid hormones including estradiol-17 (E2), progesterone (P4) and thyroid hormones; Triiodothyronine (T3) and thyroxin (T4). They were determined by ELISA reader. It has been observed that the P4 was significantly ($P \leq 0.05$) higher in the nomadic system compared to the intensive system, contrary to T4 which was significantly ($P \leq 0.000$) very high in favour of intensive system. On the other hand there were no significant deference ($P \geq 0.05$) between the two systems in E2 and T3 despite they were high in nomadic system.

Blood minerals of Sudanese camel were determined photometricaly by Atomic absorption using Spectrophotometer for Calcium, Phosphorus, Magnesium and Zinc. It has been observed that all trace elements showed very high significant differences ($P \leq 0.000$) between the two systems in favour of nomadic system.

Blood biochemical of Sudanese camel were studied and determined by some parameters such as Total Protein, Albumin, Globulin, Glucose, Total Bilirubin, Cholesterol, Urea Concentration, Uric Acid and Creatinine. This study revealed that there were no significant deferent ($P \geq 0.05$) between the two systems in Glucose and Creatinine. But there was a high significant difference ($P \leq 0.000$) in Urea Concentration in favour of intensive system. Furthermore there were high significant differences ($P \leq 0.000$) between the two systems in Total Protein, Albumin, Globulin, Total Bilirubin, Cholesterol and Uric Acid in

favour of nomadic system. It is concluded that; Reproductive performances of camels under nomadic management system (Butana region) were low which could lead to delayed age of first breeding season and increased calving interval. On the other side most camels in Butana region though are generally considered to be in good health and excellent condition, doubtless because of the ample availability of feed in the form of durra byproducts and hence availability of feed for she camels under nomadic system increased and improved most of the blood parameter.

الخلاصة

Arabic Abstract

أجريت هذه الدراسة لمعرفة أثر النظام الرعوى على الإنتاج والأداء التناسلى لبعض الإبل السودانية، ونفوق الحيران وفقدان الأجنة، وتقييم بعض مكونات الدم الكيميائية الحيوية فى بيئتهم الرعوية الطبيعية متمثلة فى منطقة البطانة فى الجنوب الشرقى للسودان، والنظام المكثف متمثل فى ولاية الخرطوم فى وسط السودان. وقد كانت الصفات التناسلية والإنتاجية كمايلى:

النسبة للصفات التناسلية لم تكن هنالك فروقات معنوية ($P\geq 0.05$) بين النظامين لكل من العمر عند البلوغ للإناث والذكور ، عدد التلقيحات اللازمة للإخصاب و طول فترة الحمل. من جانب آخر كانت هنالك فروقات معنوية ($P\leq 0.05$) بين النظامين فى العمر عند أول تلقيحة (ذكور و إناث)، عمر الإنثي عند أول ولادة و الأيام المفتوحة كذلك كانت هنالك فروقات معنوية عالية ($p\leq 0.01$) فى العمر الإنتاجى للإبل (ذكور وإناث)، طول دورة الحيال، أول تلقيحة بعد الولادة والفترة بين ولادتين لصالح النظام المكثف.

بالنسبة للصفات الإنتاجية لم تكن هنالك فروقات معنوية ($P\geq 0.05$) بين النظامين فى كل من عدد الحلبات اليومية وإنتاج اللبن اليومي بينما كانت هنالك فروقات معنوية ($p\leq 0.05$) بين النظامين فى طول موسم الحليب لصالح النظام المكثف.

نتائج الدراسة الحالية أوضحت بأن النظام الرعوى الترحالى سجل نسبة إجهاض أعلى من النظام المكثف ($P\leq 0.05$) وأكبر مشكلة تسبب فقدان الأجنة فى الإبل السودانية هى ذبح الإناث الحمل كما وجد فى مسلخ تمبول، بالإضافة الي العديد من الأسباب التى لها دور فى حدوث الإجهاض فى إناث الإبل.

كان معدل نفوق الحيران أعلى ($p\leq 0.01$) فى النظام الرعوي الترحالى (أكثر من 5% من نسبة القطيع) من النظام المكثف (1-5% من نسبة القطيع). معظم النفوق يحدث فى الأعمار الصغيرة. وقد إتضح بأن نفوق الحيران يعتبر من أكبر مشاكل مزارع الإبل.

أما عن عينات مصل الدم فقد تم تحليل هرموناتها الإستيرويدية: الإستروجين والبروجستيرون والهرمونات الثيرويدية: التراي أيودوثيرونين والثيروكسين. وحللت بواسطة الإليزا . وقد لوحظ بأن البروجستيرون كان ذو فروقات معنوية ($P\leq 0.05$) عالية لصالح النظام الرعوي مقارنة بالنظام المكثف، بعكس الثيروكسين الذي كان ذو دلالة معنوية ($P\leq 0.000$)

عالية جداً لصالح النظام المكثف. من جانب آخر لم تكن هنالك فروقات معنوية ($P\geq0.05$) بين النظامين فى الإستروجين والتراي أيودوثيروكسين على الرغم من أنهما عاليين فى النظام الرعوي الترحالى.

أما عن الأملاح فقد تم تقديرها ضوئيا بالإمتصاص الذري بجهاز الإسبيكتروفوتوميتر للكالسيوم ، الفسفور ، الماغنيسيوم و الزنك. وقد لوحظ بأن كل هذه الأملاح أظهرت فروقات معنوية عالية جداً ($P\leq 0.000$) بين النظامين لصالح النظام الرعوي الترحالي.

بالنسبة لمكونات الدم الكيموحيوية التى كانت تحت الدراسه وتم تقييمها مثل البروتين الكلى، الالبيومين،القلوبيولين، الجلكوز،البيلوروبين، الكوليسترول، تركيز اليوريا، حمض اليوريك، والكرياتنين. كشفت هذه الدراسة بأنه لاتوجد فروقات معنوية ($P\geq0.05$) بين النظامين فى الجلكوز والكرياتنين. لكن هنالك فروقات معنوية عالية ($P\leq 0.000$) فى تركيز اليوريا لصالح النظام المكثف. إضافة الي ذلك كانت هنالك فروقات معنوية عالية ($P\leq 0.000$) بين النظامين فى البروتين الكلى، الالبيومين، القلوبيولين، البيلوروبين، الكوليسترول و حمض اليوريك جميعها لصالح النظام الرعوي الترحالى. وقد خلصت هذه الدراسة بأن الأداء التناسلى للإبل السودانية تحت النظام الرعوى (منطقة البطانة) كان منخفض ربما بسبب تأخر العمر عند التلقيح وزيادة الفترة بين ولادتين. من جانب آخر معظم الإبل فى منطقة البطانة بصفة عامة تعتبر ذات صحة جيدة وحالة ممتازة ، وذلك نسبة لتوفر الغذاء الكافى من مخلفات الذرة، والدليل على ذلك أن العذاء المتاح للإناث تحت النظام الرعوى زاد وحسن من مكونات الدم.

Chapter One

Introduction

Sudan has the second largest camel population in the world, estimated at nearly 4.7million **(MAR, 2010).** Over the past few decades camels have regained recognition for their food-producing potential in arid and semi-arid areas of Sudan, after having been dismissed as uneconomical by the Sudanese government. Their vital role in supporting human populations in some of the poorest and frequently drought-stricken areas of the world has now been widely acknowledged **(Hjort af Ornäs, 1988).**

For centuries, the camel has been a very important animal in the desert regions because of its ability to provide milk, meat, and transport in harsh, dry conditions (**Fernandez-Baca, 1993).** However, camels are generally used in less well-developed countries, research into improving characteristics such as fertility and milk and meat production have been lacking. However, the development of camel racing in the Middle East has led to an increase in value of the racing dromedary and thus increased interest in improving reproductive efficiency.

The reproductive efficiency of camels under natural conditions is generally regarded to be low **(Skidmore, 2005)** when compared with other domesticated species **(Al Eknah, 2000)**.Camel is rarely considered as a productive animal, but rather as an animal from the past, just interesting to walk in the desert with the tourists. So, the scientific interest of camel appears to be low for many research institutes in the North and even in the Southern countries **(Mali, Niger, Chad, Morocco…).** But in the same time, camel farming has shown high ability to be adapted to intensification process for dairy and meat production. Elsewhere, the camel appeared as a very interesting biological model for scientists in different field. The international

scientific community must be aware to these trends, and the camel scientists, especially in the Southern countries, contribute to the promotion of new scientific approaches.

Although a lot of research has been carried on camel production milk and meat, but meager or little researches were available on camel reproduction. In dromedary, several productive and reproductive characteristics such as restricted breeding season, long gestation period, low daily body weight gain and high calf mortality appear to be the major constraints to increase productivity of dromedary herd **(Ismail, 1990).** Livestock producers have utilized many methodologies in order to improve reproductive effecincy including the use of reproductive hormones to regulate and control the estrous cycle.

Reproductive losses in Sudanese herds of camel managed under the traditional and transhumance system are manifested in long calving interval, delayed age of buberty, high neonatal mortality rates, udder disease and variety of stressors such as nutrition of which is most evident.**(Yaniz et al, 2004).**

In the Sudan the camel's herds are managed by conventional husbandry system which is deeply rooted in the society and based on superstition and practices that were founded down by father to son over age **(Yagil et al, 1994)**. The camel's herds which are managed under semi-intensive system are dictated by the prevailing ecological habitat. The area characterized by stables kept all camels and availability of pasture **(Zaied et al, 1991)**. In addition, poor management practices in the regions where most camels are raised, adversely affect its reproduction and productive performance.The most important factors affecting reproductive Parameters in the young female are nutrition and adequate growth. In pastoral system calving interval is usually 36months or even more. In view of this fact, camel mortality

possess an added effect that limits camel productivity , high calf mortality appears to be one of the major Constraints to higher productivity in camels.(Khalafallah,1999). Also the fertilization rate of camels is considered very low (Novoa, 1970). Fifty percent fertility, or even less, has been recorded (Keikin, 1976; Yuzlikaev and Akhmedier, 1965). So the objectives of this study are to:

1- Assess the difficulties and constraint facing the improvement programme in camel production and reproduction and advocate on some seid scientific solution concerning camel performance under different system of production in the Sudan
2- Measure the reproductive efficiency in Sudanese camels raised under two different systems to indicate which suitable management system.
3- Study the impact of management systems on the reproductive efficiency of she camels.
4- Study the causes of embryonic losses during the pregnancy
5- Study the causes of calf mortality in camels
6- Evaluate, the effect of management System on some blood biochemical profile during pregnancy stages and postpartum in Sudanese camel**.**

Chapter Two

Literature Review

2-1- Camel in the Sudan

The Sudan is home to some of the most well-known camel nomads, the Kababish, Shukria, Hadendowa and others. Tribal groups in Sudan breed distinctive types of camels (Mason and Maule, 1960). Well-known among these are the Anafi and Bishareen, prized for their racing and riding capacities, the Rashaidi, a sturdy transport camel with superior drought resistance, and the large whitish Lahaween, which gives high meat yields.(Internet 1).

Camel in Sudan are raised mainly in a belt north of 12˚ N latitude, while there are about 20 millions camels in the world. According to very reserved estimates, camel population in the Sudan is about 5 million. Whereas, they are concentrate in three main regions: the Eastern region, where camels are found in the Butana plains and the Red Sea hills, and the Western Regions (Darfur and Kordofan). In Butana area of Sudan camels is commonly raised under nomadic conditions in a geographical zone, which lies approximately between latitude 14-16 N and longitude 33-36 E. (Ayman, 2011). Most camels are raised within pastoral systems in western Kordofan, Darfur and eastern regions of the country, also some camels raised in the rain fed-cultivation areas in central Sudan (Ahmed et al, 2015)

2-2- Camel population in Sudan

Sudan ranks the second country in the world camel population; according to last estimation of camels in Sudan are 4.715000 heads (MARF, 2011).Also According to FAO statistics, with a camel population of 4.5 millions heads, Sudan is the second country in the world after Somalia. However now a days, if we consider the current political situation in this last

country, shared into 3 entities (Puntland, Somaliland, Somalia), the camel population in Sudan (18% of the whole population in the world) is probably the most important.

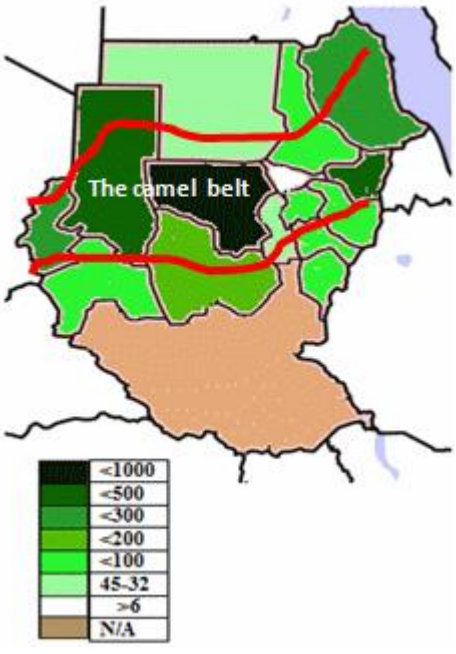
Regarding the trend since 1961 (date of the first FAO statistics), the camel population in Sudan is growing regularly with a yearly growth of 2.55%. The camel population growth in Sudan is higher than the world growth (2% per year on average). However this growth was not regular. Three periods were observed: from 1961 to 1978 with medium growth (1.3%), from 1979 to 2000 with a low growth (0.95) and a rapid growth from 2001 (5.14% per year). These differences could be attributed to the impact of drought during the years 80 and 90, but also probably to a better census of the livestock after the year 2000 (Faye et al, 2011).

2-3- Camel Distribution

It is known that camel is the animal adapted to the arid lands in the old world, in Africa and in Asia. The north of Sudan is widely included in arid areas of African continent and the camel population is concentrated between approximately isohyets 100 and 300 mm (map 1), constituting the “camel belt”. This area includes the states of North and South-Darfur, North and South-Kordofan, Khartoum, Gezira, Kassala, Red Sea, River-Nile, Northern Sudan, White Nile, Blue Nile and Sennar State. North Kordofan state only has the highest camel population with more than one million heads, representing approximately 5% of the whole world camel population. However, this population is moving and a slight expansion of the camel belt to the South is observed since one decennial as in other countries of Sahel region (Faye B, 2009). They occupy a geographical zone to the north of latitude14^{o} N in the west and 16o N in the east(Wilson, 1984) .The camels of the Sudan belong to the species *Camelus dromedaries*, and are owned and raised by nomadic tribes(El- Fadil, 1986). In Butana area of Sudan camels is

commonly raised under nomadic conditions in a geographical zone, which lies approximately between latitude 14-16 N and longitude 33-36 E. Butana camel population is representing 25% of Sudanese camel (Ayman, 2011).Camel herders migrate north in the wet season and south during the dry season. (El- Fadil, 1986)

The distribution according to the other herbivorous species is also an important indicator of the place of camel into the livestock economy. In 2008, the camel population represented 10.3% of the total DHB (domestic herbivorous biomass) to be compared to the 4.8% at the world level (for only the countries with native camels). This indicator is however higher than in Sudan in 13 countries where the desert takes a more important place. Indeed, the small ruminant population in Sudan is also important all over the country and cattle are well present in the south. So, this indicator will increase yet with the separation of Southern Sudan where the camel farming is marginal. Indeed, more than 98% of the camel population will stay in North Sudan while the total herbivorous biomass will decrease significantly. (Faye et al, 2011).



Map (1). The Camel Belt in Sudan

2-4- Camel Management System

The camel production systems in central Sudan were maintained under intensive, semi-intensive and traditional system (Ahmed, et al, 2015).The camel farming is mainly traditional based on the mobility of the herd, the use of the natural resources and a low investment in infrastructures, veterinary control and other services. However the intensification of the camel farming could represent away for modernizing the camel production at the benefice of the local producers and of the consumers of the camel products as it is observed especially in Gulf countries. It is known that the farming management has a high impact on the expected productivity with intensive management (better health care, adding concentrates in the diet, vitamin and mineral supplementation). Sudan submitted as all African countries to different trends as urbanization, high growth demography and climatic change. These trends have strong effect on camel farming. (Faye et al, 2011). Study of traditional camel management system and it's shifting towards intensive and semi-intensive in light of changing cropping pattern and shrinkage of grazing resource, change in irrigation patterns and its impact on social and economic status of camel-rearing societies will be studied. Although the camels are adapted to various kind of environmental stress situations like, high temperature and solar radiation and camel makes every attempt to maintain a constant condition of entire body at the cost of the energy available, but it remains a limiting factor for optimum growth performance. The efforts will be made to ascertain adaptability of camel to modified comfortable but practicable type of micro climate/ shelter and know its effect on production functions as well as on the adaptive physiological functions and also on biological and behavioral responses(NRC, 2011).

2-4-1- Impact of management systems on the production and reproductive efficiency of she camels:

It is known that the farming management has a high impact on the expected productivity with intensive management (better health care, adding concentrates in the diet, vitamin and mineral supplementation). (Faye et al, 2011). Good husbandry and management techniques are the reasons for the success of camel pastoralists in an environment characterized by irregular rainfall and frequent droughts. Farah et al, (2004) observed that selection and breeding are the most important husbandry practices in camel management. The selection is traditional. It means the bull or his father should have mainly female progeny with good milk performance and it should be fully grown and strong (Farah et al, 2007). Farah et al,(2004) reported that breeding management usually focused on bull selection and herders selected their breeding bulls according to specific criteria such as consideration was given to the bull's dam (milk production, fitness), bull's sire (fitness) and bull's performance ranking (body confirmation, fitness, docility, disease, drought tolerance). According to Drosa (2005) the breeding system is based on successful management of mate breeding camels.

Fertility of she-camels kept under traditional system was showed to be low percentage (45.3%) compared to the other groups. This was largely correlated with nutritional and other environmental stress. Similarly, other studies revealed the low fertility of zebu cattle in tropical and subtropical areas reported by Fitzpatrick (1993). Similar results revealed by Eisa (2006) who studied the productive and reproductive characters of camels raised in Butana area Eastern Sudan.

2-4-1-1-Production

Ahmed, et al, (2015) observed in their study that, she-camels under intensive and semi-intensive systems produce significantly ($P<0.05$) more milk than those raised under traditional system and improving management increased milk yield three times compared to she-camels under traditional management, the significant difference ($P<0.05$) in milk yield between intensive and semi-intensive systems appeared after the 6 months of lactation. High yield of milk in intensive system may be due to the supplementary feeding and improved of nutritive value of the feeds offered to this group. Similar results were obtained by Farah and Fischer (2004) whom reported that milk yield varies with breed, stage of lactation, feeding status and management conditions; also this result is similar with Bakheit (2003) who studied camels' performance under pastoral systems in Sudan. Ahmed (2012) stated that productivity of the animal depends on genetics, health status and management. Proper management and health practices ultimately lead to improved production and reproduction. The existing traditional management practices of camel production are requires interventions for the improvement of camel productivity. The great variation in camel milk production may be attributed to the methods employed to determine yield (Khan and Iqpal, 2001). Most of the authors did not specify the number of milking per day (Cardellino et al, 2004). According to Eisa and Mustafa, (2011) Sudanese camel can reach 10kg of milk/day in the early lactation and good conditions and decline to 2 kg milk/day in the late lactation and bad conditions otherwise it ranges between 5-10 kg/day. Adam et al, (2011) were reported the average daily milk yield and total milk yield per lactation was (4.3 and 1645.4 kg) for migratory and (7.5 and 2925 kg) for the sedentary system, respectively which agreed with that mentioned by Yagil, (1985). These differences may be due to the difference in lactation

length which was shorter in migratory system than sedentary due to availability of feeds. It was found that the migratory system is no longer profitable for camel production compared to sedentary where the yearly expenditure was exceeding the yearly income (59.4 vs. 40.6 %). The study found that illiteracy, diseases, tribal conflicts and wars are the main constrains that hider camel production in the study area.

2-4-1-2- Reproductive Efficiency

Camel herds sustain fewer deaths during severe droughts than other types of livestock; they do suffer deferred effects, such as markedly lower calving rates in the following year. It also suggests that the low reproductive rates, which are frequently regarded as the great economic drawback of camels, are at least in part a sound and self-regulatory physiological adaptation that attunes their population sizes to fluctuating forage availability, preventing the overgrazing of resources.(Internet 1)

At the moment the main reason against raising camels is the long periods without production: six years to wait for sexual maturity and then a long calving interval of two years (Dahl, 1979), however the calving interval can be shortened to 18 months (Knoess, 1979). With good management this interval could be reduced to a year, or 15 months. If the calves are separated from their mothers within the breeding season, a month or so after birth, the female camel will quickly come on heat. This would then allow for breeding in the same season as calving. Although climate as well as feeding have considerable effects on the fertility of the animals, improved nutrition would increase the health and so the fertility of the animals. The combination of balanced nutrition and education in the selection of both males and females will shorten the period before maturity and improve the birth weight and calving intervals. Disease control will also lessen abortions and prenatal deaths. It is quite clear that the increase in milk and meat

production will be determined by all of the above factors. Selection, on its own, will not have a great effect on undernourished animals. Well-fed animals will show no improvement if ill or worm infested. The goal of a healthy, well-fed and high-producing animal can be achieved even in a drought area with good planning, control, education and aid. Farah et al,(2004) stated Pastoral camel production is under pressure because of multiple changes in the production environment. Increasing human population pressure on pastoral grazing areas and the economic implications resulting from diseases and lack of veterinary services are some of the factors that adversely affect traditional camel production. Additionally, reproductive performance is low in camel due to late first parturition, long parturition interval and high calf mortality. Improvement of the reproductive performance and reduction of animal losses by management measures that are applicable to a mobile system appear to offer possibilities of support the increasing human population. An adequate understanding of traditional camel production practices forms the foundation upon which improvement and innovations could be based.

2-5- Breeding Management

Breeding management consists of selection and/or culling of breeding female and male animals, and controlled breeding. Regarding the selection of breeding females, all females were used for breeding. Mature female camels were dominant (54.87%) in the camel herd. The ratio of male to female camel was 1:13. (Simenew et al, 2013). This can be explained by the fact that, in general, there is hardly any possibility to select among females in larger livestock species. This is particularly so due to build stock size. Culling of breeding females also plays only a minor role among pastoral camel herders. While culling might be desirable from a performance-oriented point, the pastoralists‘ attitude seems rational and may be justified when

considering the slow herd growth in camels. The major reasons to cull female camels in the Somali society include; diseases (30%), old age (41.4%) and poor production performances (28.6%) with 99% of culling measures accounted for selling. In very rare cases, female camels were sold and slaughtered otherwise they are kept in the herd until they die. Male camels were frequently sold in that study area for the last 12 months due to different reasons. The main reasons for selling as pastoralists mentioned were due to income, buying animal for replacement and disease. In very rare cases old, infertile and sick female camels are sold and slaughtered otherwise they are kept in the herd until they die (Simenew, et al, 2013).

Elmi(1989)and Adan (1995) reported that breeding management usually focused on bull selection and pastoralists selected their breeding bulls according to specific criteria. The herders inter viewed widely agreed on the perceived proper criteria. Consideration was given to the bull's dam (milk production, fitness), bull's sire (fitness) and bull's performance ranking (body confirmation, fitness, docility, disease, drought tolerance) Once a bull was selected, he usually served as long as possible. Some herders have reported periods of up to 18 years. Such long active breeding is also common in Somalia (Elmi, 1989). Farah et al,(2004) in their study revealed that sires were kept in the herd for an average of between 4.5 and 7 years. The average age of keeping breeding male camels in the herd in the study area was 11.81±5.03 years (Simenew, et al, 2013). This is in agreement with the reports of Ishag (2009) and Simenew et al, (2013).

According to respondents 59% of Somali pastoralists kept only one breeding male camel in their herd and very few with three breeding male camels(Simenew, et al, 2013). This agrees with the finding of Melaku and Gebreah, (2001) the reasons that pastoralists keep only one bull as respondents reported were to avoid fighting and to get similar types of offspring with good performance. Breeding control is an aspect considered

important by the herders. More than half of the respondents indicated that they kept two bulls. However, only the desired bull was usually grazed together with breeding females. All the unwanted males were either kept separately from the herd or castrated. Where the household herd was split, the breeding bull was usually kept in the nomadic herd. Under such circumstances, it is possible that for the females kept in the home based herd, this practice may retard the onset of reproductive function during late lactation due to the absence of male stimuli. In the production system studied, 69% of the offspring indicated that they allowed the bull to serve his own female offspring when the latter reached puberty. Furthermore, most of the breeding bulls (70%) were selected from within the herd. Only a few bulls were borrowed (17%) from outside. Thus, limited new genetic material is introduced into the camel population. It is highly possible, therefore, that the local breeding management practices contribute to a substantial inbreeding depression in the herds (Farah et al, 2004).Hence, it may be hypothesized that camels may have the potential to breed all year round, but are prevented to do so by environmental cues. Whether daylight duration or food supply is the key factor inducing seasonality in camels remains to be clarified. Two findings of their study suggest that food supply may be more important (A. Sghiri , M.A. Driancourt. 1999).

2-6- Camel Nutrition System

In Sudan camel grazes on different types of browsed plants include trees, legumes, grasses, bushes and shrubs. The interaction between the browsing/grazing camel and its environment is important for the improvement of camel production (Dereje and Uden 2005).The camel covers large areas while browsing and grazing, and is continually on the move, even if food is plentiful. Distance of 50–70 kilometers a day can be covered (Newman, 1979). Camels in the Horn of Africa still range for their food even

though they are brought to graze on crop residues, such as Sorghum stover, Cotton stalks and Sesame waste (Hartley, 1979). The main forage is obtained from trees and shrubs (Newman, 1979). The camels graze in the early morning and late afternoon which are the coolest times of the day for feeding (Gauthier-Pilters, 1984). NRA (2011) reported that the decrease in yield of pasture and range in the Sudan was attributed to many factors which include fires, nomadic over grazing of a lot of natural pastures and range areas, unplanned expansion in crop production at the expense of pasture and range, successive drought which resulted in soil erosion and desertification in many pastoral area. Furthermore, the nutritive value of pasture and range in the Sudan was greatly affected by seasonal changes. In summer, dry period the moisture content, crude protein and total soluble sugars decrease and the plants tend to be fibrous with high ash content and relatively low nutritive value.

Large-scale mechanized mono cropping is an agricultural production technique which initially yields high returns but, subsequently, productivity declines quickly and dramatically. Monetary returns of camel husbandry are low but, on the other hand, it is an ecologically sound, long-term, sustainable strategy for arid land exploitation. Scientists have presented evidence that camel grazing is beneficial for range vegetation (Gauthier-Pilters, 1984) and it appears likely that camel husbandry might discard some of the ecologically destructive effects of mono cropping in sensitive environments throughout Sudan.

Nutrition is a very important factor in affecting the general performance of camels and particularly the quantity and quality of their milk produced, therefore, the different patterns or systems of their management and feeding regime may have some effects on those traits (Shuiep et al, 2008, Shuiep et

al, 2012), in addition to some medicinal effects (Zaid, et al, 1991, Agarwel, et al, 2005).

The influence of nutrition on milk, growth and reproduction has been extensively investigated in conventional farming species and it is generally concluded that decreased nutrient intake reduces the growth of calves, delays the onset of puberty in heifers (Formigoni et al, 1996) and increases the post-partum interval to conception in dams (Lalman et al, 2000). Dietary supplementation of dromedary during late pregnancy stage and post-partum period improves productive and reproductive parameters. Under nutrition during the last months of gestation could result in diminished rates of body weight gain, loss of body weight in dams and abortion of primiparous females.(Mohamed Hammadi,et al, 2001). Improvement of productive and reproductive traits of dromedary camels in Sudan can be achieved by improving nutritional and environmental conditions according to Babiker (2011). Faye et al,(1992) reported in their study: some camels showed a very high level of uremia (> 60 mg/l00 ml) that could be considered as a sub-toxic level. Most of these animals belonged to one farmer who had distributed a high quantity of cake mixed with concentrate. Camels are used in their original place to a low-protein diet and present a mechanism for urea recycling in times of protein deficiency in order to supply a substrate for protein synthesis (Yagil, 1985). Conversely, a high-protein diet may lead to a waste of nitrogen and to increased uremia. Camels are adapted to desert conditions and the low energy feeding. Natural grassland is obviously richer in Europe than in desert areas; so, the distribution of high quantity of cake and concentrate was a waste of nitrogen and energy which explained the high levels of uremia and glycemia. The excess, especially in late pregnancy, could facilitate some inflammatory process, as already observed in dairy cows (Barnouin and Chacornac, 1992) and could increase the risk of

mortality of the young after birth. It was obvious that it was the most serious problem for the farmer.

2-7- Scio- economic Aspects of Camel

The one-humped camels (*Camelus dromedarius*) are economically important in northern and eastern Africa, particularly in Sudan and Somalia where poor families and nomads keep them for milk, meat, wool, leather, and fuel from dried manure.(Zarroug and Shio.2014).The economy of livestock production largely depends upon the reproductive efficiency of the animals (Harrison et al, 1984).

Over the past few decades, camels have regained recognition for their food-producing potential in arid and semi-arid areas of Sudan. After having been dismissed as uneconomical by the Sudanese government, their vital role in supporting human populations in some of the poorest and frequently drought-stricken areas of the world has now been widely acknowledged (Hjort af Ornäs, 1988). The devastating African drought in 1984-1985 demonstrated that camel ownership can give pastoralists a competitive edge and an excellent chance for survival. Whereas entire herds of cattle, sheep and goats succumbed to the arid conditions, camel populations survived relatively unscathed. In parts of the rain-fed agricultural belt of the Sudan, current developments suggest that camels are indeed able to be integrated with crop cultivation systems. (Internet 1)

As well the use of camel for riding and racing is also common in Sudan. The Sudanese breeds are appreciated by the racing lover from Gulf countries. For wedding, a special palanquin is implemented on the camel. The use of camel for agricultural work is also common: for water extraction, sesame oil-press or packing (Faye et al, 2011). In the Sudan camels play important cultural economic and social roles in the live communities' .in the

emigrational land s stricken by recurrent drought the camels usually the sole survivor when all other types of live stock have succumbed. To those people camel herding is the way to live (Eissa and Mustafa, 2011).

2-8- Camel Production System

Eisa and Mustafa (2011) reported that, the nomads who inhabit the desert and semi desert regions in Sudan the camel play important cultural, economic and social roles in the lives of these communities. In those marginal lands, stricken by recurrent droughts the camel is usually the sole survivor when all other types of livestock have succumbed. To those people camel herding is a way of life, an insurance against natural disaster and a highly valued cultural heritage. In Sudan the production systems include: traditional nomadic system, transhumant or semi-nomadic system, sedentary or semi-sedentary system and intensive system which is limited to racing and dairy camels. The three main types of production systems for camel herds are adopted. These are:

2-8-1- Traditional Nomadic System

This system is dominant in the geographical zone between 13◦N to 16◦N (Northern part of the camel belt). This is typically practiced by the Kababish tribe in Northern Kordofan State. The camel herders are continuously on the move in response to availability of grazing and water supplies.(Al-Khori and Majid, 2000). The system of breeding installing, although it is possible, but almost none practiced. It is a traditional breeding system where the herd is left free without guarding. In general the stock breeders attend their herds at long periods(a few months) around the water points(Mongi,2004) Camels are able to migrate far enough north during the rainy season to utilize the only remaining non-cultivated areas. The amplitude of their annual migrations varies from year to year depending on

the amount of rainfall, but in a normal year the range is between 200 and 300 km. During the rainy season in June and July, they move northward to about 16°N (200 mm isohyet) to exploit the seasonally abundant forage **(**Internet1). Adam et al, (2011) their results obtained showed three production systems, the nomadic migratory 22 %, semi-nomadic 36 % and the sedentary production system 42 %. These findings agreed with previous results reported by Wilson (1984) and Jasra and Isani (2000). Illiteracy among camel herders groups of age was (32.3 %) for herders aged 15–29 years, (67.7 %) for 30–49 years and > 50 years old, respectively indicating high illiteracy rate among middle and old herders which goes in line with Majid and Sakr (1998) who stated domination of illiteracy among camel herders (70%). The average herd size was 62 heads for migratory and 118 for sedentary grazing systems, with male to female percentage of 25.6 % and 74.4 %, respectively showing high tendency of keeping large number of females. Irrespective of sex, herd composition less than one year represented 14.4 % of the herd, 23.9 % less than 4 years, 48.9 % less than 14 years and 12.9 % above 14 years old. This goes in agreement with Wilson, (1978) except for age group 1-4 years which was higher (36 %) than that in the present results. In addition, a negative decrease (-18.5 %) in camel herd population under migratory system revealed a positive increase (5.2 %) in sedentary system

2-8-2- Transhumant or Semi- Nomadic System

This system is found in eastern regions of the camel belt as in Butana region and is practiced by semi-nomadic tribes.(Al-Khori and Majid, 2000). It is mainly adopted in Gadarif and Butana area by semi-nomadic tribes such as Lahawiyin, Kawahla, Shukriya, Rashaida , Bija And Bawadra. tribes Darosa (2005). This system is characterized by two phases, the first is the mobile phase in which young men travel during the dry season with their

animals fetching for water and feed, while families are settled in villages, and the second phase when camel herds come home and stay around the villages especially in the rainy season (Al Khouri and Majid, 2000). In this system a degree of settlement is experienced during the rainy season where rain fed agriculture is practiced for stable food production and the crop residues provide feed supplement for camel populations (Bakheit, 1999). Several tribes in Eastern Sudan practice a transhumant mode of range utilization (Abbas et al, 1992). They move from one area to another following certain migratory routes (Al-Amin, 1979)

2-8-3- Sedentary and semi-Sedentary System

This system is practiced in the eastern region of Sudan (East of River Nile and west of the Red Sea hills). It is also practiced in the agricultural areas in the central and southern parts of the camel belt. .(Al-Khori and Majidu, 2000). Ishag and Ahmed, (2011) mentioned that the sedentary system is adopted by majority of camel owners in Sudan.

2-8-4- Intensive and semi-intensive System

In the past, this type of production was practiced in all camel area but it is limited for racing camel only (very small number of camel). Recently an intensive system of camel meat and dairy production farming exists as a kind of commercial investment around Khartoum state (Eisa and Mustafa, 2011). In this system camels are kept in open fences in which continuous water supply through pipe line and good feed quality including concentrate supplement are provided. Also camel herders from natural pastures of Kordofan and Darfur select a group of lactating she-camel and kept it in west Omdurman for producing milk in commercial quantities (Mohamed, 2009)

2-9- Reproduction of Camel

Reproductive efficiency and fertility are generally regarded to be low in dromedary camels. Although end-of-season pregnancy rates of 50–80% can be achieved with improved nutrition and reproductive management, birthing rates barely exceed 40% in traditional management systems (Tibary et al, 2005). The low reproductive performance is the one of the most important factor effecting camel productivity .factor contributing to low fertility in camels are many and complex :the advanced age at puberty (3-4years).in addition poor pastoral management system which include poor feeding and handling prevail in regions where camels are raised adversely affecting camel reproduction and productivity (Skidmore,Adams_2003).

Vyas et al, (1999) mentioned that the reproductive performance of traditionally managed pastoral camel herds in Africa was low and this due to the late age at sexual maturity and first calving, the long post-partum anoestrus and calving intervals, and the factors that cause low fertility include poor nutrition, poor management practices, little or no disease control, limited breeding opportunities for females due to the seasonality of breeding and limited rutting potential of signal stud bull used to service many females.

The camel has a longer breeding life than other domestic species (Ibraheem_2008). The life span of female dromedary is about 30years (El-Amin_1984). When well fed and managed some camels live up to 40years Mukas and Mugerwa (1981). She-camels can breed up to 20 or even 30 years of age (Hartley, 1979).

2-9-1- Reproductive Physiology in Male of Camel

The reproductive efficiency of male dromedary camels under natural conditions is regarded to be low due to a relatively short breeding season and a long pre pubertal period (Zarroug and Shio 2014).

During the first five years, males with unknown genetic background and potential had to be used for breeding. Recently, however, young bulls from high producing mothers have been introduced into the breeding program. Although, the parents of these young males were known, only the performance of the dam could be evaluated. Progeny testing of these young bulls will take another 6–8 years (Nagya, et al, 2013).

2-9-1-1- Puberty & Maturity

Puberty age in the male camel is generally defined as time when he is capable of successful mating and getting female pregnant (Wiltbank1974) The camels are sexually mature at 4 to 5 years of age (Evans and Powys, 1979; Mares, 1954; Yasin and Wahid, 1957), although a 3-year old camel can be used for reproduction (Leonard, 1894; Novoa, 1970; Williamson and Payne, 1959). In the male, full reproductive prowess is not developed until six years (Novoa, 1970) or even seven years (Hartley, 1979) of age (Romero, 1927), but the fertility of both males and females at this age was low (Koford, 1957). Also Simenew et al, (2013) reported that the average age to select breeding male was 5.94±0.81 years. Males begin to mate at around three years of age, too, but still are not sexually mature until six years of age.(Naumann, 2012). According to Drosa (2005) the breeding system is based on successful management of mate breeding camels. Ahmed et al,(2006) reported that the male reaches sexual maturity at seven years and capable of serving 10 females, 10 services per day (including the night). A single male can successfully serve 60 to 67 females in breeding season. Full reproductive potential of the male camel is reached at 5-6 years (Novoa, 1970). However,(Al-Qarawi *et al*, 2001) reported that the first ejaculum that contains higher concentrations of spermatozoa is produced at 6 years old in dromedary camel. The full overt sexual activity may be delayed until 8 years. Physiological capacity may increase up to 10 years, then remains at a more

or less constant of fairly High level until 18-20 years of age (Yasin and Abdul–Wahid.1957; Matharu, 1966).

Puberty is genetically determined and is conditioned by environmental factors (Joubert, 1963) which affect body weight, organ growth and nutritional status (Hunter, 1980). Since weight of the animals, which in the main is determined by nutritional status, strongly influences puberty (Tucker and Oxender, 1980), the comparatively old age at puberty in camels can be due to slow rate of growth (Chatty, 1972). Schwartz et al, (1983) reported that under traditional nomadic management in Kenya, camels reach their mature body weight at between 7 and 8 years of age**.**

2-9-1-2- Seasonality

Sexually mature camels show a short annual breeding season which is an important factor for low reproductive performance (Skidmore, 2005; Bhakat et al, 2005) and is considered a major obstacle in their population growth(Marai et al, 2009). Male and female camels are both seasonal breeders. They breed only during certain times of the year. Contradictory results are available regarding the beginning and duration of the sexual activity in dromedary camels. For example, it is reported to occur from December to April in Egypt (Hegazy et al, 2004), March to August in Sudan (Musa and Abusineina, 1978), April to May in Soma-lia (Ghazi, 2007) and October to December in Saudi Arabia(Tingari et al, 1984).

There are two seasons when breeding peaks are: the main one during and immediately after the rainy season, lasting from July to September; and another occurring in December and January. Generally, one breeding male is kept for 40 to 50 females but in larger herds there is more than one breeding male.(Internet 1). The epididymal activity of the Sudanese camel can be considered to increase gradually during May and June and reach its peak during July, August and September. Similarly, Babiker et al, (2011) who

observed increased testosterone hormone levels in Sudanese male camel suggested a period of breeding between March and August(Hegazy et al, 2004). Contradictory results concerning the onset and cessation of rutting period in camel may be partly due to the nutritional status of the animal which is considered high during rainy seasons, and these are in autumn in Sudan, in summer in Somalia and in winter in Egypt and Saudi Arabia. However, Deen (2008) noted that factors responsible for the onset and cessation of sexual activity in camels under natural conditions are unknown; further, environmental factors, in addition to visual and olfactory stimulation, could influence the sexual activity via the central nervous system. Sumar, (2000) considered both male and female camels as seasonal breeders affected by long daylight during the warmest months of the year. Once a bull was selected, it usually served as long as possible and it kept up to 18 years. According to Wilson, (1984), camels considered to be seasonal polyestrous animal. Rao et al,(1970) reported that camel bulls show their sexual cycle during 3-4 months in winter season, beginning in December. Camels (Camelus dromedarius) are seasonal breeders, and the breeding activity takes place during the coolest winter months of the year (Deen 2008). Depending on the genetic and health condition of the sire, the geographical location, and environmental and nutritional parameters, the duration of the breeding season (also called the “rut”) ranges from 2 to 6 months (Meriem et al, 2014).Al-Qarawi (2005) stated that the onset and duration of the camel breeding season and the intensity of male sexual activity were influenced by meteorological parameters, such as temperature and relative humidity, and Bono et al, (1989) Out of the breeding season, male camels lose their libido and do not copulate with females (El-Hassanein 2003), but, on the contrary, it is also reported that a stud male is capable of mating with and fertilizing an estrus female at any time of the year (Al-Qarawi 2005); Skidmore (2011) stated that the presence of female led to the increase of the male’s libido

and of its behavioral signs. Vyas et al, (2001) and Bhakat et al, (2005) proved that parading of male camels in front of females increased their rutting behavior. it was postulated that the regular female exposure was the major factor for stimulating the sexual behavior in housed male dromedary camels. We could therefore assume that not only climatic factors but also olfactory and visual cues are likely to influence reproductive activity in male dromedary camels as they do in many other species (McDonnell 2000). The presence of the female induced and stimulated the males to express their normal sexual behavior (Meriem et al, 2014).

2-9-1-3- Endocrinological Evidence for Seasonality

Lincoin and Short (1980) were of the view who reported that the low reproductive activity of the male camel during non-breeding season might be due to high activity of the pineal gland provoked by the long summer days. The pineal gland plays an inhibitory role controlling the secretion of the gonadotropins from the pituitary and declined activity of testicular enzymes associated with androgen biosynthesis in other mammals, and it is quite probable that similar physiological role might occur in camel.

Some males lose libido early while others maintains it for longer periods. Reasons for this variability are not fully known. A thorough and systematic investigation on circulating testosterone profiles and sexual libido in male camel all around the year has not been carried out. The study on circulating testosterone profiles and their correlation with sexual libido in ensuing months was conducted to understand trends of reproduction and its association with endocrine profiles in male camels.(Aminu, 2007)

Libido is defined as the biological need for sexual activity and frequently is expressed as sex-seeking behavior. Its intensity is variable between individuals as well as within an individual over a given time. Little is known about the physiological basis of libido (Osman and Ploen (1986).

2-9-1-4- Rutting Behaviour and Aggressiveness

Normally camels are tame and calm animals. During the rutting season both males and females become more aggressive (FAO, 1990). The camel breeding season (rut) often lasts about 3 to 6 month on average (Williamson, Payne. 1978). When the males exhibit the rut, they become very aggressive towards other males and can attack humans (Yagil and Etzion, 1984 &Tibary and Anouassi, 2000). Wardeh (2004) and Ahmed et al,(2006) reported that rutting bull camel well be able to identify female on heat by smelling female genital area by observing symptoms such as restlessness and urination. (Hegazy et al, 2004). During the non-rutting period (summer and autumn), however, the breeding activity almost ceases completely. The period of maximum breeding activity for the male (winter and spring seasons) is known as the "rutting period," while the breeding activity during the non-rutting period (summer and autumn seasons) almost ceases entirely. During rutting, the temperament of the animal changes to a more aggressive and less tractable nature. A prominent feature of rutting behavior is frothing at the mouth with loud, vocal gurgling, typically accompanied by the protrusion of the markedly oedematous and mobile soft palate. Another noted feature of rutting is a profuse secretion of foetid fluid from the pole glands (Yagil and Etzion, 1980; Noakes et al, 2001). Testosterone is the main sex hormone controlling most of the reproductive functions including libido, later stages of spermatogenesis and the activity of accessory sex glands in male animals (Hafez and Hafez, 2000). Significantly higher serum level of this hormone during the rutting period was anticipated. Higher levels of progesterone in rutting animals suggest this hormone is readily available for its conversion into testosterone, which, in turn, stimulates breeding activity during this period. Similar to the findings of the present study, Yagil and Etzion (1980) reported significantly higher ($p < 0.01$) serum androgen levels in camels

during the rutting than the non-rutting periods. Khanvilkar et al,(2009) recorded in male camels the sexual instincts are suppressed for a long period throughout the year. Rutt is generally seen in the later half of the cold weather (December to March) when the grazing conditions are optimum. The sexual activity in general lasts for 3-6 months. Further, the rutt male camels remain silent for sexual activity throughout the year.

2-9-1-5- Copulation

Aminu (2007) observed copulation time(s) were high during January–April. Copulation time declined slowly over May and complete cessation of libido was observed during later half of June. During July–November months, the values of copulation time were almost negligible. The copulation time was also low during December. Under natural breeding, Rai et al, (1988) also observed that copulation time was shorter during the initial breeding season, increased during peak rutting season and declined as weather became warmer and breeding season approached termination.These findings also resemble to the general belief and that of Zhao (2000) that the male is sexually quiescent during non-breeding season, and contradicts the views of Arthur et al, (1985) that a stud male is capable of mating with and fertilizing an oestrous female at any time of year. Adam et al, (2011) reported that the male to female percentage of 25.6 % and 74.4 % for migratory and sedentary respectively.

2-9-2- Reproductive Physiology in Female of Camel

2-9-2-1- Puberty & Maturity

Puberty of female occurs at the 3-4years age and 4-4.5 years of age the animals are first used for breeding (Hartely, 1979). It is common practice to withhold female camels from breeding until they are 4–6 years old (Williamson and Payne, 1978; Matharu, 1966). The onset of sexual activities

in the female camel marks the beginning of puberty and it has been found to start as early as 2-3 years of age (Molash, 1990; Arthur et al, 1985; Yagil, 1985; Chen and Yuen, 1979).However, they are usually not bred until they reach their physical maturity at about 70% of their adult body weight at 3-4 years of age (Yasin and Abdul Wahid, 1957; Molash, 1990; Al-Hozab, 1999). Factors such as adequate nutrition, body weight, photoperiod, and temperature and water availability can influence the onset of sexual activity Wilson (1989).Williamson and Payne (1978) and Matharu (1966) estimated that the sexual maturity of dromedaries occurs at 3 years. Spencer (1973) observed that the Rendille camel of northern Kenya may reach 6 years before getting her first calf. Allowing for a year's gestation period, this would give an age of 5 years at first conception. (Singh 1966) wrote that the age of first sexual desire among male camels in India was 2 years but that full must was delayed until 8 years, although the animals could be sparingly used for service at 6 years.(Leupold ,1968) is of the view that both sexes attain sexual maturity at 3 years. However, (Khatami, 1970) indicated that both the Iranian female and male camel reach sexual maturity at the age of 5 years. Full reproductive capacity of the female camel is reached at 6 years (Singh, 1966; Khatami, 1970), but it can be bred at 3-5 years of age (Matharu, 1966; Williamson and Payne, 1978). Also Saini et al, (2007) said that the average age of mating is 5-6 and 4-5 years, respectively, in male and female camel.Yasin and Abdul-Wahid (1957) reported that the female camel would breed until 30 years of age. Skidmore (2005) found that there are many factors affecting age at puberty including nutrition, season of birth and breed of camel.

2-9-2-2- Seasonality

The female camel has a seasonal reproductive pattern that is primarily controlled by nutritional condition and management (Tibary and Anouassi, 1997c; Sghiri and Driancourt, 1999; Tibary et al, 2007). Under optimal herd health management and nutritional conditions, camels display ovarian activity throughout the year. Male and female camels are both seasonal breeders. They breed only during certain times of the year affected by long daylight during the warmest months of the year (Chen and Yuen 1979; Sumar, 2000). Also Khanna et al, (1990) founded in Indian camel, Seasonality in breeding was observed as 92% of calvings occurred from December through March. Contradictory results concerning the beginning and duration of the sexual activity in dromedary camel were found. Otherwise Arthur et al, (1985) have suggested that camel can reproduce throughout the year. Curasson (1947) also expressed similar views that camel can breed all round the year provided food supply is abundant.

2-9-2-3-Oestrus Cycle:-

Estrous behavior is highly variable in duration and intensity and is therefore unreliable for the detection of estrus and difficult to relate to follicular activity in the ovaries. Camels are induced ovulators and thus normally only ovulate in response to mating. In the absence of mating, ovarian follicles tend to regress after a period of growth and maturity, whereas if male and females are kept together the female gets mated when the dominant follicle measures between 1.3 and 1.7 cm in diameter and the corpus luteum that develops has a lifespan of only 10-12 days. Peripheral concentrations of oestradiol increase with increasing follicle diameter until the follicle reaches 1.7 cm in diameter at which time they start to decrease even if the follicle continues to grow. The concentrations of progesterone remains low in non-mated animals but in mated camels it increases 3-4 days

after ovulation (day of ovulation=Day 0) to reach maximum concentrations on Days 8-9 before decreasing rapidly on Days 10-11 in the non-pregnant animal.(FAO,1990). External signs of heat are less evident than that in cows and mares, being manifested by restlessness, swelling of the vulva, and slight vulval discharge. (Musa and Abusineina, 1978). Joshi et al, (1978) They disagreed with Musa and Abusineina,(1978) reporting that estrus behavior in camels was intense. Later, Homeida et al, (1988), reported that high serum estrogen levels during the 5 days of mature follicular development stimulated estrus behavior such as straddling of the hind legs and urination and receptivity to the male.

The mean duration of the estrous cycle has been reported to be 28 days in Sudan (Musa and Abusineina, 1978). For the Bactrian camel, a mean cycle length of 19 days and a range of 14-24 days has been reported (Chen and Yuen, 1984 b). Estrus, or sexual receptivity, lasts 4-6 days.

Estrus detection can have great impact on a farm's profitability (Saint et al, 2011), because the lack of estrus detection has been identified as a major limiting factor for reproductive performance in modern dairy herds. In spontaneous ovulators, estrus detection by visual observation to identify the ovulation period (i.e., best timing for mating/artificial insemination) is currently well understood (Holman et al, 2011).The duration of estrus cycle varies from 16-22 days and the duration of heat is for 3-4 days. Camels generally do not come in heat in the summer season (Khanvilkar et al, 2009).

2-9-3- Measurement of reproductive efficiency in camel:

2-9-3-1- Number of Service per Conception or Fertilization rates

Service per conception: is the number of service required to effect pregnancy. The number of service per conception camel breed is 1.78-2.72 (Guptalal, 1968) one mating per conception also reported by Arthur et

al,(1985). Also according to (Hermas and Sharieha, 1991-Wilson, 1986-Buol and Ella, 1991) the number of service per conception is 1.8±0.1. Saini et al, (2007) reprted that; the number of service per conception varied between 1to 3 for different zones of Rajasthan.

2-9-3-2- Age at the First Mating and Calving:

Females are bred for the first time at the age of four to five years, producing their first calves one year later. In dry years, when forage is scarce, maturity is delayed and first conception occurs at a later age. Under such circumstances the sexual activity of male animals is also depressed. (Internet1). Rao et al,(1970) and Farah, (2004) mentioned that camels are mated for the first time at the age of 3-4 years. It is possible to breed with camels up to 25-30 years leading to 8-10 calves in a lifetime. On the other hand Farah et al, (2004) noted that normally camels are sexually mature at the age of 4.5 years based on breed and forage situation, but Somali camel herders rarely let them mate before they reach physical maturity at five to six years. On the other hand Wardeh, (1989) in Sudan mentioned that the female camel reaches sexual maturity at the age of 3 years, but usually ready for fertility at the age of 4 to 5 years, Accordingly a female camel has it's first calf at 6-7 years under normal conditions, thus a female camel that gives birth every each 2 year will have eight to ten calves in her breeding life of around 25 to 30 years. Khanna et al, (1990) founded in Indian camel, age at first service was 1390 ± 25 days(represent 5.44±0.07 years)., although it can be reduced to 2 to 3 years with better management practices and genentic improvement. The average age at first calving was 1882 ± 28.69 days (represent5.22±0.08 years.

First parturition generally occurs at five years (Moslah and Megdiche, 1989). First parturition varies from 3 to 7 years of age (Tibary and Anouassi, 1997b). In semi intensive improved state in Somalian state

first calve (57±5.52) month that's mean all most 5 years (Simenew et al, 2014). The mean age of first calving in Mayouf at 2014 is 4.66 years Mayouf et al,(2014) reported that age at the first calving in western Sudan is 52.44±7,74 month(4.37 years)(Musa et al, 2006)also Abdalgader and Falah (2010) reportd that first calving occur between 36-85month the mean is 54.8 month(represent 5.66 years). Calving according to (Zubair et al, 2015) is 4.34±0.73 years in semi intensive and 5.32^{a}±0.45 years in traditional nomadic.

2-9-3-3- Gestation Period

Rao et al,(1970) they mentioned that the gestation period is between 370 -375 days. Ahmed et al, (2012) mentioned that the gestation period ranged between 365-398 days. Al-Bisher, (1998) found that gestation length in the camel is 373–393 days. This is consistent with the findings of other authors _Musa and Abusineina, (1976); Hermans and Shareha, (1990); Abdel-Raouf,(1993). However, longer and shorter gestation periods have been reported Yagil and Etzion, (1984). This variation in gestation length could be due to the method of husbandry, number of matings over the entire period of oestrous Novoa, (1970), number of pregnancies, sex of the foetus _Agarwal et al, 1987; Arthur et al, 1982., level of feeding _Yagil and Etzion,1984., or season of conception _Elias et al, 1991.. The accuracy in diagnosing pregnancy may help in determining the exact gestation length. Duration of gestation in female of dromedary is not affected by dietary level and overall mean was 384.8 ±14.0 days (Mohamed Hammadi et al, 2001).
The dromedary lasted in gestation for 12 months and three weeks which is not affected by dietary effect (Mohamed Hammadi,et al, 2001). Also Khanna et al, (1990) founded in Indian camel, The average gestation length was 389.3 ± 0.0781 days with heritability 0.703 ± 0.2087.The average gestation period was 398±13 and 372±11 in camels bearing male and female fetus,

respectively, with an overall mean of 383±9 day as Agarwal et al,(1989) Founded.

2-9-3-4- Open Period:

Days open: The time from when a she camel calves until when it conceives, The open period for 135 camels examined averaged 10.6 month it range from 1 to23 month after calving (Sallal et al, ,2010). Days open was lower in one herd (319 and 352 days) possibly due to earlier weaning of calves (Aboul-Ela, 1994) although a few females come back into heat as early as 1 month after parturition (Williamson and Payne, 1978).

The level of nutrition is a factor here, since when feed supplies are inadequate, maintenance, growth and lactation take priority over reproductive performance, which becomes a physiological luxury. At any rate camels usually calve only every other year, or at best twice in 2 years (Williamson and Payne, 1978).

2-9-3-5 Calving Interval

Calving interval: time between when the she camel delivers a calf until the next calf is born. Due to gestation length and seasonality of breeding, calving in practice occurs every two years (Wilson, 1984; Arthur et al, 1985). However, in Kenya and in corralled camels a calf every year is possible (Yagil, 1985). The long calving interval is attributed to lengthy gestation, limited breeding season and late postpartum estrus which is frequently one year after parturition (Mukasa-Mugerwa, 1981). Richard (1985) observed calving intervals of 15 months, when the animals were well fed. Schwarz et al, (1983) recorded calving intervals of 28.4 months in traditionally maintained herd's versus20.9 to 22.2 months in herds with both good sanitary control and nutrition. The age at the first calving generally 5_7 years (Ibrahim, 2008) The mean age at first calving and calving interval were 5.17±0.94 and 2.82±0.77years (kella et al, 2008) in Somalia long calving

interval were 34month (Baumann and Zesssin, 1992) .Intensive camel husbandry system in Saudi Arabia that the mean age at a first calving was 52 month (Abaas et al, 2000). Calving interval per month was 23.28±3.36 in the nomadic system Simenew et al, (2013). (Abdel Rahim and El Nazier, 1990) reported intercalving periods lower than two years in camels bred in semi-intensive system. Calving interval according to Zubair et al,(2015) was 19.09±1.76months in semi intensive and 25.01^{a}±0.00 months in traditional nomadic. It is generally held that the normal calving intervals for camels is two years or more and that camels conceive no earlier than one year after giving birth. While this appears to be the prevailing pattern, the Rashaida point out that a minority of females actually become pregnant within two months of parturition, resulting in calving intervals as short as14 to15 months and some females reproducing almost every year. These observations indicate pronounced genetically determined fertility differentials between individuals and also indicate that the breeding seasons, in this geographical zone at least, are much less circumscribed than previously assumed. (Internet1). The generation interval and the age at first birthing are high in dromedaries (Tibary and Anouassi, 1997). The long generation interval for camels is due in large part to long production cycles and management methods. Both lactation (≈585 days) and gestation (≈390 days) periods are long, resulting in a calving interval of 2–2.5 years (Tibary et al, 2005). Also Khanna et al, (1990) founded in Indian camel average inter-calving period was 771.66 ± 8.08 days. This similar with Saini et al, (2007), Inter calving period was found to be 2 years for majority of camel keepers. On the other hand, it was found that herds also contained a number of older females that had never produced a living calf, or had given birth only once. Such animals are kept on, not out of a desire for large herds or for reasons of prestige, but because they often continue to produce milk, even without becoming pregnant again (Internet 1).

Under semi-intensive system 77.8% of females had been pregnant in 5th - 8th month post-partum and the calving interval varying between 17 to 20 months. On the other hand under traditional system and during the experimental period 44.5% of females were pregnant in the 11th – 16th month and the calving interval varying between 23 to 28 months. The ratios of pregnant vs. non-pregnant camels during experimental period in the semi-intensive and traditional were 88.9% vs 11.1% and 44.5% vs 55.5%, respectively (Sallam et al, 2016).

2-9-3-6-Pregnancy Rates

Reproductive efficiency and fertility are generally regarded to be low in dromedary camels. Although end-of-season pregnancy rates of 50–80% can be achieved with improved nutrition and reproductive management, birthing rates barely exceed 40% in traditional management systems (Tibary et al, 2005). Indeed, pregnancy rate seems to be strongly affected by the nutritional and health status of the animals and by the husbandry. reproductive management is still on the basis of natural mating, with males free in the herd, given that this still ensures a higher pregnancy rate than in herds where hand mating is practiced (Tibary et al, 2005).Thus, better identification of estrus using a behavioral test could enhance fertility rates in camels.

2-9-4. Care during Pregnancy:

Once pregnancy is confirmed the care has to be taken to avoid abortion. Pregnant camel should not be allowed to run extensively. Balanced nutrition with plenty of water is required. Feed quantity should be increased by 25% for growing fetus. Fighting in camels leads to rupture of uterus. Kicking and biting on the abdomen should be avoided as far as possible. Plenty of green and dry fodder is necessary. Generally, parturition occurs in sitting position. (Khanvilkar et al, 2009).

2-10- Production:

2-10-1. Camel Milk Production

The milk production is one of the main objectives of the camel producers (Faye 2004). Camel milk is a staple food of desert nomad tribes and is sometimes considered a meal in and of itself; a nomad can live on only camel milk for almost a month(Rise and Jocelyn,2009) Camel milk is rich in vitamins, minerals, proteins, and immunoglobulin's(Shamsia,2009) compared to cow's milk, it is lower in fat and lactose(FAO,2001) and higher in potassium, iron, and vitamin C (site of amazing fact2012) Bedouins believe the curative powers of camel milk are enhanced if the camel's diet consists of certain desert plants(Rice and Jocelyn,2009) Camel milk can readily be made into a drinkable yogurt, as well as butter or cheese, though the yields for cheese tend to be low(Rice and jocelyn,2009) –FAO, (2001).

According to the scientific literature, the milk productivity of camels in Sudan is low: between 820 and 2400 litres/ lactation for 12-18 months lactation (Faye 2004). These observations are not in accordance with the official statistics. It is known that the farming management has a high impact on the expected productivity. With intensive management (better health care, adding concentrates in the diet, vitamin and mineral supplementation), the total milk production per lactation was 2633 litres in semi-intensive system vs 1204 litres only in traditional system (Bakheit et al, 2008) i.e. on average 6.9 vs 3.1 liters per day. Faye, (2008) reported that the total production varies between 1000 and 12,000 l during an (8–18) month lactation period.

In Sudan camel, average milk production was 5-10 kg/day, less than these, reported in three herds of Western Sudan camel, the mean daily milk yield was 2.36 liters. On the other hand, camel milk yield in Butana area can reach 8 liters per day in the rainy season and good conditions, but at the end of summer the amount of milk decreases to 1.38 liters/day. There is influence

of the type of camels feed on the quantity of milk production. It can be seen that the camel herders who depend on other sources (scheme residue, irrigated crops) of feed rather than mainly on the natural pasture, their camel produce more milk than herders who depend mainly on natural pasture and forage. The mean milk yield for camels in Gadarif state was 4.5kg per day, where Gadarif state as part of Butana region. (Ayman Balla,2011).Also M.O. Eisa and A.B. Mustafa (2011) were reported milk yield of Sudan camel can reach 10 kg/day in the early lactation and good conditions and declined to 2 kg/day in the late lactation and bad conditions (in best animal) otherwise it range 5 - 10 kg / day. On average daily milk yield is from 8 to 10 liters but under intensive management conditions milk yield is from 15 to 20 liters daily. However, some specimens have been reported to yield as high as 40 Liters per day (Qureshi, 1986). Khanna et al, (1990) founded in Indian camel, milk production varied from 3.8 to 10.8 kg/day.

The means for daily milk yield of the she camels kept in the semi-intensive, traditional nomadic (Moya) and traditional nomadic (Butana) systems were 3.49±0.89, 3.30±1.12 and 2.73±0.65 L, respectively (Zubair et al, 2015). The means for the daily milk yield of the camels reared under semi-intensive system and traditional nomadic system (Moya Mountain) were significantly ($P<0.05$) higher than those reared under traditional nomadic system of Butana Zubair et al, (2015).

2-10-2. Milking Frequency:

The milking frequency in the study of (Zubair et al, 2015) was found to range between 2-3 times per day. This finding supported the finding of(Mehari et al, ,2007).The milking practices in semi-intensive and nomadic systems are presented in (Zubair et al, 2015) Camel herders in semi-intensive system practiced three times milking per day, whereas in nomadic system adopted two times milking per day. (Shuiep et al, 2014) found that the

milking practices in semi-intensive system were two times milking per day and in the nomadic system, the herders adopted two times milking per day.However, (Babiker and El Zubeir 2014) reported that camel herders in the selected farms are using hired labor for milking, which was done three times per day at intensive system and twice per day for semi-intensive system. Number of milking according to (Zubair et al, 2015) is three time in semi intensive and two times for traditional nomadic.

2-10-3- Lactation Length

The lactation length of camels in the study area depended mostly on management, feeding, and survival of the calf. The length of lactation ranged from 6 to 19 months, with an average of 12.5 months (Abdalgadir et al, 2012). Also Qureshi, (1986) reported that the lactation length of she-camel depends upon various factors and varies from 9 to 18 Months. The mainly available food item for the pastoralists is the milk of she-camel; therefore, they do not dry the animal, which results in the lengthy lactation period, even higher than 18 months. lactation length is 12 month in the most cases but factor effecting lactation length include season of the year and demand for milk by the owners for more prolonged time(Mayouf,2014). This result agrees with FAO, (2014) the average length of lactation in the camel is 12-18 months. In other study lactation period per day was 303-306 days Aboulella, (1994); Musa et al, (2006). However according to some researchers, the milk yield and lactation length of Pakistani camel averaged 1894.93 liters and 445.58 days (15 months), respectively (Baloch, 2001). Farmers reported a lactation length of 270 To 525 days (9-18 months) with a the total milk yield ranging in between 1,250 to 3,650 liters with an average of 1,800 liters per lactation (Jasra And Aujla, 1998). The authors (Raziq, 2004) have observed that the causes for different length of lactation probably are due to the breeder's control, fluctuations in vegetation, long prevailed drought in the last decade (1996-2002) and poor manage mental practices of different areas.

Musaad. et al, (2012) were founded that the overall mean values were milk yield up to 12 months, 790 l±1,970 ; lactation length, 12.5 months. Camels can provide 15-20 liters of milk per day for a lactation period of up to 18 months, making it a very good farm animal. The Camel produces in harsh and hostile conditions where other animal may not survive (A. Raziq et al, 2008). The lactation length in camels extends upto 14-16 months and the average daily milk production in indigenous Bikaneri, Jaisalmeri and Kachchhi camels is 3.220.15, 2.170.16 and 3.940.13 liters/day without any supplementary feeding (Sahani et al, 1998). In other side was 15-18month according to Dmitrez and Ernest (1989) and 567 days in study by Bekele et al, (2002)

2-11- Constraints of Camel Reproductive:

Mongi.(2004) stated that, the camel production systems in Africa face several constraints of various importance in particular:

- The insufficiency of programs and strategies for the development of the camel sector at various scales: national, regional and international.
- In dromedary, several productive and reproductive characteristics such as restricted breeding season, long gestation period, low daily body weight gain, and high calf mortality appear to be the major constraints to increase productivity of dromedary herds (Ismaïl, 1990).
- Ahmed, et al, (2015) said that, Traditional camel husbandry in Sudan has no future. The main constrains facing camel pastoral system; camels loose their base environments and desire of the herders to settlement in towns.
- Reproductive inefficiency is a major problem in many camel herds, where delayed first service, long calving interval, relatively short breeding season, and poor conception rate are major contributors (Al Eknah, 2000; Kaufmann, 2005). Likewise, herd management, nutritional and patho

logical factors could be involved (Sghiri and Driancourt, 1999; Tibary and Anouassi, 2000; Kaufmann, 2005). Nevertheless, the basic causes of the reproductive problems in a herd are not always clear. In this concern, blood profile might be a potential aid in characterizing the problem.

- In dromedary, several productive and reproductive characteristics such as restricted breeding season, long gestation period, low daily body weight gain, and high calf mortality appear to be the major constraints to increase productivity of dromedary herds (Ismaïl, 1990).
- According to FAO statistics, camel population in Sudan ranks the second in the world after Somalia. Estimated at nearly 4.7million according to ministry of Animal resources-Sudan (2011). This population is quite important while the camel production appears, at least officially, very low. With a meat production of 49,880 tons and a milk production of 120,000 tons, camel production is far away from the potential. Even if these data did not cover the entire reality, it is obvious that camel production in Sudan is insufficiently valorized. Meat from young camels has been reported to be comparable in taste and texture to beef. Inspite of the increase in local camel meat consumption to 63,000 tons in 2009, yet camel meat is common in some parts of the country and milk consumption under *gariss* form is popular in rural areas where camel is generally reared.
- Camel diseases are the major constrains of production such as trypanosomiasis and mastitis. The modernization of meat and milk processing could be the motor for the improvement of camel production. Both in terms of research and of development, the identification of the main constraints for the camel sector is the way to propose a fruitful strategy (Faye et al, 2011**).**

- On the other hand, it was found that herds also contained a number of older females that had never produced a living calf, or had given birth only once. Such animals are kept on, not out of a desire for large herds or for reasons of prestige, but because they often continue to produce milk, even without becoming pregnant again.(Internet 1)
- Also Dromedary being a seasonal breeder with a long gestation period and reaching to puberty at a very late stage, is likely to produce a few offspring during its breeding life.(Manzoor A.& et al, 2005)
- Short breeding season is an important factor for the low reproductive performance of dromedary camel. It remains as a major obstacle to the growth of population of dromedaries (Marai et al, 2009).
- When energy supply is insufficient, the mammary gland receives nutritional priority over the reproductive system due to an inverse relationship between production level and reproduction function (Nebel et al, 1993). As well Ayman, (2011) reported that, the constraints of camel production in Gadarif State are:

(1) Shortage in water

From information collected from water Corporation of Gedarif state, the amount of coverage of drinking water to the animal population in the state is about 50%, which means that a lot of efforts and funds must be spent to increase the drinking water coverage for livestock in the state.

(2) High taxes

There are many complains among the camel herders and owners from high market taxes and other local governmental taxes (district) ,consequently this may lead the camel owners and herders to abandon the commercial activity concerning camel business to other types of activities for their living.

(3) Shortage in pasture and fodder

The main sources of live stock fodder in the area is grazing and browse provided by natural vegetation but because the natural pasture in this area is

increasingly diminishing by the expansion of mechanized agriculture farming, the camel herders and owners become increasingly dependent on crop residues. The camel owners and herders are becoming increasingly unsatisfied by this situation because of the high price of crops residues imposed by the farmers and the competition among the three system of camel production.

(4) The losses due to theft of animal

Theft of camels occurs during the wet season when a lot of ethnic group are found in one area.

(5) Disease control

The Ministry of animals' resources and fishers (Gedarif State) is responsible body for livestock disease control. The Ministry mainly targets its health services towards cattle, sheep and poultry while little services are targeted towards camels. The main camel diseases in the Gadarif State are mange (29.3%) and Trypanosomiasis (23.3%). Mainly the camel herders practice traditional treatment for most disease (firing) and rarely take their sick camels for proper veterinary treatment to the major veterinary hospital in the towns.

(6) Low level of education among camel's herders and owners

There is a high percent of family members who are IIIiterate because they did not find a chance for education. Illiteracy among the herd's owners and their families reached as high as 69.78 %. This indicates the need for appropriate systems for education to suit the camel herders and improve their life standard.

(7) Capital of investment

Other constraints to camel production in Butana region included lack of enough capital for investment, labour problem and marketing shortages. These constraints may indicate that changes from subsistence to commercialization were already well advanced in the area. Thus, it would be

expectable that labour and capital constraints would assume more significance in the future, if the more pressing problems of pasture, veterinary services, security water shortages received proper attention.(Aiman, 2011)

2-12- Calves Management

According to Farah et al, (2004) calf management is considered important by herders and it given considerable attention. It is begins from the parturition process especially in Dystocia cases followed by the first suckling which taking place between one to three hours post calving. In addition to several management processes such as sufficient milk supply, provision of water during the dry season, provision of good pasture and tick control are important calf care measures. However, Schwartz and Dioli (1992) observed that the majority of the herders did not allow their calves to access initial colostrums, but instead milked it out. This arises from a common belief that colostrums will result in ill-health to newborn calves. According to Yagil (1994), the above mentioned belief is probably due to the normal powerful laxative effect of colostrums. It is highly possible that the high calf mortality usually reported could be attributed to this practice of denying the calves' access to colostrums.

2-12-1- Calves weaning:

According to Farah et al,(2004) weaning of calves is at age of 8-18 months, 1-1.5 years (Ahmed et al, 2012), depending on the browse situation, the milk production of the dam, and the growth of the calf and future use of the calf (sale or slaughter). Farah et al, (2004) mentioned that several different systems of weaning are practiced by Somalia herders, of which the most famous are: tying the dam’s teats with a softened bark. This practice is common in Sudan called (sorar) used to prevent calves from suckling at pasture during the day by tying up one or more teat with special strings using tape of goats or cows leather with narrow and small part of wood (Eisa and

Mustafa, 2011) Jasara and Isani (2000) reported that the majority of pastoralists mentioned that the weaning period is one year. After complete weaning, the selection of future sires is made, and the rejected males at this age are castrated, sold or slaughtered (Farah et al, 2004). Although the lactation period of the female camel may last up to 2 years, the suckling young are generally weaned much earlier, at any time between 3 and 18 months under traditional pastoral systems, the average being 12 months (Mukasa-Mugerwa, 1981). The Weaning age of camel calf in Babilie district found to be 8.4 and 8.3 months for male and female respectively, whereas, in Kebribeyah it found to be 9.1 months irrespective of the sex of the calf. This finding is in agreement with Ali Hussein (1989) in that weaning is at 8-18 months, depending on the browse situation, the milk production of the dam, and the growth of the calf. Whereas, much lower than those of Abdussamad et.al. (2011), Benaissa et al,(2012) in that dromedary calf was weaned between 12 and 16 months with a mean of 12.4 months. Benaissa et al, (2012) reported that the average weaning age of camel calves in the area is more than 1 year.Ayman et al, (2014) found majority of calves (84%) weand for more than 10 months among all regions of nomadic in Sudan.

2-12-2- Calves Mortality in Camel

Recent outbreak with high mortality rate was observed in Sudan and attributed to emerging diseases (like PPR), this new disease is mainly viral origin have to be controlled with caution and there is a strong necessity to achieve epidemiology survey and to have clear diagnosis (Khalafalla et al, 2010). The multi-factorial diseases (calf diarrhea, respiratory diseases, reproduction diseases, infertility) are not properly studied because yet mainly based on the research of pathogenic agents (Ali et al, 2005; Yagoub,2005) Faye et al, (1995) reported that the mortality rate was high before one month of age. Symptoms were weakness, slow death and ataxia. Autopsy showed

ascite, atrophy of myocardium and discoloration of the heart. Selenium deficiency was suspected in many cases, but was not measured. On the whole, the mortality rate before 1 year was 42%. A total of 90% of mortalities occurred within 30 days after birth. A relationship was observed between the young camels' mortality and the ceruloplasmin level in the animals fed the mixed diet (concentrate + trace-elements) the odds ratio was high (5.47) but the confidence interval remained wide (1.20-26.50), even if nil risk was excluded.The diseases reported in that study were those defined by the farmers themselves. There was no precise diagnosis. However, emaciation, acidosis, titubation and diarrhoea were the most frequent disorders, and most of them could be linked to metabolic disorders. Adam et al, (2011) have found through their study high mortality rate among young calves (76.5 %) compared to adult camels (18.9 %) and other losses (4.5 %) from 2001 to 2003, this goes in accord with Wilson, (1984) who mentioned 50 % mortality rate is at one year of age. This result also agreed with Khanna et al, (1990who found in Indian camel high mortality risk age group was from birth to 3 months of age and period from May through July as high mortality risk months. Also Mehta et al, (2012) reported The mortality was maximum in adults above 3 years of age (0.20) followed by 0-1 year (0.19) and 1-3 years age group (0.09). Of the total camels died, 38.4% died in the first year of their life followed by 13.8% in 2^{nd} Year, 5.5, 5.5 and 5.2%, respectively in the 3^{rd} to 5^{th} year. Of the camels that succumb to death in the first year, 49.5% died in the first month of their life followed by 15.3% in the 2^{nd} month, 11.7% in the 3rd month. The major threats during first year of life were identified as pneumonia, heat stroke and enteritis. The mortality due to different systems differed significantly (X^2 =318.35, $P<0.01$). Maximum mortality (41.39%) was due to the involvement of digestive system followed by respiratory system (22.36%). The average annual herd growth was 8.53%. The standard death rate in the four genotypes viz. Bikaneri, Jaisalmeri,

Kachchhi and Arab-cross was 4.80, 3.01, 3.63 and 10.49%, respectively. Scientifically planned breeding and improved health management could improve the situation and increase productivity. Bissa et al, (2004) reported that the postnatal losses in camel are more frequent than in other domesticated livestock species. In literature, calf losses have been noted in the range of 20-40%. That study was undertaken to study the post calving losses of female calves from birth to age at first calving at different ages. The female calf mortality from birth to age at first calving (AFC) at different ages 0 to 3 month, 3 months to 1 year, 1 to 2 years, 2 to 3 years and 3 years to AFC were 8.6, 3.3, 5.3, 4.7 and 5%. Total mortality was 21.89% before they reached the age at first calving. Period of birth have significant effect on mortality in 3 months to 1 year and 1 to 2 year-age group. Month of birth had significant effect on mortality at 0 to 3 months and 2 to 3 years. The culling of female calves from birth to AFC at different ages 0 to 3 month, 3 months to 1 year, 1 to 2 years, 2 to 3 years and 3 years to AFC were observed as 0.18, 7.2, 11.9, 12.4 and 14.7% respectively. About 33% of the female calves born were culled due to different reasons as congenital defects, deformities, poor growth rate or late maturity etc., before they reached the breeding herd. Period of birth significantly affects culling in 3 months to 1 year, 1 to 2 years and 2 to 3 years age group. The month of birth had highly significant effect only upon culling in 1 to 2 year age group.

Deaths and losses of newborn and calves up to one month were six fold compared to the grown up camels with 3% of losses (Farah et al, 2007). Management practices, as well as disease, emerge clearly as a crucial factor in the high calf mortality rate of 30 - 60 %, and doubtless also affect embryonic and foet al, losses as well as other aspects of fertility (Mukasa-Mugerwa, 1981). The death rate of Babilie district camel calves for the last five years (1993 - 1997) found to be between 6.9 (Year 1995) to 18.9 (Year 1994), whereas in the same time interval camel calves death rate for

Kebribeyah found to be between 22.4 (Year 1993) to 56.8 (Year 1994). Out of the calf death registered in the year 2004/05, 28.6% in Babilie district and 89.4% in Kebribeyah district was due to disease. This implies that disease is more important cause of calf death in Kebribeyah than in Babilie district. The main reasons for the high postnatal mortality found to be poor management practice and diseases. The newborn calf has no natural protection against diseases, as there is no antibody transfer from the mother during fet al, development. The calf can obtain immediate immunization soon after birth only through the colostrum, which has a very high concentration of antibodies. Therefore, it is vital for the calf to suckle as soon and as much as possible (Kamber et al, 2001). In traditional production systems, post-weaning mortality tends to be lower than mortality before weaning (Traore and Wilson, 1988). For camels, the mortality rates for young stock range between 20 and 50% (Wilson, 1986a). During drought, young-stock losses are likely to be much higher.

2-12-1-1- The Reasons of Calf mortality in Camels

The factors which commonly cause death after weaning are disease and malnutrition. The age of the animal also affects post-weaning mortality rates, such that the risk of death initially declines and increases again towards the end of the animal's life. In some parts of Africa, predators can also cause significant losses. Young-stock losses before weaning are influenced by: season of birth which has an effect on the quality and quantity of feed (milk and forage) available, the incidence of disease and the level of parasite infestation, sex of the offspring, age of the offspring (the ability to survive up to weaning time increases with increasing age) parity, which affects the dam's mothering ability and milk production, and management, which affects disease prevalence and season of birth (Meriem et al, 2016). Tuteja et al, (2012) reported; Since calf could not get colostrums, so the camel milk feeding through nipple bottle was started on day first, as a usual practice

adopted for such calves on the farm. On the 3rd day calf stopped feeding and suffered with respiratory insufficiency with deep laboured respirations along with abdominal movements and fever of 103°F. The calf was treated with antibiotics, but the calf died on 6th day. Also this Agreed with Mehta et al, (2003) in their report: The mortality was significantly ($P<0.05$) higher in males (13.10%) than females (9.51%). Highly significant effect ($P<0.01$) of age group on mortality was observed, Maximum mortality (48.78%) was due to the involvement of digestive system. Respiratory system was involved in 17.56% cases. The nervous system was involved in 4.88% cases whereas the cardiovascular, urinary and genital system were involved in 4.39, 0.44 and 0.44% cases, Deaths in 23.41 % cases were due to poisoning, euthanisation due to fracture of long bones/incurable disease, pica etc. Improved management practices, cost effective management of long bone fractures and supplementary feeding can be of great use in reducing the mortality in young and adult camels.

Bhakat and Sahani.(2001). Founded among the different camel health disorders, parasitic mange case was highest. It was followed by Trypanosomiasis, general fever, respiratory infection, other problems like digestive disorders, worm etc. The mortality in camel calf (<1 year age) and adult were 33.05±2.63% and 8.10±1.070%, respectively.

2-13- Embryonic Losses & Abortion in Camel

An early pregnancy loss is probably one of the most important factors resulting in the reduction of reproductive efficiency in camels. At present, there is no practical way to reduce embryonic loss in camels, however, recognizing the occurrence and incidence of embryonic loss may be instrumental in application of new reproductive technologies to increase service rate in a herd (Skidmore, 2000; Vyas et al, 2002). Abortion can occur in pregnant animals, particularly during mid pregnancy (Bakhat et al, 2003).

Pratap et al, (2012) reported in their study; embryonic death in camelidae may be attributed to genetic factors, corpus luteum insufficiency or hostile uterine environment, however, no single factor can be manipulated to improve embryo viability. Early pregnancy loss between day 20 to 90, post breeding in group I (5.7%) was non-significantly lower than group II (16.9%). The pregnancy loss during embryonic stage and early fet al, stage was 10.8 % (7/65) and 6.9% (4/58) in group II whereas in group I no early fet al, loss had occurred. In a clinical survey study, high rate of embryonic death up to 35% was reported in dromedary camels (Tibary and Anouassi, 1997). Research investigation on control of skin diseases, abortions and mastitis are some other health problems, which need immediate attention and surveys in the areas will be conducted to know the prevalence and traditional practices followed by the farmers and based on the information available the scientific validation will be under taken for ethno veterinary products and practices in general and as per need the treatment and diagnosis support services will be offered (NRCC.2011). The incidence of early embryonic death seems to be high in the camel. Babiker (2011) reported that all the aborted cases occurred during the last trimester of pregnancy. The laboratory examinations of all specimens(blood, tissues and aborted fetus) did not indicate the cause of abortion Accordingly, it is possible to say that Feeding of the pregnant camel's large quantities of green fodder(alfalfa and fescuc) during the last trimester of pregnancy may be responsible for abortion in camels He also reported that alfalfa had played a role in the abortion outbreak, due to fact that estrogen from alfalfa will summate with endogenous estrogen in the last trimester of the pregnant camels; it is possible that the net concentration of estrogen would correlate with possible high level of prostaglandin F2a. This miglt be a factor in the abortion. Abortion in camels was reported to be associated with various pathological conditions such as brucellosis, trypanosomiasis, toxoplasmosis, campylo

bacteriosis and salmonellosis. Other les causes or abortions in camels include overworked twining, hemorrhagic disease, camel pox, endotoxin, excitement, malnutrition medication and over exertion. Ayman et al, (2014) reported in their research Greater number (80%) conformed that 1-5% of abortion in camel herd was occurred yearly in Butana region.

2-13-1-The reasons of embryonic losses during the pregnancy

2-13-1-1-Embryonic losses in Slaughterhouse:

Besides milk, meat is one of the most important products of the camel. It is good in yield and quality of the carcasses. But camels are still not bred for meat production in many regions as camels are considered less valuable. For this reason, usually males and infertile female camels are sold as slaughter animals by pastoralists. Nevertheless, the sale of these camels for meat production can present an important source of income. (Farah and Fischer, 2004). Death of the embryo or fetus in early gestation (reasons not yet known) and occasional outbreaks of abortion contribute further to overall mortality, poor real reproductive performance and slow herd expansion rates. (Bakhat et al, ; 2003).

2-14- Hormonal Assay:

The hormonal mechanisms that contribute to the development of such structures, and the reasons why they occur in only a proportion of camels, have not yet elucidated although one study suggests that E2 and P4 concentrations were greater or tended to be greater in animals with ovarian cysts than in the control group. According to that study, animals having ovarian cysts with thin walls and homogenous contents (type1) had greater serum E2 and P4 concentrations than those having thick walls and non-homogenous contents (type 2), suggesting that type 1 cysts were still endocrineologically active. In cattle, dominant follicles in growing and early

plateau stage of the cycle contained high levels of E2 and P4 concentrations, and most of them on Estradiol dominant (E2 >P4) (Ali et al, 2001).

2-14-1- Progesterone Measurement

Progesterone hormone level in females is a very useful tool to monitor pregnancy in camels (Alfuraiji, 1998). The primary source of progesterone in the female camel is the corpus luteum (CL). The placenta does not contribute to progesterone secretion, and all camelids depend entirely on progesterone from the CL to maintain their pregnancy (Skidmore, 2005). Camels are induced ovulators and exhibit follicular cycles with follicles developing and regressing successively. Plasma progesterone level remains very low throughout the follicular wave in the absence of mating and ovulation (Ismail et al, 1998). Progesterone concentration starts to rise after mating and during pregnancy and falls just before parturition. Outside the breeding season, mating activity ceases and the ovaries are inactive or only have a few small follicles (Zeidan, 2011). Babiker et al, (2011) were found in their Research the highest progesterone level (13.75 ng/ml) was recorded during July which was the last month of pregnancy, while the lowest value (0.19 ng /ml) was recorded after parturition at August. The level remained low throughout September, October, November, December, January and February. Progesterone hormone concentration started to rise again at March (6.46 ng/ml) and remained high during April, May and June. Also Ghoneim et al, (2013) shown in their research's the Concentrations (mean ± SEM) of P4 in serum of camels bearing either oversized follicles or pre ovulatory follicles were 0.53 ± 0.05 and 0.42 ± 0.05 ng/ml respectively.

A plasma progesterone concentration in camels remains constantly low _Homeida et al, (1988). Following mating, at least one corpus luteum is formed, secreting a significant amount of progesterone. M.M. Al

Eknah,(2000) found a value of more than 2ng/ml was recorded during pregnancy. Although both ovaries equally produced ova, pregnancy occurred only in the left uterine horn. Embryos resulting from fertilized ova in the right horn must have migrated to the left horn for unknown reasons (M.M. Al Eknah,(2000).

Serum P4 concentration was significantly higher in female camels with vaginal adhesions than in other groups (P = 0.0001). There was a tendency for the serum P4 concentration to be greater in the group with vaginal adhesions and intra-uterine fluid accumulation than in those with vaginal adhesions but without fluid accumulation (15±2.7 ng ml−1 vs 10.4±2.1 ng ml−1, P = 0.2). At the same time, female camels with ovarian cyst type1 had greater serum P4 concentration than those with ovarian cyst type2 (17.4±1.7 ng ml−1 vs 2.7±2.2 ng ml−1, P = 0.0001). .(A. Ali et al, 2009)

Parturition is a continuous process in camels, which could be elicited by hormonal changes. It appears that expulsion of the foetus in the camel is preceded by the attainment of a minimum level of plasma progesterone and high levels of estrogen (Elias et al, 1984; Al-Bisher, 1998).

Babiker et al, (2011) Found that the Plasma progesterone level was high during July, while it dropped at parturition during August. The level of progesterone remained low during the period from September to February, before it started to rise again in March and remained high until the end of the study in June. The rise of progesterone level in females coincided with the rise of testosterone in males. Ovarian activity was observed throughout the different seasons with a maximum activity during autumn. According to the hormonal findings and ovarian activity, there is a clear breeding season in Arabian dromedary camel in the Butana area, northeast of Sudan extending throughout summer (March – June) and autumn (July–October)

Ahmed, et al, (2015) reported that, the level of progesterone hormone levels increased from the 9th month post-partum till it reached the peak in 13th and 14th months postpartum before started to decrease gradually. That study indicated that more than 75.2% of the camels reared under intensive and 80.8 % semi-intensive systems became pregnant early; however only 45.3% were pregnant late in the traditional system. She-camels start to be pregnant at the 8th month postpartum that means the supplementation stimulated the ovarian activities. In accordance to these results, farming system had a clear effect on the progesterone hormone concentration in camel. This may be attributed to pregnancy which took place earlier and that occurred in high percentage in she-camels reared in intensive and in semi-intensive systems. Agarwal et al, (1987) reported the mean progesterone levels fluctuated between 4 and 5 ng/ml throughout pregnancy except for a slightly lower value (2.5 ± 0.27) at 9 to 10 month of gestation. On an average, the camels carrying a male fetus had higher progesterone levels (5.13 ± 0.69 ng/ml) then those carrying e female fetus (3.45 ± 0.20). The data suggested that the steroid hormone levels are influenced by the stage and sex of the fetus. Cases of abortion and unsuccessful conception could be identified. On the other hand Zia et al, (2007) found in their research on male camel that the serum levels of P4 during the rutting and non-rutting period were 203.19±14.87 pg/ml and 150.75±10.12pg/ml respectively. Caldwell et al, (2001) have reported that testosterone increases the specific progesterone binding in the specific area of the brain in rats, which plays a vital role in sexual activities. In pregnant females progesterone concentration increased significantly ($P<0.05$) during early months of pregnancy to a value above 2 ng/ml blood. During pregnancy the value is increased to an average value of 5.8 ±1.45 ng/ml blood over a period of 8 months followed by a strong decrease during the last two months before calving (Bakheit et al, 2012). Ahmed et al, (2016)

reported P4 concentration in serum camel was 0.65±0.33ng/ml. Ali et al, (2009) reported P4 level in serum of camel was 1.7± 0.2pg/ml.

Progesterone measurement of camel Progesterone levels during pregnancy in all species of Camelids remains above 2ng/ml from initial detection with Corpus Luteum formation until shortly before Parturition, (Sumar, 1988). Hegazy et al, (2004) revealed that the progesterone level in non-pregnant female camel was between 0.0 and 4.7ng/ml with a mean value of 1.1ng/ml. Agarwal et a: 1991) found that the level of progesterone hormone in non-pregnant female camel varied between 0.28 and 1.73 ng/ml, on other hand Hassan et al,: (1996) mentioned during pregnancy, the progesterone level fluctuated between 2 and 5 ng/ml. Zhao, (1995) demonstrated that the Progesterone levels ranged between 1.01ng/ml and 6.34 ng/ml on day on post parturition, and gradually decreased to reach undetectable level after 12 days. Vyas et al, (2004) studied the serum progesterone concentration on female camel after mating and they found that the progesterone level is lower than 0.5 ng/ml(≤ 0.5 ng/ml) before joining and varying between(1.0 7.5 ng/ml), (2,0 10.5 ng/ml) and G.0 17.0 ng/ml) on 7, 20 and 40 days after mating respectively.

In some studies it was shown that the Progesterone profile on female camel during the first month after mating, the levels is a considerable individuals variation and range from 3.0 ng ml to 9.0 ng/ml (Agarwal and Khanna, 1990; Elias et al,: 1984 and Agarwal, et al, 1987. In India, Vyas et al, (1999) revealed that the progesterone level in serum of non-pregnant female camel was ranging between 0.21ng/ml and 0.58ng/ml at 45 days after mating: On the other hand progesterone level on the pregnant female was varying between 3.0ng/ml and 9.85ng/ml. Skidmore et al, (1995) demonstrated that the progesterone levels during the first 90 to 100 days were relatively constant between 3.0ng/ml and 5.0 ng/ml, and then decreased

significantly to stabilizer for the rest of the Pregnancy at 2.0 ng/ml to 4.0 ng/ml. Agarwal et al, (1991) postulated that the progesterone levels in the dromedary decrease gradually from 5 months of gestation until parturition. The mean of progesterone concentration was slightly higher during early pregnancy and fluctuated between 4.0 ng ml and 5.5ng/ml throughout gestation with the exception of a mild decrease between the ninth and tenth months of pregnancy.

In pregnant females Progesterone concentration increased significantly during early months. The range of Progesterone concentration varied between 1.10 – 5.76 ng/ml and 0.67 – 2.53 ng/ml in semi-intensive and traditional system, respectively (Sallam et al, 2016). Agarwal et al, (1991) reported that the Progesterone hormone level in pregnant she-camel was decline during the 4th -7th month of gestation. Skidmore et al, (1996) demonstrated that the progesterone levels during the first 90 to 100 days were relatively constant between 3.0ng/ml and 5.0ng/ml, and then decreased significantly to stabilizer for the rest of the pregnancy at 2.0ng/ml to 4.0ng/ml. Serum progesterone concentrations in the pregnant camel (0.19 to 1.43ng/ml) were 4 to 16 times higher than in the non mated camels (0.05 to 0.09ng/ml). After calving, a decrease of serum progesterone occurred during the first 6 day and was accompanied by a dramatic decrease in the weight of the corpus luteum. During the subsequent 2weeks, serum progesterone concentrations dropped close to the values reported for non pregnant camels (Ismail, 1987). The highest progesterone level (13.75ng/ml) was recorded during July which was the last month of pregnancy, while the lowest value (0.19ng/ml) was recorded after parturition at August (Babiker et al, 2011). Progesterone was found to be high during pregnancy and fall just after expulsion of the foetus (Alfuraiji, 1998; Skidmore, 2005). The primary source of progesterone in the female camel is the corpus luteum. Since the

camel is an induced ovulator, which ovulates only in response to mating stimuli, level of progesterone remains low in the absence of mating and ovulation (Ayoub et al, 2003; Skidmore, 2005; Ghazi, 2007).

In pregnant camels the progesterone levels increased progressively after 2 months of gestation. A slight decline at 3 months preceded the peak at 5 months (7.96 ± 3.21 ng/ml) whereupon the levels gradually declined to 1.30 ± 0.16 and 1.16 ± 0.02 ng/ml, 10 and 1 days prior to parturition, respectively. On the day of parturition the progesterone level was 0.29 ± 0.12 ng/ml and remained low (0.15 ng/ml) during the postpartum period (Elias et al, 1984)

The progesterone concentrations attained a higher value (3.83 ± 0.08 ng/ml) in the semi-intensive system as compared with the traditional system (1.46 ± 0.82ng/ml). The range of the progesterone hormone concentrations varied between 1.10 – 5.76 ng/ml and 0.67 – 2.53 ng/ml in semi-intensive and traditional system, respectively. The level of the progesterone hormone in the semi-intensive system increased significantly ($P<0.05$) on the 5th month postpartum till reach the peak on the 14th month postpartum after that decreased gradually during the remaining experimental period. The levels of Progesterone hormone in camels reared under semi-intensive system were showed non-significant difference on eight months postpartum, but the trend of the progesterone level showed significant increasing during the next month's till reach the peak and still constant during the 13th and 14th months postpartum before start to decrease gradually. On the contrast, the progesterone concentrations in the traditional system showed non-significant difference during 11th months postpartum, but there were obvious increasing start at the 12th month postpartum. The Progesterone levels within the pregnant she-camel are varying between 2.2ng/ml and 7.6 ng/ml decline during the last 4 months before parturition, (Sallam et al, 2016) his results are in agreement with the findings of Agarwal et al, (1991) who postulated that the progesterone levels in the dromedary decrease gradually from 5

months of gestation until parturition. The mean of Progesterone concentrations was slightly higher during early pregnancy and fluctuated between 4.0ng/ml and 5.5ng/ml throughout gestation with the exception of an easygoing decrease between the ninth and tenth months of pregnancy. The Progesterone levels in camels under traditional system and non-pregnant females recorded values varying between 0.4ng/ml and 1.8ng/ml. These results are in line with the findings of Vyas et al, (1999) who mentioned that the Progesterone levels in non-pregnant female camels was ranged between 0.21 ng/ml and 0.58 ng/ml at 45 days after mating, elsewhere Progesterone levels on the pregnant female varying between 3.0 ng/ml and 9.85 ng/ml. Those results are in line with the findings of many authors (Agarwal and Khanna, 1990; Elias et al, 1984; Agarwal et al, 1987) who mentioned that the Progesterone profile in female camel during the first month after mating show a considerable individual variation and ranged from 3.0 ng/ml to 9.0 g/ml. That was in agreement with the results of Hegazy et al,(2004) who revealed that the Progesterone levels in non-pregnant female camels was between 0.0 and 4.7 ng/ml with a mean value of 1.1 ng/ml. The levels of the Progesterone in the pregnant camels on this study were on line with findings of Skidmore et al, (1996); Karimi and Kimenye (1993) who demonstrated that the Progesterone levels during the first 90 to 100 days were relatively constant between 3.0 ng/ml and 5.0 ng/ml, and then decreased significantly for the rest of the pregnancy at 2.0 ng/ml to 4.0 ng/ml. Findings of this study showed that the pregnant camels' percentages were 88.9% and 33.3% in semi-intensive and traditional system, respectively.

2-14-2- Estrogen Measurement

Estrogens are continuously secreted during pregnancy in the camel. (Agarwal et al, 1987). At mid-gestation, estrogen concentrations rise, suggesting continued follicular development during pregnancy (El-Wishy et

al, 1981; Wilson, 1984). High concentrations of estrogens in the allantoic fluid on the day of parturition have also been demonstrated in the camel, suggesting that the placenta could be a probable source of estrogens (Elias et al, 1984).

The high levels of E_2 in camels during Months l0- 12 of pregnancy reported in Elias et al, (1984) study are in agreement with the substantial increase in the weight of the fetus between 9 and 12.5 months of pregnancy and the dramatic increase in the volume of fet al, fluids observed by others (Elwishy et al, 1981). The rapid rise in serum E2 concentration observed during the third trimester of pregnancy probably originates from the placenta as it does in the cow (Edqvist et al, 1972). This suggestion is supported by Elias et al, (1984) observation that the Estradiol level in the allantoic fluid on the day of parturition is extremely high (2411±390 pg/ml, n = 4). The time when the E2 level begins to increase in the blood of pregnant animals varies among the species. The camel in this respect resembles the cow and the mare whose estrogen levels begin to rise 30 and 45 days, respectively, before parturition (Edqvist et al, 1973; Love11 et al, 1975). In the pregnant mare the level of E2 rises to a peak at Day 210 or 240 and gradually declines until parturition (Nett et al, 1975) which is similar to the findings in pregnant camels reported in the Elias et al, (1984) work. The increase in the level of E2occurring during the third trimester of pregnancy coincides with the gradual decrease in the level of progesterone. In pregnant camels serum levels of E2 are variable, sometimes similar to the E2 concentration in the first day of the estrus. In the last 2 months of pregnancy, the levels of E2are consistently higher than those observed during estrus or the non-breeding season and probably originate from the fet al,-placental unit (Elias et al, 1984). Serum estrogen and progesterone were measured in pregnant and non pregnant camels. In non pregnant camels, serum estrogen concentrations were found to be higher in, multiparous (154.1 + 69.3 pg/ml) than in

nulliparous camels (70.8 + 44.2 pg/ml) In pregnant camels, serum estrogen concentrations are higher during the last trimester (after the seventh month) of gestation. There was a clear increase in serum estrogen concentration at 15 to 21 day post partum. This increase could be a signal to stimulate pituitary luteinizing hormone synthesis and subsequent resumption of ovarian activity after calving (Ismail, 1987).

. Blood constituents in female camels affected with different forms of reproductive disorders. Serum E2 concentration tended to be greater in female camels with vaginal adhesions and ovarian cysts than for other groups (P = 0.08). Those with vaginal adhesions and intra-uterine fluid accumulation had greater serum E2 concentration than for those with vaginal adhesions without intra-uterine fluid accumulation (207±72 pg ml−1 vs 52.5±23 pg ml−1, P = 0.02). At the same time, female camels with ovarian cyst type1 had greater serum E2 concentration than for those with ovarian cyst type2 (62.7±26 pg ml−1 vs 31.4±7pgml−1, P = 0.001). (Ali et al, 2009). Ghoneim et al, (2013) reported that the Estradiol-17b (E2; pg/mL) and progesterone (P4; ng/ml) in blood serum and follicular fluids were analyzed using EIA kits (Cayman Chemical Company, Ann Arbor, MI, USA). The intra- and interassay CVs were 5.3% and 4.7%, and 4.9% and 2.5%, for E2 and P4, respectively. Concentrations (mean ± SEM) of E2 in serum of camels bearing either oversized follicles or pre ovulators follicles were 186.60 ± 32.53 and 164.10 ± 33.39pg/ml respectively. On the other hand Zia et al, (2007) reported in their research on male camel that the serum levels of E2 during the rutting and non-rutting period were 15.79±1.29 pg/ml and 13.2±1.58pg/ml respectively. Agarwal et al, (1987) reported that the mean estradiol levels increased progressively from a basal level of 20pg/ml at 2 to 3 month of pregnancy to about 450 at the final stages of gestation. The camel bearing a male fetus had relatively lower estradiol concentration (76. 5 ±10.8

pg/ml) as compared to those carrying a female fetus (112.3± 19.6 pg/ml). During the estrous cycle of the camel the concentration of estradiol (E2) varies between 9 and 110 pg/ml. In early estrus, the peak level of E2 (74.7 ± 6.61 pg/ml, n = 11) is maintained for 2.9 ± 1.83 days. In the 10th month of pregnancy the level of E2 rises abruptly to 338.3 ± 162.42 pg/ml and continues to rise until the 12th month, peaking at 606 ± 120.27 pg/ml. The hormone concentration then drops until the day of parturition (mean 113.4 ± 26.51 pg/ml). The level of E2 during the non breeding season (May–November) is low (6–48 pg/ml) (Elias et al, 1984). Ahmed et al, (2016) reported E2 concentration in serum camel was 1793±1295.1pg/ml. The concentration of Estradiol (E2) in the 10th month of pregnancy the level of E2 raised to338.3 ± 162.42pg/ml and continues to rise until the 12th month, peaking at 606 ± 120.27 pg/ml. The hormone concentration then drops until the day of parturition (mean 113.4 ± 26.51 pg/ml). The level of E2 during the non breeding season (May–November) is low (6–48 pg/ml) (Elias et al, 1984). Ali et al, (2009) reported E2 level in serum of camel was 12.4±34 pg ml−1.

2-14-3- Tri-iodothyronin (T3) and Thyroxin (T4):

The thyroid is an endocrine gland of a unique feature characterized by its ability to concentrate large amount of iodine for the synthesis of thyroxin from Triiodothyronine (Banks, 1993). Thyroid hormones are crucial for development of the fet al, brain, as well as for many other aspects of pregnancy and fet al, growth. Thyroxin is essential for proper body metabolism and it plays significant role in the development and differentiation of all body cells (Choksi et al, 2003). So far, numerous morphological variations of this gland are still undiscovered. Moreover, compared to studies on other domestic animals such as cattle, sheep, and goats, literature is scanty on the physiological and hormonal changes during pregnancy in camel. Camels have a long gestation period (~ 13 months) and

it is anticipated that energy requirements surge promptly during pregnancy. This might impact the levels of some biochemical indices (Yousef et al, 2015). Thyroid hormones, including T3 and T4, are mainly associated with general body metabolism. The gradual increase in their level may be associated with the increasing energy balance later in the postpartum period toward the first postpartum estrus. However, the T4:T3 ratio was higher in the rutting than the non-rutting camels. Perhaps serum T4:T3 ratio is more important than the level of individual hormone from reproductive and fertility point of view (Zia-ur-Rahman et al, 2007).

Thyroid hormones increase metabolism in almost all cells of the body. If carbohydrates and fats are insufficient for energy, thyroid hormones cause a rapid degradation of proteins for energy. If, however, adequate substrates for energy are available, thyroid hormones can enhance the rate of protein synthesis (Hyyppa 2005)

The mean levels of thyroid hormones (T3and T4) were lower in pregnant than those of non-pregnant camels it were 14.8±2.4and 17.9±1. 9(µg/dl) for T4 and 1.8±0.5 1.9±0.5 T3 (ng/dl) for T3 respectively, (Yousef et al, 2015) and they said; these results indicate the stability of body and/or energy metabolism in camels regardless of reproductive status, as thyroid hormones are known as important modulators of general metabolism in which carbohydrates and lipids are the major constituents. These findings in accordance with former studies demonstrated insignificance of pregnancy effect on thyroid hormones levels in one humped (Omidi et al, 2014a) and two humped camels (Omidi et al, 2014b). Also, Agarwal et al, (1989) indicated that T4 and T3 levels were not affected by failure of conception or by abortion. In general, serum levels of thyroid hormones in camels are mainly affected by general body metabolism, season and water availability (Nazifi et al, 2009). Triiodothyronin (T3) and total thyroxin (T4) concentrations (ng/ml) were analyzed using EIA kits obtained from

BioCheck (Foster city, CA, USA). The intra- and interassay CVs were 4.1% and 2.3%, and 5.1% and 3.1%, for T3 and T4, respectively. Also Concentrations (mean ± SEM) of Triiodothyronine (ng /ml) were 1.56± 0.19 and 1.40 ± 0.21, Thyroxin (µg/ml) 12.35 ± 0.66 and 12.74± 0.77 in serum of camels bearing either oversized follicles or pre ovulatory follicles. (Ghoneim et al, 2013). Zia et al, (2007) reported in their research in male camel that the serum levels of T3 and T4 during the rutting period were o.45±0.08 ng/ml and 84.13±7.55ng/ml and the non-rutting periods 2.06±0.48ng/ml and 116.75±9.85ng/ml respectively. Thyroid hormones, including T3 and T4, are mainly associated with general body metabolism. Low levels of these hormones in rutting camels may be due to the fact that males spend most of their time during this period in sexual activity and seeking out females. Those results decreased feed intake and low body metabolism. Perhaps serum T4:T3 ratio is more important than the level of individual hormone from reproductive and fertility point of view. Yagil et al, (1978) reported that in one humped camel, thyroid metabolism was higher in summer than in the winter. Nazifi et al, (1999) also recorded higher serum T3 and T4 concentrations in the summer than the winter in dromedary camels. According to Abdel-Magied et al, (2000), in summer most of follicles in the thyroid gland were large and lined by very low cuboidal follicular cells. Agarwal et al, (1989) reported that the mean T4 and T3 concentrations varied from 76 to 116ng/ml and 0.73 to 1.32ng/ml, respectively, during various stages of gestation. In general, the T4 and T3 levels were higher during early pregnancy, with lowest values in the tenth month. T4:T3 ratio showed minor, non significant fluctuations. Agarwal et al, (1989) reported that the Mean T4 and T3 concentrations varied from 76 to 116ng/ml and 0.73 to 1.32ng/ml, respectively, during various stages of gestation. In general, the T4 and T3 levels were higher during early pregnancy, with lowest values in the tenth month.

Thyroid hormones play a significant role in animal body metabolism (Cassar-Malek et al, 2007; Kale et al, 2007; Todini, 2007). They stimulate protein synthesis, increase adipose tissues lipolysis and blood glucose (Chatterjea and Shinde, 2005; Todini, 2007). Mutassim and Akram, (2014) reported that T3 and T4 levels of the camels were significantly lower during summer season (185.32±11.23 ng/dl and 11.52±1.36 µg/dl) when compared with the spring (209.22±6.83 ng/dl and 13.69±2.31µg/dl) respectively. This result was expected since camels during summer suffer from water shortage and consequently dehydration. This finding agreed with Yagil et al, (1978) who reported that the decline in thyroid function, as gauged by hormone secretion during dehydration in the summer, aids in preservation of body water by decreasing pulmonary water loss and dropping basic metabolism. Ali et al, (2009) reported T4 level in serum of camel was 14.7±1.3µg/dl.

2-15- Minerals:

Minerals perform vital part in the growth and reproductive health of animals (Baiomy AA et al, 2009**).** Blood parameters in female camels affected with different forms of reproductive disorders. (A. Ali et al, 2009).

2-15-1-Effect of minerals on reproductive:

Minerals play an important role in the growth of animals and their reproductive performance. Reproductive performance of farm animals depends on adequate balanced levels of vitamins and essential minerals due to their important roles in cellular metabolism, maintenance and growth (Gutteridge et al, 1994). Also these nutrients have specific roles and requirements in reproductive tissues (Kolb et al, 1997). Major minerals deficiency and some imbalances can cause metabolic disturbances and produce specific diseases, including infertility in most animal species (Ali, 1992; Faye et al, 1995**).**

2-15-2-Minerals Deficiencies:

Major minerals deficiency and some imbalances can cause metabolic disturbances and produce specific diseases, including infertility in most animal species (Ali, 1992; Faye et al, 1995). Mineral investigation is an important tool for evaluating the state of nutrition and health of animals (Spears, 1991). Also Yousef et al, (2015) reported Macro- and micro-electrolytes are necessary elements for animal functioning and health. Saini et al, (2010) reported that the average blood minerals concentration was above the critical limit and values of P, Cu, Zn and Mn showed significant increase with supplementation of these minerals.

2-15-3- Zinc (Zn)

Serum Zn concentration was significantly lower in female camels with endometritis, vaginal adhesions, and ovarian cysts compared to the control group (P = 0.003) (A. Ali et al, 2009) Adequate levels of zinc and copper are important for normal reproduction in males and females. Zinc deficiency can lead to such problems as impaired synthesis/secretion of FSH and LH, abnormal ovarian development, disruption of the estrous cycle, frequent abortion, a prolonged gestation period, stillbirth, difficulty in parturition, and infertility (Reddy and Frey, 1990; Fayez et al, 1992; Bedwal and Bahuguna, 1994; Chan et al, 1998). It was noted in those studies that all females with reproductive disorders showed serum Zn concentration lower than that of the control group. Faye et al,(1995) were founded Zn in serum 34.6 ± 7.8 µg/l00 ml. Zinc values were very low, and the maximum (63 µg/l00ml) indicated that the values observed in the such study were all under the deficiency threshold generally accepted for ruminants (Lamand, 1978). However, in study of Faye et al,(1992) has shown that camels compensated for zincemia at a low level: zinc supplementation did not increase the plasma zinc level up to 3540 µg/l00ml, in accordance with the results of Abdalla et al, (1988) in

racing camels. Zia et al, (2007) reported Zn level in serum of male camel during rutting and non-rutting periods was 208±14µg/dl and 180±20µg/dl respectively.Ali et al, (2009) reported Zn level in serum of camel was 1.07±0.114µg/ml. Adequate levels of zinc and copper are important for normal reproduction in males and females. Zinc deficiency can lead to such problems as impaired synthesis/secretion of FSH and LH, abnormal ovarian development, disruption of the estrous cycle, frequent abortion, a prolonged gestation period, stillbirth, difficulty in parturition, and infertility (Fayez et al, 1992; Bedwal and Bahuguna, 1994; Chan et al, 1998). It was noted in this study that all females with reproductive disorders showed serum Zn concentration lower than that of the control group (Ali et al, 2009).

2-15-4- Magnesium (Mg):

Mohamed and Hussein (1999) mentioned in normal Hijin'racing camels the serum Mg concentration was 2.50+0.64mg/dl (1.03+0.26mmol/l). Nermala et al, (2014) registered in their research Magnesium concentration in camel serum was 3.57 ±0.28in rangeland grazing and 3.74±0.28mg/dl in supplementary stall feeding with non significant. Ahmed et al, (2016) reported Mg concentration in serum camel was 2.33±0.2mg/dl. Also Mg in camel serum was 2.7±0.63mg/dl as in Raida and Zuhair (2014) reported. Mutassim and Akram, (2014) mentioned that the Mg concentration in serum did not show any significant change in their levels as a result of season changes, it was (1.79±0.03mg/dl) during spring and (1.75±0.04mg/dl) during the summer season. Khaled, (2010) reported in his research that the Mg concentration in lactating camel was 1.6 ± 0.12mg/dl. Also it was 3.54±0.59mg/dl in adult camel as Barri et al,(2005) reported in their research. Zia et al, (2007) mentioned that the Mg concentration in serum of rutting and non-rutting were 3.0 ± 0.6and 2.1.0 ± 0.5mg/dl respectively. Ali et al, (2009) reported Mg level in serum of camel was 2.5±0.04 mg/dl.

Magnesium level increases are rarely seen, including during acute renal failure. It decreases in ruminants due to dietary deficiency, either acute (grass staggers) or chronic, and diarrhea (uncommon) (MVM, 2015).

2-15-5- Calcium (Ca):

Yousef et al, (2015) registered Calcium were 8.9±0.4 in pregnant and 9.1±0.2 mg/l in non-pregnant. Alia et al, (2007) found serum calcium (Ca) concentrations were significantly ($p<0.05$) higher during the green season (2.20±0.02) than dry season (2.06±0.02) mmol/l.). Mohamed and Hussein (1999) mentioned in normal Hijin'racing camels the serum Ca concentration was 8.98+1.08mg/dl (2.25+0.27mmol/l). Nermala et al, (2014) registered in their research Ca concentration in camel serum was 10.39±1.14 in rangeland grazing and 10.93±1.14 mg/dl in supplementary stall feeding with non significant. Ahmed et al, (2016) reported Ca concentration in serum camel was 8.11±0.15mg/dl. Also Ca in camel serum was 8.4±1.0mg/dl as in Raida and Zuhair (2014) reported. Also Patodkar et al,(2010) reported the mean value of serum calcium was 9.67± 0.339 mg/dl. Mutassim and Akram, (2014) mentioned that the Ca concentration in serum was significantly higher ($P<0.01$) during spring (6.85±0.16 mg/dl) when compare with summer season (6.17±0.11 mg/dl).The increase in Ca concentration in serum during spring may be attributed to the availability of range plant with high levels of minerals and other nutrients (Osman and Al-Busadah, 2003; Kuria et al, 2006; Ahmed et al, 2013). Khaled, (2010) reported in his research that the Ca concentration in lactating camel was 11.4 ± 0.32 mg/dl. Also it was 10.48±0.30 mg/dl in adult camel as Barri et al,(2005) reported in their research. Nermala et al, (2014) registered in their research Ca concentration in camel serum was 6.09±0.32 in rangeland grazing and 6.35±0.32 mg/dl in supplementary stall feeding with non significant.Zia et al,(2007) mentioned that the Ca concentration in serum of rutting and non-rutting were 11.6 ±

1.2 and 8.5.0 ± 1.4mg/dl respectively. Ali et al, (2009) reported Ca level in serum of camel was 8.6±0.7 mg/dl. Babeker et al,(2013) mentioned The results of his study showed seasonal variation in the concentrations of serum Ca and k in the dromedary camels, The observed marked increase in the concentrations of serum Ca and k during the Dry hot summer season and Dry weight winter, respectively, may be attributed to the availability of plants rich us minerals (ash content) during the wet season (Amin et at, 2007).Calcium level increases due to dehydration (which is also associated with increased albumin) (MVM, 2015). Concentration of serum minerals in camels: Serum inorganic calcium (Ca+2) during Dry hot summer was significantly higher with other periods (Babeker et al, 2013). Calcium is responsible for steroidgenesis in leydig cells thus the high level of calcium in testis during rutting period seems to be responsible for steroid production (Zia et al, 2007).

2-15-6- Phosphorus (P):

Ali et al,(1987) Founded that the Concentration of (P) in camel serum (mean ± SEM)was 8.4±1.7 mg/dl. They reported it would appear to be little difference in phosphorus contents of the serum of several species of ruminant. A value of 5.4 ± 1 mg/dl has been reported for sheep, 6.7-8.5 mg/dl for the cow and 6.4±0.1 mg/dl for the camel (Biochemical Data Handbook). The value obtained from the work for the camel, 8.4 ± 1.7 mg/dl, is in excellent agreement with these authors. Bhakat et al, (2006) reported the levels of phosphorus were slightly higher in intensive system as compared to semi- intensive system management. Yousef et al, (2015) registered Phosphorus were 4.9±0.4 in pregnant and 5.1±0.2 (mEq/l) in non-pregnant. Alia et al, (2007) found serum inorganic phosphorus (P) concentrations were significantly ($p<0.05$) higher during the green season season (2.35±0.03) than dry season (1.94±0.03) mmol/l. Mohamed and

Hussein (1999) mentioned in normal Hijin'racing camels the serum Phosphorus concentration was 5.02+1.15 mg/dl (1.62+0.37 mmol/l). Ahmed et al, (2016) reported P concentration in serum camel was 7.11±0.59mg/dl. Also P in camel serum was 5.2±1.62mg/dl as in Raida and Zuhair (2014) reported. Also Patodkar et al,(2010) reported the mean value of serum P was 5.64± 0.567mg/dl. Mutassim and Akram, (2014) mentioned that the P concentration in serum did not show any significant change in their levels as a result of season changes, it was (3.33±0.05mg/dl) during spring and (3.34±0.04mg/dl) during the summer season. Khaled, (2010) reported in his research that the P concentration in lactating camel was 6.2± 0.51mg/dl. Also it was 6.12 ± 0.47mg/dl in adult camel as Barri et al,(2005) reported in their research. Ali et al, (2009) reported P level in serum of camel was 6.7±0.3 mg/dl.

2-16- Biochemical analysis of blood:

Biochemical analysis of blood may provide valuable information for diagnosis and surveillance of general health (Nyanga et al, 1997; Rezakhani et al, 1997) Changes in the biochemical constituents of blood are important indicators of physiological state of an animal (Perveen and Usmani, 1993). Al-Ali et al,(1987) that reported that the biochemical analysis of blood can often provide valuable information concerning health and sickness in animals. Determination of the concentrations of various blood constituents may be of great help in the diagnosis of many diseases. The concentrations of blood metabolites are sensitive to seasonal changes in nutrient supply. Therefore, they could be used as indicators of nutritional status (Pamba–Gollah et al, 2000). In Sudanese camels the concentrations of plasma glucose and serum urea, creatinine, phosphorus (P) and calcium. Blood urea concentration was increased in camels (Wensvoort et al, 2004). Nonetheless, investigations determining normal values of blood constituents in camels and

the way they are affected by age, sex, breed, season, nutritional status and other factors seem to be limited**.** (El Dirdiri et al, 1987; Abdalla et al, 1988).

Table (1) Results of Authors for Concentration of some blood components found in camel serum (mean + SEM)serum parameters

Serum Parameters / Authors	Total protein (mg/dl)	Glucose (mg/dl)	Cholesterol (mmol /l)	Urea (mmol /l)	Creatinine (µmol /l)	Uric acid (mg/dl)	Bilirubin (mg/dl)	Globulin (g/l)	Albumin (g/l)
Nazifi and Malek(1998)	5300±160	5 ±0.2	1.3 ±0.1	10.9 ±0.5	179±4.5				
Ghoneim et al, (2013)	-	276.11 ±47.03	51.43 ±5.49 mg/dl	-					
Al-Ali et al,(1987)	-	138±17.7	30.5± 8.7 mg/dl	-	-	0.16±0.03	0.049±0.0		
Faye et al, (1995)	69.2±6.1 g/l	111±12.2 mg/100ml		30.0±14.8 mg/100ml				32.7±5.1	36.4±4.7
Faye et al, (1992)		0.77-0.84 g/l in plasma		13.519.0mg/l in plasma					
Mohri et al, (2008)	62±6.0 g/l	6.9±1.1mmol/l	1.04±0.32	7.9±2.5	132.6±44.2		5.3±0.5µmol/l		34±4.0
Patodker et al, (2010)	7.49±0.372 g/dl			18.99±0.168 Mg/dl	1.87±0.215 mg/dl			3.36±0.198 g/dl	4.13±0.208 g/dl
Raida and Zuhair l (2014)		174.1±46.34 mg/dl		22.9±8.25 mg/dl	1.8±0.15 mg/dl				4.4±0.28 g/dl
Haroun EM (1994)	62.3±8.9 g/l			6.6±1mumol/l		232±35.77mumol/l	**8.7**±1.7mumol/l		33.5±8.9 g/l
	4.81±3.2 g/dl		76.03±9.76 mg/dl	8.79±1.18 mg/dl	1.23±0.37 **md/dL**				

2-16-1- Liver Functions:

2-16-1-1- Total Protein:

Haroun (1994) reported that; the mean values for total protein and albumin of young Najdi camels ((6.2±0.9 g/dl or 62.3 ± 8.9g/l) and (3.4±0.9 g/dl or 33.5 ± 8.9g/l) respectively) are lower than those reported by Hussein and Hussein (1985) for male and female Najdi camels of different ages (82.2 ± 6.8 g/l and 45.6 ± 5.1 g/l). Mean values are also slightly lower than those reported by Abdel Gadir et al, (1979) for adult Sudanese male camels (7.3 ±0.5 g/d1 and 3.8 ± 0.32). On the other hand, mean values of total protein and albumin are generally comparable with those of cattle, sheep and goats (Kaneko, 1980; Coles, 1980). Also Nazifi and Malek. (1998) founded total protein in serum 5300±160mg/dl. Faye et al, (1995) they reported in their research total protein (69.2 ± 6.1 g/l). Consequently, total proteins also were similar to the values observed in arid conditions. However, we noted that the standard deviation was slightly higher in our sample than in tropical conditions (Bengoumi, 1992). It seems that feeding conditions are more diversified in French camel herds than in sub-desert and desert countries, especially as regards the dietary protein content which can explain the variation observed in protein parameters. The protein supply was affected by the season. Bhakat et al, (2006) founded the level of total protein significantly increased in intensive system management as compared to semi- intensive system management group. Also Saini et al, (2010) reported in his study the concentration of total protein was significantly higher in supplementation group (intensive system) (6.69 mg%) compared to control (traditional system) (5.95 mg%). Haroun. EM (1994), found in his research the total protein in camel serum 62.3±8.9 g/l. Ashwag et al,(2015) reported that the total proteins concentrations was significantly higher ($P \leq 0.001$) in the pregnant group than the non-pregnant ones (7.9± 0.82 and 7.1±0.53 g/dl

respectively). Alia et al, (2007) found serum total protein concentrations was significantly ($p<0.05$) higher during the dry season (8.43±0.08 g/dl) than green season (7.08±0.08 g/dl). Nermala et al, (2014) registered in their research total protein in camel serum was 5.71 ±0. 17g/dl in rangeland grazing and 5.73 ±0. 17 g/dl in supplementary stall feeding with non significant. Also Patodkar et al,(2010) reported the mean value of serum total Protein was 7.49± 0.372g/dl. . Mutassim and Akram, (2014) found in their study that the level of protein concentration was in camels during spring (7.69±0.18mg/dl) and (7.48±0.17mg/dl) during summer season. Ali et al, (2009) reported total protein in serum of camel was 7.9±0.4g/dl. The overall mean serum total proteins concentration was 5.53±0.30 g/dl (Shujait et al, 2008). According to Dalvi et al, (1998), the blood total protein contents in Indian camels, averaged 7.42±0.54 g%. In buffaloes, plasma total proteins concentration was 7.68±0.34 g/dl (Arshad et al, 2005). Besides species and breed difference, variation in climatic conditions may be attributed for these minor discrepancies (Shujait et al, 2008).

2-16-1-2- Albumin and Globulin:

Total protein contents can be fractionated into albumin and globulin. In camels, the overall mean serum albumin and globulin concentrations were 3.63±0.20 and 1.86±0.16 g/dl, respectively (Shujait et al, 2008). Based on 9000 samples analyzed during 1996–1997 in Dubai, UAE, the reference serum albumin level for camels was 3.75±0.75 g/dl, the range was 3.0–4.5 g/dl (Anon., 1997), which supports the findings of Shujait et al,(2008) study. However, Dalvi et al,(1998) recorded the mean serum albumin and globulin levels of 2.9±0.33 and 4.53±0.49 g%, respectively, in Indian camels kept in a hot humid climate. Albumin level increases due to dehydration (MVM, 2015).

Faye et al, (1995) they found in their research albumin (36.4± 4.7 g/l), total globulin (32.7 ± 5.1 g/l). Bhakat et al, (2006) reported higher level of albumin was found in intensive system than semi- intensive system management. The level of globulin significantly increased in intensive system as compared to semi- intensive system management. Haroun. EM (1994), found in his research the albumin in camel serum 33.5±8.9 g/l. Ashwag et al,(2015) reported that there was highly significant increase (P≤ 0.001) in the globulins concentration during pregnancy (4.4 ± 0.81 g/dl) in the pregnant group and (3.5± 0.49 g/dl) in non-pregnant females. While, there was no significant difference in the concentration of albumin. Alia et al, (2007) found serum globulin concentrations was significantly ($p<0.05$) higher during the dry season (5.83±0.39 g/dl) than green season (4.0±0.38 g/dl).Although albumin concentration was slightly higher during the dry season (3.17±0.05 g/dl), than green season (3.09±0.05 g/dl) the difference was not statistically significant. Nermala et al, (2014) registered in their research Albumin and Globulin in camel serums were 2.72±0.095 g/dl and 2.99±0.22 g/dl in rangeland grazing and 3.02±0.095 g/dl and 2.70±0.22 g/dl in supplementary stall feeding respectively.). Ahmed et al, (2016) reported Albumin concentration in serum camel was 2.95±1.56g/dl. Also Patodkar et al,(2010) reported the mean values of serum Albumin and Globulin were 4.13± 0.208g/dl and 3.36± 0.198g/dl. Mutassim and Akram, (2014) found in their study that the level of Albumin was in camels during spring (3.34±0.03 µg/dl) and (3.31±0.04 µg /dl) during summer season. Ali et al, (2009) reported level of Albumin and globulin in serum of camel was 4.2±0.4 and 3.7±0.5g/dl respectively.

2-16-1-3-Glucose

Glucose level increases due to high-carbohydrate meals, sprint exercise, stress or excitement.(MVM,2015). Plasma glucose concentration (μ = 79.7 ± 5.4 mg/100 ml) was higher in MC (Animals supplemented Mangrove and Concentrate). and MTC(animals supplemented Mangrove , Trace elements and Concentrate)-complemented groups than in group MT (supplemented Mangrove and Trace elements) and control group M(supplemented Mangrove) were 0.79 , 0.84, 0.78 and 0.77 g/l respectively . Sudden variations were observed in the control group. That was essentially due to the camels in poor condition which had very low blood glucose levels prior to death (Faye et al, 1992). Al-Ali et al,(1987) reported that the glucose content of camel blood determined in this work was 138 + 17.7mg/dl. This value is in excellent agreement with the data of several other authors, including Chandrasena et al, (1979) 129mg/dl and Barakat and Abdel-Fattah (1970) 80-140mg/d. The concentration of glucose in the serum was 5 ±.02 mmol/l as Nazifi and Malek(1998) were founded. Also Faye et al, (1995) found in their research the concentration of glucose (111.0 ± 12.2 mg/l00 ml). Also Alia et al, (2007) found in their research plasma glucose concentrations was significantly ($p<0.05$) higher during the green season (4.81±0.13 mmol/l) than dry season ((3.31±0.13 mmol/l). Mohamed and Hussein (1999) mentioned in normal Hijin'racing camels the serum glucose concentration was 97.8±18.77 mg/dl (5.38±1.03mmol/l). Nermala et al, (2014) registered that the serum glucose was significantly higher in group fed on stall feeding (94.06±3.84mg/dl) than rangeland grazing group (47.44±3.84mg/dl). Babeker et al,(2013) reported that the Serum glucose was found to be significant (P<O.O5) higher (80.40 ± 5.04) in Dry weight winter, then showed a significant low level (36.45 ± 6.14) during Rainy season. Mutassim and Akram, (2014) found in their study that the higher level of

glucose in camels was during spring (54.13±0.97 mg/dl) comparable with summer season (50.76±0.74 mg/dl). Ali et al, (2009) reported glucose level in serum of camel was 71±9 mg/dl. Shujait et al, (2008) reported that the overall mean serum glucose concentration in the female dromedary was 186.90± 14.40 mg/dl, his value is higher than the concentrations reported in the literature for other species, e.g. 39.67±0.61 mg/dl in postpartum buffaloes (Quayam et al, 1988), 46.6 mg/100 ml in anoestrus pre-pubertal buffalo heifers (Kumar et al, 1992) and 82±3 mg/dl in cows (Simpson et al, 1994). It appears that the serum glucose contents in the female camel are much higher than those reported for other species. The camel is a beast of the desert where the climatic conditions are very severe and harsh. The high serum glucose level might be important for the survival of this species in such a harsh environment (Shujait et al, 2008). The camel has the ability to increase its blood glucose level during stress and dehydration by decreasing the renal glucose threshold; under such conditions the glucose concentration in the camel blood can go up to 1300 mg/ml (Al-Ani and Faye, 2004). Besides species differences, nutritional plan or physiological status of the animal can also influence serum glucose levels (Shujait et al, 2008). Moreover, the supply of camels after fasting increases the level of plasma glucose (Wensvoort et al, 2004).

2-16-1-4-Cholesterol

The serum cholesterol level generally varies inversely with thyroid activity. The net effect of thyroid hormone on cholesterol metabolism is to increase the rate of its catabolism by the liver, thereby lowering the cholesterol (Bartley, 1989). In contrast to above opinion, Wasfi et al, (1987) reported that the concentrations of thyroid hormones were not correlated with cholesterol levels. The explanation for these findings is not possible at

this moment in time. The cause of these findings is unclear and, there is no earlier report in this respect.(Saeed et al, 2002)

Nazifi and Malek, (1998) reported that the cholesterol in serum was 1.35±0.1mmol/l (52.204±3.87mg/dl), and was 1.04±0.32mmol/l (40.216±12.37mg/dl), as Mohri et al, (2008) were said. Ghoneim et al, (2013) mentioned it was 51.43 ±5.49 mg/dl, and 30.5± 8.7 mg/dl as Al-Ali et al,(1987) found in their research. Ashwag et al,(2015) reported that there was no significant different in the concentration of cholesterol in the pregnant group and the non-pregnant ones. Mohamed and Hussein (1999) mentioned in normal Hijin'racing camels the serum cholesterol concentration was < 35.00 mg/dl (< 0.91mmol/l). Ahmed et al, (2016) reported cholesterol concentration in serum camel was 76.03±9.76mg/dl. Ali et al, (2009) reported cholesterol level in serum of camel was 235±20 mg/dl. The overall mean serum cholesterol level in female camels was 39.06±5.82 mg/dl (Shujait et al, 2008). The reference value of serum cholesterol in camels published by the Central Veterinary Research Laboratory, Dubai, UAE (Anon., 1997) was 30–62 mg/dl. It is well known that cholesterol is the precursor of all steroid hormones including estrogen, and the estrogen contents in the follicle fluid were also higher in the low breeding season. It appears that higher cholesterol levels in follicle fluid result in high estrogen levels (Shujait et al, 2008). The serum cholesterol level generally varies inversely with thyroid activity. The net effect of thyroid hormone on cholesterol metabolism is to increase the rate of its catabolism by the liver, thereby lowering the cholesterol (Bartley, 1989). In contrast to above opinion, Wasfi et al, (1987) reported that the concentrations of thyroid hormones were not correlated with cholesterol levels. The explanation for these findings is not possible at this moment in time. The cause of these findings is unclear and, there is no earlier report in this respect.(Saeed et al,

2002). Cholesterol level increases due to fatty meals, hepatic or biliary disease, protein-losing nephropathy (and other protein-losing syndromes to some extent), diabetes mellitus, hyperadrenocorticism, and hypothyroidism. It decreases in some cases of severe liver dysfunction and occasionally in hyperthyroidism.(MVM,2015)

2-16-1-5- Bilirubin:

The mean total Bilirubin value for young Najdi camels (0.5 ± 0.1mg/dl or 8.7 ± 1.7 µmol/l) was slightly higher than the value reported by Abdel Gadir *et al*, (1979) for Sudanese adult male camels (0.32 ± 0.16 mg/dl). It is also higher than the values reported by Coles (1980) for adult cattle, sheep and goats but lower than the value reported by the latter author for calves. (Haroun, 1994). Excellent correlation was also obtained between the Bilirubin levels determined by. Al-Ali et al,(1987) they made in their work, 0.049 mg/dl, and those of Hassan *et al*,(1983) 0.034 mg/dl. Haroun, (1994) found in his research the Bilirubin in camel serum 8.7±1.7mumol/l. **Yousef** et al, (2015) registered that the total Bilirubin were 0.13±.02 mg/l in pregnant and 0.12±.02 mg/l in non-pregnant and there were non-significant differences. **Mohamed and Hussein (1999**) mentioned in normal Hijin'racing camels the serum total Bilirubin was 0.51±0.30 mg/dl (8.72±5.13µmol/l). Bilirubin level increases due to fasting (benign effect in horses and squirrel monkeys may be caused by hepatic lipidosis in cats), hemolytic disease (usually mild increase), liver dysfunction. (MVM, 2015)

2-16-2- Kidney Functions

2-16-2- 1- Urea

Urea level increases due to excess dietary protein, poor quality dietary protein, carbohydrate deficiency, catabolic states, dehydration, congestive heart failure, renal failure.(MVM,2015). Urea plasma concentration was

lower in supplemented groups (10.5-21.5 mg/100 ml) (Faye et al, 1992).Usually, urea in blood increases when protein content rises in the diet (Emmanuel et al, 1976). The increase of uremia after a long period of low protein feeding (2 months) indicates excessive catabolism; values of up to 45 mg/l00 ml were observed. The mineral complementation attenuated this phenomenon (no uremia exceeded 36 mg/l00 ml in group MT). However, Mathur et al, (1981) observed a very low concentration of urea in blood of the Indian camel (6.3 mg/l00 ml). (Faye et al, 1992).Also was 10.9±0.5 in serum as Nazifi and Malek (1998) reported. Faye et al, (1995) they found in their research urea (30.0 ± 14.8 mg/l00ml). It seems that feeding conditions are more diversified which can explain the variation observed in urea, it presented an important variation (4.1 up to 69.0 mg/l00 ml) which was rarely observed in tropical conditions: 29.4 up to 41.2mg/l00 ml in Syria (Kouider et al, 1988) 33 up to 55.7 mg/l00 ml in Syria too (Ateeq *et al, 1*984), 13.3 up to 21.7 in Sudan (Mousa *et al, 1*983) and 39.7 up to 41.6 in the Arab Emirates (Snow et al, 1988). Haroun, (1994), found in his research the urea concentration in camel serum 6.6±1mumol/l, some camels showed a very high level of uremia (> 60 mg/l00 ml) that they could consider as a sub-toxic level. Most of these animals belonged to one farmer which had distributed a high quantity of cake mixed with concentrate. Camels are used in their original place to a low-protein diet and present a mechanism for urea recycling in times of protein deficiency in order to supply a substrate for protein synthesis (Yagil, 1985). Conversely, a high-protein diet may lead to a waste of nitrogen and to increased uremia. Camels are adapted to desert conditions and the low energy feeding. Natural grassland is obviously richer in Europe than in desert areas; so, the distribution of high quantity of cake and concentrate was a waste of nitrogen and energy which explained the high levels of uremia and glycemia. We think that this excess, especially in late pregnancy, could facilitate some inflammatory process, as already observed

in dairy cows (Barnouin and Chacornac, 1992) and could increase the risk of mortality of the young after birth. It was obvious that it was the most serious problem for the farmer. According to Schwartz (1992) camels feeding on low protein forages can recycle and utilize body urea for microbial protein synthesis more efficiently than true ruminants.

Yousef et al, (2015) registered that the blood urea nitrogen were 14.6±1.5 mg/dl in pregnant and 16.0±1.8mg/dl in non-pregnant and there were non-significant differences. Also Alia et al, (2007) found in their research serum Urea concentration was significantly ($p<0.05$) higher during the green season (9.18±0.29 mmol/l) than dry season (5.66±0.30 mmol/l). Mohamed and Hussein (1999) mentioned in normal Hijin'racing camels the serum Urea nitrogen concentration was 15.4+4.52mg/dl (5.50+1.61mmol/l). Nermala et al, (2014) registered in their research Urea in camel serum was 53.52 ± 1.15mg/dl in rangeland grazing and 42.64 ± 1.15mg/dl in supplementary stall feeding with high significant.

2-16-2-2- Uric Acid:

Haroun (1994) reported that; urea and uric acid mean values in young male Najdi camels in his present investigation (urea= 6.6 ± 1 µmol/l and uric acid = 232±35.7 µmol/l) are higher than the values reported by Abdel Gadir et al, (1979) for adult male Sudanese camels (31.48 ± 8.92 mg/dl and 0.46 ± 0.1 mg/dl). Mean uric acid concentration is also higher than the mean value reported by Abdalla et al, (1988) for adult racing camels in the United Arab Emirates (11.9 ± 2.60 mg/dl) as well as the mean value reported by Hussein and Hussein (1985) for male Najdi camels of different ages (3.8 ± 1.1 µmol/l). McGrane and Kenyon (1985) however, reported uric acid value (15.6-48.4 mg/dl) comparable with those reported in the present investigation. Mean urea and uric acid values for young Najdi camels (6.6 ±

1µmol/l and 3.9 ± 0.6 µg/l respectively) are higher than those reported by Coles (1980) for cows, sheep and goats. Haroun. EM (1994), found in his research the uric acid concentration in camel serum 232±35.77mumol/l. Al-Ali et al,(1987) they made a comparison between the uric acid levels of the cow, 2.0±0.6mg/dl, and the camel, 0.16± 0.03 mg/dl, reveals that camel serum contains far less uric acid than the cow. Babeker et al,(2013) reported that the serum uric acid showed the same significance for increased values during dry hot summer (2.99±0.08mg/dl) as compared to other environmental and physiological conditions(0.24 ± 0.07, 0.34 ± 0.03 and 0.34 ± 0.05 in Rainy season, rainy hot summer and dry wet winter respectively. Their value for the camel is in good agreement with the data of Barakat and Abdel- Fattah (1970) who obtained a mean value of 0.14 ±

2-16-2-3- Creatinine

Nazifi and Malek(1998) reported that the Creatinine in serum was 179± 4.5 µmol/l, and Mohri et al, (2008) found 132.6±44.2 µmol/l. Yousef et al, (2015) registered that the total Creatinine were 1.3±0.1 mg/dl in pregnant and 1.4±0.1 mg/dl in non-pregnant and there were non-significant differences. The Creatinine level (marker of kidney function) is dependent on the dietary intake, synthesis rate of Creatinine. Therefore, the high Creatinine levels in animals during gestation could be as a result of higher protein needs and this is associated with late stage of pregnancy due to the lower rate of kidney elimination (Omidi et al, 2014b). Omidi et al, (2014b) stated that, while the serum levels of biochemical parameters (urea, Creatinine and total proteins) were not significantly different with pregnancy. Also Alia et al, (2007) found in their research serum Creatinine concentration was significantly ($p<0.05$) higher during the green season (136.14±3.54 µmol/l) than dry season (74.26±4.42 µmol/l). Mohamed and Hussein (1999) mentioned in normal Hijin'racing camels the serum Creatinine concentration

was 1.97±0.33 mg/dl (174.14±29.17µmol/l). Ahmed et al, (2016) reported Creatinine concentration in serum camel was 1.23±0.37md/dl. Also Patodkar et al,(2010) reported the mean value of serum Creatinine was 2.13± 0.182mg/dl. Mutassim and Akram, (2014) found in his study that the higher level of Creatinine in camels was during summer (1.92±0.03mg/dl) comparable with spring season (0.89±0.01mg/dl). The overall mean values of serum creatinine in the present investigation were within the normal standard range for creatinine (0.6 to 2.0 mg %) as given by Peake and Whiting (2006).

Chapter Three

Material and Methods

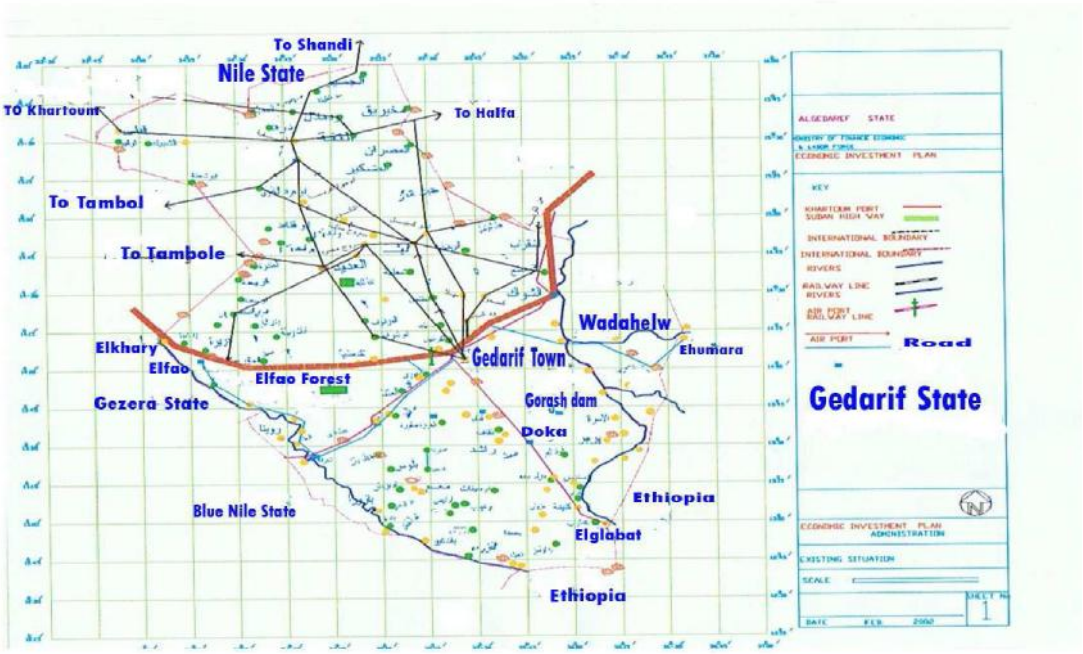
This study was conducted in Butana region(Kassla, Gadarif and Tumboul) and Khartoum state through three avenues: **first** by questionnaire to collect the information from Butana region representing the Nomadic system and selected farms located in Khartoum representing the Intensive system with general survey to collect the information about the camel production and reproduction in the different systems, **Second** the case study on embryonic losses at Tumboul –center of Camel Research and the slaughter house in the region, **third** the Blood sample for hormonal assay (Estrogen, Progesterone, T3 and T4), blood biochemical (total Protein, Albumin, Globulin, total Bilirubin, Cholesterol and Glucose , Creatinine, Urea and uric acid) and blood minerals constituent(Zn- Ca- Mg-P) to measure their effection.

3-1- Description of the study area:

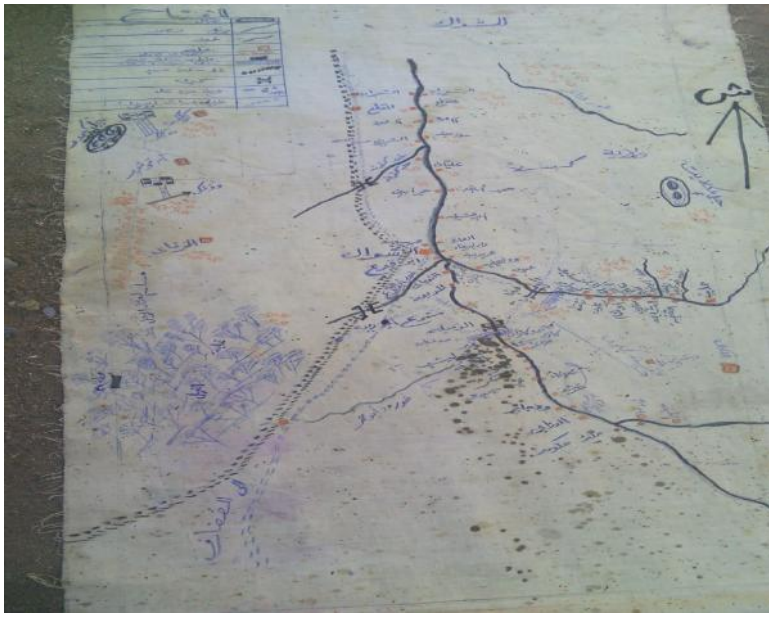
3-1-1- Butana plain is a semiarid clay region covers most of the present Kassala and Gedaref States in Eastern Sudan. It lies between Latitude 13°40' and 17 50' North and Longitude 32 40' and 36 00' East. It is bound by the Main River Nile on its northwestern border, the Blue Nile on its southwestern edge, the Atbara River in the northeast and by the railway connecting Kassala and Sennar on the south. The area is composed of mountainous ranges intersecting the plain to the western and southern borders. It is crossed by many seasonal rivers namely, Atbara, Seitite, Ba-Salam, Gash and Rahad Rivers. Small temporary seasonal valleys do run through these plains during the rainy season. The rocky basement complex Forms the geological underlining of Butana plains with sandy and stony soils in the North, light non-cracking clay in the Central, Eastern and Western regions and dark Cracking clay in the South. As a result of this and with the

exception of small water Catchments in the mountains mentioned before, very limited water resources are available.

Seasonal shallow surface water wells are present as well as few very deep bore wells. However, the amount of water and the persistence of reserves during the summer dry season depend on the quantity of rainfall the wet season. In the Butana, a tropical continental climate prevails ranging from a sub-equatorial condition with rain in the south to desert climate in the north. Most of the rains are in the form of showers or thunderstorms. The rainfall in Butana region is highly variable from one year to the other. It ranges between 600 mm/year in the southeast to less than 100mm/year in the northwest. As always in the semiarid regions, rainfall is the most important climatic factor in Butana because people and their livestock depend on this factor which supports the growth of the vegetation for their animals. The annual mean temperature ranges from 32 C° during the day to 16 C° at night in January (winter) and from 46 C° during the day to 27 C° at night in May-June (summer). Two vegetation zones are existing in the area, namely semi-desert *Acacia* shrub and short grasslands of the North Central Sudan and secondly, the low woodland savannah of Central Sudan. The vegetation of Butana is constantly changing as a result of annual rainfall, accidental fire outbreaks and expansion of agriculture and grazing (Saint-Martin et al, 1992).



Map(1) Gadarif State



Map (2) Area of research in AlShouk

3-1-2- Khartoum features a hot desert climate (Köppen climat classification) with a dry season occurring during "wintertime", typical of the Sahara-Sahelian zone which marks the progressive passage between the Sahara Desert, vast arid areas and the Sahel, vast semi-arid areas. The climate is extremely arid for most of the year with about nine months where average

rainfall is lower than 5 mm (0.20 in). The very long dry season in itself divided into a hot, very dry season between November and March as well as a very hot, dry season between April and June. During this part of the year, hot, dry continental trade winds from deserts sweep over the region such as the harmattan (a northerly or northeasterly wind): the sky is perfectly clear, the weather is stable, very dry . The very irregular, very brief, rainy season lasts about one month as the maximum rainfall is recorded in August with about 75 mm (3.0 in). The rainy season is characterized by a seasonal reverse of wind regimes, when the Intertropical Convergence Zone goes northerly. Average annual rainfall is very low, with only 162 mm (6.4 in) of precipitation. Khartoum records on average six days with 10 mm (0.39 in) or more and 19 days with 1 mm (0.039 in) or more of rainfall. The highest temperatures occur during two periods in the year: the first at the late dry season, when average high temperatures consistently exceed 40 °C (104 °F) from April to June, and the second at the early dry season, when average high temperatures exceed 39 °C (102 °F) in September and October months. (Wikipedia, 2016)

3-2- **Questionnaire:-**

A set of detailed structured questionnaires were used to collect information from total of 40 farms in different sites between the two systems by guided interviews (17 farms in Khartoum state and 23 farms in Butana area) as interview conducted over single visit (Appendix.1), data were collected by direct communication with camel pastoralist and herders in study areas. The questionnaire was designed to cover information on general household information, herd structure purpose and size, herd management systems, production, reproduction traits and constrains.

3-3-Blood samples and analysis

Blood samples were drawn from the jugular vein of each she-camel. Ten ml of blood were collected into tubes. Serum was prepared by centrifugation at 1400 r for 15 min. (Feldman et al, 2000). Then separated from the other container tube and was immediately frozen at -20°C for future analyses until assayed.

The serum samples were analyzed for concentrations of steroid hormones including estradiol-17 (E2), progesterone (P4), Try Aiodo-thyronin (T3) and thyroxin (T4) determined by ELISA Reader (CLINDIAG, MR-96 -2015.Belgium) using the standard kits(USA) methods.

Serum samples were also analyzed for main elements (Calcium (Ca), Phosphorus (P), Magnesium (Mg)) and trace elements (Zinc (Zn), were measured photometrically by atomic absorption spectrophotometer Using commercial kite provided by Human.

3-3-1- Biochemical tests:

BIOMERIEUX diagnostic kits (France) were used to determine the concentrations of the following parameters in serum samples: total Protein, Albumin, Globulin, total Bilirubin, Cholesterol and Glucose to know the Liver Functions also determine the Creatinine, Urea, uric acid as well as the activities of the Kidney. All parameters were determined photometricaly using Spectrophotometer – JENWAY (Genova. UK).

All blood parameters were determined in the Veterinary Research Division-National Research Center-Cairo–Egypt. As in following:

3-3-1-1- Total Protein

Procedure:

	Blank (ml)	Standard (ml)	Sample (ml)
Standard		0.025	-
Sample	-		0.025
Reagent	1.0	1.0	1.0

Mix well; incubate for 10 min at 37°C. Read the absorbances of the sample (A_{sample}) and standard ($A_{standard}$) against reagent blank at 550 nm. (520-570nm). Color stable for one hour. Linearity up to 10g/dl.

Calculation:

Protein Concentration (g/dl) = $\frac{\text{A sample}}{\text{A standard}} * 5$

Reference:

Gomal A.C; Bardaill C.J, and David M.M(1949): J. Biol. Chem.177:751.

3-3-1-2- Albumin:

Procedure:

	Blank (ml)	Standard (ml)	Sample (ml)
Standard		0.01	-
Sample	-		0.01
Reagent	2.0	2.0	2.0

Mix well, then measure after 5 min. The absorbencies of the sample (A_{sample}) and standard ($A_{standard}$) against reagent blank at 630 nm. (620-640nm).

Calculation:

Albumin Concentration (g/dl) = $\frac{\text{A sample}}{\text{A standard}} * 4$

Reference: Doumas B.T et al, (1971) Clin. Chim. Acta 31-87.

3-3-1-3- Globulin:

Calculation:

Globulin Concentration (g/dl) = Total Protein - Albumin

3-3-1-4- Glucose

Procedure:

Working reagent: Mix equal volumes of reagent 2 and 3immediately befor the assay.			
	Blank (ml)	Standard (ml)	Sample (ml)
Standard	-	0.01	-
Sample	-	-	0.01
Working reagent	1.0	1.0	1.0

Mix well; incubate for 10 min at 37°C. Measure the absorbances of the sample (A_{sample}) and standard ($A_{standard}$) against blank at 510 nm. (490-530nm).The color stable for 30 min. Linearity up to 500 mg/dl.

Calculation:

Glucose Concentration = $\frac{A\ sample}{A\ standard}$ * Standard Concentration.

Reference:

Trinder P. (1969) Ann.Clin. Biochem,6,24.

3-3-1-5- Bilirubin- Total

Procedure:

	Total Bilirubin	
	Blank (ml)	Sample (ml)
Reagent 1	1.0	1.0
Reagent 2	-	0.05
Sample	0.1	0.1

Mix, incubate at room temperature for 10 min .away from light. Read the absorbances of the sample (A_{sample}) against its blank at 535 nm. (530-540nm). Using cuvettes 1cm light path. Linearity up to 25mg/dl(425µmol/L). color stable for one hour.

Calculation:

Total Bilirubin (mg/dl) = A_{sample} * 14

Reference: Walter M.and Gerade H.,(1970) Microchem.J.15.231.

3-3-1-6- Cholesterol

Procedure:

Working reagent: Mix equal volumes of reagent 2 and 3immediately befor the assay.			
	Blank (ml)	Standard (ml)	Sample (ml)
Standard	-	0.01	-
Sample	-	-	0.01
Working reagent	1.0	1.0	1.0

Mix well; incubate for 10 min at 37°C. Measure the absorbance of the sample (A_{sample}) and standard ($A_{standard}$) against blank at 500 nm. (492-550).The color intensity is stable for 30 min. Linearity up to 500 mg/dl.

Calculation:

Cholesterol Concentration = $\frac{\text{A sample}}{\text{A standard}}$ * Standard Concentration.

References:

Richmond W.,(1973) Clin. Chim., 19, 1350.

Allain C. C. et al,(1974) Clin. Chim., 20, 470.

3-3-1-7- Urea Concentration:

Procedure:

	Blank (ml)	Standard (ml)	Sample (ml)
Standard	-	0.01	-
Sample	-	-	0.01
Reagent 2	0.2	0.2	0.2
Mix, incubate for 5 min at 37°C			
Reagent 3	1.0	1.0	1.0
Reagent 4	1.0	1.0	1.0

Mix, incubate for 10 min at 37°C. Measure the absorbances of the sample (A_{sample}) and standard ($A_{standard}$) against blank at 550 nm, (530-570 nm). Color stable for 5 hours. Linearity up to 200 mg/dl(33.3 mmol/L).in serum or plasma and 4g/dl (665 mmol/L) in urine.

Calculation:

Urea in urine (g/dl) = $\frac{\text{A sample}}{\text{A standard}}$ * 5

References:

Fawcett, J.K and Soctt,J,E., (1960): J, Cline., Path. 13: 156-159.

3-3-1-8- Uric Acid:

Procedure:

	Reagent blank	Standard	Sample
Demineralized water	20µl	-	-
Standard	-	20µl	-
Sample	-	-	20µl
Reconstituted Reagent 3	1 ml	1 ml	1 ml
Mix. Perform photometry after incubation for: 5 min at 37°C 10 min at 20-25 °C			

Color intensity is stable: 30 minutes at 20-25°C (15 min in the dark for urine samples).

Calibration stability: perform a calibration for each series of tests.

Calculation:

Without deduction of sample blank

Concentration of sample = $\frac{\text{A sample}}{\text{A standard}} * n$

n= standard concentration

References:

4- Chalas J., Chevenne . – Acide Urinari- ISB, 1988-vol. 14, n°6, Vll.

5- Chevillon I., Larrose C., Moreau N., et al,-Conservation des echantillons de song avant analyse des parameters biochimiques les plus courants- Ann. Biol. Clin.(Paris) – 1998, vol.56, p. 200-204.

3-3-1-9- Creatinine:

Procedure:

Wavelength ——————— 492 nm(Hg 492nm)

Temperature ——————— 30°C or 37 °C

Cuvette ——————— 1 cm light path

Zero adjustment ——— air or demineralized water

Introduce in a thermostatically controlled tube or cuvette at 30 or 37°C:	
Working solution heated at 30 or 37°C	1ml/100µI
Mix. Measure the absorbance between t=20sec (A_1) and t= 80 sec (A_2) Standardize the time between addition of the sample and the 1st reading (A_1)	

Calibration stability: Perform a calibration for each series of tests.

RESULTS AND INTERPRETAION

Interpretation of the test results should be made taking into consideration the patient's history and, if necessary, the results of any other tests performed.

Calculation:

Sample concentration = $\frac{\Delta A \text{ sample}}{\Delta A \text{ standard}} * n$

$\Delta A = A_2 - A_1$

n= concentration of standard

References:

Kroll M.H., Roach N.A., POE B. And Elin R.J. – Mechanism of Interference with the Jaffe Reaction for Creatinine – Clin Chem.- 1987, vol.33, n°**7,**p . 1129 – 1132.

Houot o.- Creatinine –In Silest G., Henny J., Schiele F. Young D.s et al, Interpretation of clinical laboratory tests. – Ed. Biomedical Publications, 1985 – chap. 17,p. 220- 234- ISBN 0 931890-11-X.

3-3-2- Hormonal assay:

The concentrations of estradiol, progesterone and Thyroid hormones (Triiodothyronin, Thyroxin) in serum were measured using ELISA micro wells procedures.

3-3-2-1- Estradiol (E17-β) assay:

Serum estradiol levels were assayed using enzyme immunoassay test kit (Cat. No.: BC-111, from BioCheck, Inc, Foster City) according to **Tietz (1995)**

Principle: -

The assay based on the principle of competitive binding between estradiol in the sample and estradiol-horseradish peroxidase (enzyme-labeled estradiol) for a constant amount of rabbit anti-estradiol. The absorbance is measured by ELISA reader at 450 nm and the colour intensity was inversely related to the estradiol concentration of the sample.

E17-β levels were estimated as follows:-

1. Secure the desired number of coated wells in the holder.
2. Dispense 25 µl of standards, specimens and controls into appropriate wells.
3. Dispense 50 µl of rabbit anti-estradiol (E2) reagent to each well.
4. Dispense 100 µl of estradiol-HRP conjugate reagent into each well.
5. Thoroughly mix for 30 seconds.
6. Incubate at room temperature (18-25 ºC) for 90 minutes.
7. Rinse and flick the micro wells 5 times with washing buffer (1x).
8. Dispense 100 µl of TMB reagent into each well. Gently mix for 10 seconds.
9. Incubate at room temperature (18-25 ºC) for 20 minutes.
10. Stop the reaction by adding100 µl of stop solution to each well.
11. Gently mix for 30 sec. it is important to make sure that all the blue color changes to yellow color completely.
12. Read absorbance at 450 nm with a micro titer well reader within 15 minutes.

3-3-2-2- Progesterone (p4):

Serum progesterone levels were assayed using kits as described by **Tietz (1995)**.

- Principle: -

The assay depends on competition of the sample progesterone and horseradish peroxidase-progesterone (enzyme-labeled progesterone) for binding on the limited number of anti-progesterone sites on the micro plates. The absorbance is measured by ELISA reader at 450 nm and the color intensity was inversely related to the progesterone concentration of the sample.

P4 was measured by using an Enzyme Linked Immuno-Sorbant Assay (ELIZA) kit (Cat. No.: BC-111, from BioCheck, Inc, Foster City). The following steps were conducted as:

1. Secure the desired number of coated wells in the holder.
2. Dispense 25µl of each calibrator, control serum or specimen with new disposable tips into appropriate well.
3. Dispense 100µl of working progesterone-HRP conjugate reagent into each well.
4. Dispense 50µl of rabbit anti progesterone reagent into each well.
5. Thoroughly mix for 30 seconds. It is very important to mix them completely.
6. Incubate at room temperature (18-25 ºC) For 90 minutes.
7. Rinse and flick the micro wells 5times with distilled or deionized water.
8. Dispense 100µl of TMB reagent into each well. Gently mix for 10 seconds.
9. Incubate at room temperature (18-25ºC) for 20 minutes.
10. Stop the reaction by adding 100µl of stops solution to each well.
11. Gently mix for 30 seconds. It is important to make sure that all the blue color changes to yellow color completely.
12. Read the absorbance on the micro plate reader at 450 nm within 15 minutes.

3-3-2-3-Triiodothyronine (T3) assay:

Serum T3 levels were assayed using kits purchased from immunespec, Germany according to (Hoffenberg, 1978).

Assay procedure

1. Secure the desired number of coated wells in the holder make data sheet with sample identification.
2. Dispense 100 µl of standards, specimens and controls into appropriate wells.
3. Thoroughly mix for 10 seconds, and then Dispense 100 µl of enzyme - conjugate reagent into each well.
4. Thoroughly mix for 30 seconds. It is important to have a complete mixing in this step.
5. Incubate at room temperature (18-25 ºC) for 60 minutes.
6. Remove the incubation mixture by flicking plate contents into a waste container.
7. Rinse and flick the micro wells 5times with washing buffer (1x).
8. Strike the wells sharply onto absorbent paper to remove residual water droplets.
9. Dispense 100 µl of TMB reagent into each well. Gently mix for 5 seconds.
10. Stop the reaction by adding100 µl of stop solution to each well.
11. Gently mix for 15 seconds.
12. Read absorbance at 450 nm on the micro plate reader within 15 minute.

3-3-2-4- Thyroxine (T4) assay:

Serum T4 levels were assayed using kits purchased from immunespec, Germany according to **Schuurs (1977)**.

Assay procedure:

1. Secure the desired number of coated well in the holder make data sheet with sample identification.
2. Dispense 50 µl of standards, specimens and controls into appropriate wells.
3. Dispense 100 µl of enzyme - conjugate reagent into each well.
4. Thoroughly mix for 30 seconds. It is important to have a complete mixing in this step.
5. Incubate at room temperature (18-25 ºC) for 60 minutes.
6. Remove the incubation mixture by flicking plate contents into a waste container.
7. Rinse and flick the micro wells 5times with washing buffer (1x).
8. Strike the wells sharply onto absorbent paper to remove residual water droplets.
9. Dispense 100 µl of TMB reagent into each well. Gently mix for 5 seconds.
10. Incubate at room temperature (18-25 ºC) for 20 min without shaking.
11. Stop the reaction by adding100 µl of stop solution to each well.
12. Gently mix for 5 seconds.
13. Read absorbance at 450 nm on the micro plate reader within 15 minutes.

3-3-3- The Main Elements:

The concentrations of Selenium, Calcium, Magnesium Phosphorus and Zinc in serum were measured using ELISA micro wells procedures.

3-3-3-1- Calcium:

Procedure:

Rinse test tubes before use with working reagent if necessary.

Working reagent: Mix one volume of reagent 2 with one volume of reagent 3 befor use.			
Pipette into test tubes (Free of CALCIUM)			
	Blank (ml)	Standard (ml)	Sample (ml)
Sample	-	-	0.02
Standard (R1)	-	0.02	-
Working reagent	1.0	1.0	1.0

Mix well; wait 5 min. at room temperature. Read the absorbance of the sample (A_{sample}) and the standard ($A_{standard}$) against blank at 585 nm. (575-590).The color is stable for at least 60 min. Linearity up to 20 mg/dl.

Calculation:

Calcium Concentration = $\frac{\text{A sample}}{\text{A standard}}$ * Standard Concentration.

Quality control:

For accuracy and reproducibility control:-

Assayed multi-Sera, Normal and Elevated

References:

Gindler M. King J.D.(1972): Am. J. Clin. Path. 58, 376.

3-3-3-2- Phosphorus:

Dilute reagent 3, 100 times immediately befor use (0.1 ml +10.0 ml dist water). Pipette into test tubes (PHOSPHORUS- FREE):

	Blank (ml)	Standard (ml)	Sample (ml)
Standard	-	0.025	-
Sample	-	-	0.025
Reagent	1.0	1.0	1.0
Mix, then add			
	0.1	0.1	0.1

Mix well; let stand for 10 min at 37°C. Read the absorbance of the sample (A_{sample}) and the standard ($A_{standard}$) against blank at 640 nm (630-650). Color stable for one hour. Linearity up to15mg/dl.

Calculation:

Phosphorus Concentration in serum or plasma

$$= \frac{\text{A sample}}{\text{A standard}} * \text{Standard Conc.}$$

Quality control:

For accuracy and reproducibility control:-

Assayed multi-Sera, Normal and Elevated

References:

El-Merzabani.M.M.;El-Aaser.A.A. and Zakhary, N.I.(1977).J.Clin. Chem. Clin. Biochem. 15: 715-718.

3-3-3-3- Magnesium:

Procedure:

Working reagent:

Mix equal volumes of Dye 2 and Buffer 3. Immediately befor use.

The use of disposable tubes in recommended. Glassware should be rinsed with dilute hydrochloric acid and rinsed with distlled water

	Reagent Blank (ml)	Standard (ml)	Sample (ml)
Working Reagent	1.0	1.0	1.0
Distilled water	0.02	-	-
Standard	-	0.02	-
Sample	-	-	0.02

Mix, incubate for two min. at room temperature and read the absorbance of the sample (A_{sample}) and the standard ($A_{standard}$) at 520 nm, against the reagent blank within 30 min. The method is linear up to 2.67mmol/l (6.49 mg/dl). Samples with higher concentrations should be diluted 1+1 with redistilled water and reassayed. Multiply the result by 2.

Calculation:

Magnesium Concentration (mg/dl) = $\frac{\text{A sample}}{\text{A standard}} * 2.43$

Quality control:

For accuracy and reproducibility control:-

Assayed multi-Sera, Normal and Elevated

References:

1- Grinder et al, Clin. Chem.(1970): 17;662

2- Teitz N.W. Clinical Guide to Laboratory Tests. W.B. Saunders Co. (1983).

3-3-3-4- Zinc:

Procedure:

Pipette into test tubes (free of Zinc)

	Blank (ml)	Standard (ml)	Sample (ml)
Distilled water	0.5	-	-
Standard (R1)	-	0.5	-
Sample	-	-	0.5
Buffer (R2)	0.5	0.5	0.5
Chromogen (R3)	0.5	0.5	0.5

Mix, incubate for 10 min. at 25C^{o}. Measure the absorbance of standard ($A_{standard}$) and sample (A_{sample}) against the reagent blank at 610 nm(660-620 nm), within 15 minutes. Linear up to 153µmol/l (1000 µg/dl).

Calculation:

Zinc in sample (µg/dl). $= \frac{\text{A sample}}{\text{A standard}} * \text{Standard Conc.}$

Notes:

1- All glassware must be immersed in dilute HCL or dilute HNO_3 and then rinsed in DDH_2O.

2- Rubber cap of Commercial Control serum or Sample tube can be a cause of Zinc contamination.

Quality control:

For accuracy and reproducibility control:-

Assayed multi-Sera, Normal and Elevated

References:

Hayakawa R.Jap J.Taxic Environ. Health 8, 14-18 (1961).

3-4- Statistical Analysis:

For Statistical analysis using the Statistical Package for Social Sciences program (SPSS software, version 11). The Questionnaire data were analyzed mainly in the form of Descriptive Statistics for means and Chi-square test was used to significantly difference and also T. test was used to compare means, STD error. Independent samples T. test was used to analyze the blood biochemical, hormonal assay and minerals and one way ANOVA test was used to significant difference between means of pregnancy stages within group.

Chapter Four

Results

The data through questionnaire has disclosed results that revealed the effects of the management system on the reproductive efficiency, calf mortality & embryonic losses in Sudanese camel as following:

4-1.General Information:

4-1-1.Age of owner:

The data in table (1) revealed that the majority of camel herd owner's are mature and more than 40 yearsof age. The Percentage of owner less than 40years were 17.6%, 26.1% in the intensive and nomadic system respectively, while those who were 40 years and over were 82.4% and 73.9% in the two system respectively.

4-1-2. Level of education:

Statistical analysis by Chi.α showed that there was highly significant different in level of education between owners of herds in the two system. In nomadic majority of them were illiterate (82.6%) and followed by those who were complete Primary & Secondary (8.7% for both), while there is no university graduated. On the other hand illiterate owners in intensive system were very few (5.9%) and most of them were educated and gradual from Khalwa (23.5%) to University (29.4%) as in the following table**.**

4-2.Information about Herd:

4-2-1. Herd Size:

The result of study displays that high percentage of herd size in the Nomadic system 87% of owners have more than 50head and 13% of them have less than 50 head. But in intensive system herd size divided near halve recorded 58.8% for more than 50head and 41.2% for 20-50 head. Depend on Chi.α there is significant different between systems, table (1) showing that.

4-2-2. Breeds of camel

Arabian camel breeds compose the majority of camel populationin the Sudan. It represents (78%) In nomadic system followed Anafi then Rashaidy. Also In intensive system (41.2%) Arabi followed Anafi and Bushari then Rashaidy as in table (1). The result reflecting the Arabi breed is preferable among the owner in Sudan.

4-2-3. Number of Female and Male in herd:

In this survey, the number of female recorded higher percentage (65.2%) of herd more than 40 heads in nomadic system than in intensive system (52.9%). Whereas the number of male in herds of camel in both systems were different between one to three heads 52.9%, 52.2% and 35.3%, 47.8% and 11.8%, 0.0% for1 head, 2-3 head and more than 3 head for intensive and nomadic system respectively. The most herds of camel in both systems are involved only one male camel as in a table below.

Table No (1) Herd General Information

Items	Parameters		Management system		Sig*
			Intensive	Nomadic	
Age of owner (%)	20-40 years		17.6	26.1	
	More than 40 years		82.4	73.9	NS
Level of education (%)	Illiterate		5.9	82.6	.000[a]
	Khalwa		23.5	-	
	Primary		29.4	8.7	
	Secondary		11.8	8.7	
	University		29.4	-	
Herd Size (%)	20-50 head		41.2	13.0	.04[b]
	More than 50 head		58.8	87.0	
Breeds of camel (%)	Anafi		17.6	4.3	-
	Arabian		41.2	78.3	
	Rashaidy		-	4.3	
	Arabi + Anafi		11.8	13.0	
	Arabi + Rashaidy		11.8	-	
	Arabi + Bishari		17.6	-	
Sex ratio (%)	Female	15-40 head	47.1	34.8	NS
		More than 40 head	52.9	65.2	
	Male	1 head	52.9	52.2	NS
		2-3 head	35.3	47.8	
		More than 3 head	11.8	-	
Herd take care (%)	Owner		29.4	100	.000[c]
	Hired person		70.6	-	

** Sig at 1%. Chi.α= 26.175[a] & 23.193[c,] respectively

* Sig at 5%. Chi.α=4.126[b]

4-2-4. Breeding system and Purpose of breeding

The data in table (2) showed that the majority of camel herders and owners (73.9%) are adapted to Semi-nomadic management system in Butana region followed by Nomadic system(26.1%),whereas in Khartoum state representing Semi-intensive and Intensive management system 64.7% and 35.3% respectively with significant affects.

This survey is display that (100%) all camel owners in nomadic system inherited the herd from parents and they have commitment to generations Table (2). While in intensive system the majority of owner (76.5%) used camel for Trading & profit, some owners (17.6%) used it for living hood and few (5.9%) for research.

Table No (2) Breeding system and Purpose of breeding

Management system	Breeding system (%)				Sig**	Purpose of breeding (%)				Sig**
	Intensive	Semi-intensive	Nomadic	Semi-nomadic		Trading & profit	Living hood	Research	Inherited job	
Intensive	35.3	64.7	-	-	.000	76.5	17.6	5.9	-	.000
Nomadic	-	-	26.1	73.9		-	-	-	100.0	

* Sig at 1%. Chi.α= 40 for both

4-2-5. Sources of Nutrition & herder management:

Table (3) illustrates that in nomadic system the majority (91.3%) camels depend grazing on natural pasture (range grazing) &fodders from Rain fed agriculture and few herds (8.7%) of camel depend completely on grazing from natural pasture. While that in intensive system some (58.8%) herds depend in their feeding on pasture+ fodders + concentrate and others (35.3%) depend completely on fodders+ concentrate without grazing. And few of them (5.9%) depend on pasture + fodders.

Table No (3) Sources of Nutrition

Management system	Sources of Nutrition (%)				Sig*
	Browsing	Browsing & Fodders	Browsing & fodders& concentrate	Fodder & Concentrate	
Intensive	0	5.9	58.8	35.3	[a] .000
Nomadic	8.7	91.3	0	0	

* Sig at 1%. Chi.α= 36.094[a] & 23.193[b,] respectively

4-2-6. Herd Structure:

The result revealed that there is no difference between two systems in total herd structure 83± 10.66, 87± 10.83 heads, the number of newborn 16± 2.26, 13± 1.34heads, number between 1-4 years24± 4.50, 20± 2.57, number of Female more than 4 years 41± 5.09, 53± 7.62 heads and number of male more than 4 years2± 0.34, 2± 0.14heads in intensive and nomadic system sequentially as in a table below.

Table No (4) Herd Structure

Items	Management system	Minimum	Maximum	Mean ± Std.Error	Sig^{NS}
Total herd (head)	**Intensive**	25	176	83± 10.66	0.798
	Nomadic	41	282	87± 10.83	
Number of newborn	**Intensive**	3	40	16± 2.26	0.192
	Nomadic	4	28	13± 1.34	
Calf No between 1-4 years	**Intensive**	5	72	24± 4.50	0.420
	Nomadic	8	60	20± 2.57	
No of Female more than 4 years	**Intensive**	15	75	41± 5.09	0.228
	Nomadic	20	200	53± 7.62	
No of Male more than 4 years	**Intensive**	1	5	2± 0.34	0.113
	Nomadic	1	3	2± 0.14	

NS: No Significant

4-3. Management:

4-3-1. Mortality:

Table (6) illustrates the mortality occurs in all herds of nomadic system (100%), whereas intensive system some herders have no mortality in their herds (23.5%) but the majority have (76.5%) with different significant ($P \leq 0.05$).

4-3-1-1- Group mortality in the herd:

The results of the current study revealed that the majority of mortality occurs in small ages followed by old ages in both systems intensive and nomadic system sequentially (58.8% and 91.3%) small

ages, (11.8% and 8.7%) old ages and (5.9% and 0.0%) for both small & old ages with different significance (P≤ 0.05)., as in table (5) below.

4-3-1-2- Number of Mortality:

As in table (5) there is a high significant (P ≤ 0.01) deference in number of mortality in herds/year between two systems it was10± 1.396 head/ year in nomadic system and 3± 0.468 head/year in intensive system. This may be related to high mortality in new born 7± 1.219 head/year in nomadic system and 3± 0.4445 head/year in intensive system with significant (P≤ 0.05).Also there is a high significant deference (P≤ 0.01) in number of mortality in adult it was 3± 0.294head /year in nomadic system and 1± 0.317head/year in intensive system .

Table No (5) number of mortality in different ages

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig**
No of mortality in adult/year	**Intensive**	0	4	1± 0.317	.001
	Nomadic	0	6	3± 0.294	
No of mortality in new borns /year	**Intensive**	0	6	3± 0.445	.02
	Nomadic	1	31	7± 1.219	
No of mortality in Herd/year	**Intensive**	0	6	3± 0.468	.000
	Nomadic	3	37	10± 1.396	

4-3-1-3- Reasons of Mortality:

4-3-1-3-1- General reasons of mortality:

The study revealed as in table (6) that there are many reasons cause mortality as follows: negligence or bad management, diarrhea, malnutrition, disease, high temperature, toxicity from range, unexpected mortality and Dystocia. In nomadic system as the majority of herders said diarrhea and disease reported the highest percentage (60.9% and 52.2%) followed by high temperature, toxicity From Range 13% for both and the lowest reason were bad management, malnutrition 4.3% for both. Also in intensive system as in nomadic system disease reported the highest

percentage (35.3%) then flowed by Negligence (23.5%), toxicity From Range (17.6%), all diarrhea, malnutrition, Dystocia and high temperature were (11.8%) and unexpected mortality (5.9%).

Table No (6) Mortality

Items	Parameters	Management system		Sig*
		Intensive	Nomadic	
Mortality (%)	**Yes**	76.5	100	.01**
	No	23.5	0	
Group mortality (%)	**Small ages**	58.8	91.3	.042*
	Old ages	11.8	8.7	
	Both Small & old	5.9	0	
	No Mortality	23.5	0	
General reasons of Mortality (%)	**Diarrhoea**	11.8	60.9	-
	Disease	35.3	52.3	
	Toxicity From Range	17.6	13.0	
	High temperature	11.8	13	
	Malnutrition	11.8	0	
	Dystocia	11.8	0	
	Unexpected mortality	5.9	4.3	
	bad management	23.5	4.3	

* Sig at 5%. Chi.α= 8.187

** Sig at 1%. Chi.α= 6.013

4-3-1-3-2- Reasons of Mortality in different ages:

Table No (7) reasons cause mortality in different ages as follows: negligence or bad management, diarrhea, malnutrition, disease, high temperature, toxicity From Range, unexpected mortality and Dystocia.

Owners who said that the mortality only occurs in older ages the reasons as follows: in intensive system where the highest proportion disease (23.5%) followed by toxicity from Range (17.6%) then Dystocia and unexpected mortality both was (5.9%). Also in nomadic system disease recorded the highest proportion (43.5%) followed by toxicity

from Browsing (13%) then high temperature and unexpected mortality both was (4.3%).

Owners who said that the mortality only occurs in smaller ages the reasons as follows: in intensive system where the highest proportion malnutrition (35.3%) followed by negligence and diarrhea both were (23.5%) then disease (17.6%) then high temperature (11.8%) and last unexpected mortality and Dystocia both was (5.9%). But in nomadic system diarrhea recorded the highest proportion (82.6 %) followed by negligence (13%) then high temperature, disease and malnutrition all of them were (4.3%).

Owners whom said that the mortality occurs in older and smaller ages together the reasons as follows: in intensive system where the highest proportion disease (17.6%) followed by malnutrition (5.9%), also in nomadic system just disease (39.1%).

Table No (7) Percentage of Reasons of Mortality in different ages:

Reasons	Age period of Animal	Management system			
		Intensive		Nomadic	
		(%)	Total (%)	(%)	Total (%)
Disease (%)	Adult	23.5	58.8	43.5	87
	Small	17.6		4.3	
	Both Adult and Small	17.6		39.1	
Malnutrition (%)	Adult	-	41.2	-	4.3
	Small	35.3		4.3	
	Both Adult and Small	5.9		-	
Dystocia (%)	Adult	5.9	11.8	-	0
	Small	5.9		-	
	Both Adult and Small	-		-	
Negligence (%)	Adult	-	23.5	-	13
	Small	23.5		13	
	Both Adult and Small	-		-	
Unexpected mortality (%)	Adult	5.9	11.8	4.3	4.3
	Small	5.9		-	
	Both Adult and Small	-		-	
Toxicity From Range (%)	Adult	17.6	17.6	13	13
	Small	-		-	
	Both Adult and Small	-		-	
Diarrhoea (%)	Adult	-	23.5	-	82.6
	Small	23.5		82.6	
	Both Adult and Small	-		-	
High temperature (%)	Adult	-	11.8	4.3	8.7
	Small	11.8		**4.3**	
	Both Adult and Small	-		**-**	

4-3-1-4- Age period of mortality in calves:

Data in table (8) showed that the mortality occurred more through the first three weeks both in two systems; however in nomadic system mortality continues until after one year, but in intensive system mortality decreases after the first three weeks and little occurred after one year.

Table No (8) Age period of mortality in calves

Items	Age period	Management system	
		Intensive	Nomadic
Age period of mortality in calves	Week1	52.9	43.5
	Week2	35.3	47.8
	Week3	11.8	34.8
	Week4	0	47.8
	Month2	0	34.8
	Month3	0	13
	Month4-6	0	8.7
	After 1 year	5.9	4.3

4-3-1-5- Percentage of calves' mortality per year:

In the table below the results of study revealed that the highest proportion of herders (56.5%) mentioned more than 5% of calve mortality ratio of herd in nomadic system. While the highest of herders (70.6%) reported the ratio of mortality ranged 1-5% of herds in intensive system, with very high significance (P≤ 0.01).

Table No (9) Percentage of Calves mortality per year

Management system	Calves mortality per year (%)			Chi	
	None	1-5%	More than 5%	Value	Sig**
Intensive	29.4	70.6	-	17.680	.000
Nomadic	-	43.5	56.5		

** Sig at 1%.

4-3-1-6- Causes of Calf's mortality:

The study revealed there are a variety of reasons have a role in the calves' mortality in nomadic system diarrhea and diseases have the largest quota, they were 91.3% and 56.5% respectively followed by High temperature 26.1% and then Tick, Negligence and Weak born all of them were 8.7% and the last one was Quantity of suckling 4.3%. Also in intensive as in nomadic system diarrhoea recorded the highest percentage

41.2% followed by Quantity of suckling 29.4%, then malnutrition, weak born and disease were 23.5% after that negligence and high temperature were 11.8 and Ticks was the last one 5.9%. It was observed that diarrhea and disease are considered the biggest problem facing calves.

Table No (10) Causes of Mortality in Calves

Reason	Intensive	Nomadic
Disease (%)	23.5	56.5
Diarrhoea (%)	41.2	91.3
Tick (%)	5.9	8.7
High temperature (%)	11.8	26.1
Weak born	23.5	8.7
Quantity of suckling milk	29.4	4.3
Malnutrition (%)	23.5	-
Negligence (%)	11.8	8.7

4-3-2-Number of milking per day:

The data in table (11-A) projected that no significant different between the two systems. The overall mean number of milking per day was 2.35±.931, 2.61±.583 times in Khartoum semi intensive system and 2.61±.583 times in Butana regions nomadic system. Also the particulars in table (11-B) portrayed that there was no significantly effects between regions in number of milking per day.

Table No (11-A) number of milking/day in the two systems:

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig^{ns}
Number of milking / day	**Intensive**	1	3	2.35±.931	.293
	Nomadic	1	3	2.61±.583	

NS: Not significant

Table No (11-B) the percentage number of milking per day

Management System	No of milking/day percentage (%)			Sig
	Once	Twice	Three time	
Intensive	11.8	58.8	29.4	.135^{NS}
Nomadic	4.3	34.8	60.9	

4-3-3.Milk production:

The data in table (12) projected that there were no significant different (p>0.05) between the two systems. The overall mean milk production per day was 6.53± .631 liters in intensive system and 6.48± .332 liters in nomadic system and this revealed that she-camels under intensive and semi-intensive systems produce more milk (P>0.05) than the traditional system. It was observed that improving management increased milk yield

Table No (12) milk production per day/liter in the two systems:

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig
milk production per day/Liter	**Intensive**	4	12	6.53± .631	.94 ^{NS}
	Nomadic	4	11	6.48± .332	

*: significant (p≤0.05)

4-3-4- Lactation period:

The data in table (13) projected that significant different (p≤0.05) between the two systems. The overall lactation period was 9.29±2.201months in intensive system and 11.83±3.822 month in nomadic system

Table (13) lactation Length in the two systems/ month:

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig*
Lactation period:	**Intensive**	5	12	9.29±2.201	.019
	Nomadic	5	18	11.83±3.822	

*: significant (p≤0.05)

4-3-5. Colostrums:

Majority of camel herders in intensive and nomadic system respectively (100% and 91.3%) allows newborns suckling colostrums directly after birth. And before allows them suckling herders eliminated the colostrums because respondent confirmed it may cause disturbance, as in the table (14)**.**

The duration of colostrums in intensive system were 5-6 days (52.9% of herd), more than 6 days (41.2% of herd) and 3-4 days (5.9%of herd).but in nomadic system were 3-4days (60.9% of herd), 5-6 days (21.7% of herd) and more than 6 days (17.4% of herd).

Table No (14) Colostrums

Items	Parameters	Management system		Sig*
		Intensive	Nomadic	
Suckling Colostrums directly after birth (%)	Yes	100	91.3	NS
	No	-	8.7	
Duration of colostrums nutrition (%)	3-4 days	5.9	60.9	.002**[a]
	5-6 days	52.9	21.7	
	More than 6days	41.2	17.4	
Elimination or milking some of colostrums	Yes	70.6	100	.005**[b]
	No	29.4	0	

** Sig at 1%. Chi.α= 12.914[a] and 7.731[b]

4-3-6. Suckling of Calves:

Majority of camel herders in intensive and nomadic system respectively (76.5% and 69.6%) allows newborns suckling without preventing them, and little (23.5% and 30.4%) allows them suckling during specific time. Also the majority (70.6% and 69.6%) of camel herders mentioned there is relation between Mortality of newborn from more or little suckling, higher percentage (66.7% and 87.5%) from this

relation due to large quantity and some (25% and 6.3%) of them mentioned that it is due the little suckling.

Table No (15) Suckling of Calves

Management system	Suckling without prevent (%)		Relation between Mortality of newborn from more or little suckling (%)		Reasons of Mortality from more or little suckling (%)		
	Yes	No	Yes	No	few quantity	large quantity	More & Less quantity
Intensive	76.5	23.5	70.6	29.4	25	66.7	8.3
Nomadic	69.6	30.4	69.6	30.4	6.3	87.5	6.3

4-3-7. Herd feeding:

In nomadic system all interviewees (100%) mentioned that the camel grazing all day and depend completely in their feeding on grazing from Browsing, contradictory with the intensive system some (58.8%) of them feeding camel twice per day and others (41.2%) once with grazing from Browsing in the morning.

Table No (16) Feeding the herd during the day

Management system	Time No of feeding (%)			Chi	
	Once	Twice	All day	Value	Sig**
Intensive	41.2	58.8	-	40.000	.000
Nomadic	-	-	100		

4-3-8.Care for pregnant

As in table (17) there is very high significance difference (P≤ 0.00) between two systems, in intensive system founded there are high nutritional care for pregnant, in contrast with nomadic system there are low nutritional care for pregnant and little(13%) of herders have care nutrition. and this care is as follows:

Herders in intensive system majority (76.9%) of them care by good nutrition, and some (15.4%) by Prevented from grazing in the early months of pregnancy and few (7.7%) by Prevented from grazing in the last months of pregnancy, but in nomadic system herders were equal (33.3%)on the three ways and no significant difference between two systems.

Table No (17) Nutritional Care for pregnant

Management system	Nutritional care (%)		Sig**	How do you care about pregnant (%)			Sig
	Yes	No		Good Nutrition	Prevented from grazing in the early months of pregnancy	Prevented from grazing in the last months of pregnancy	
Intensive	76.5	23.5	.000	76.9	15.4	7.7	.305 NS
Nomadic	13	87		33.3	33.3	33.3	

** Sig at 1%. Chi.α= 16.385[b]

4-3-9. place for calving:

The study revealed that there is no specific place for calving in nomadic system (100%) also in intensive system the majority(76.5%) haven't, but some (23.5%) have with significance difference (P≤ 0.05) .

Table No (18) Specific place for calving

Management system	Specific place (%)		Chi.α	
	Yes	**No**	**Value**	**Sig***
Intensive	23.5	76.5	6.013[a]	.014
Nomadic	-	100		

* Sig at 5%

4-3-10. Handling the female during and after calving:

As in the table (19) below there is no difference between two systems for dealing with the female during and after calving, some (17.6% , 4.3%) have good nutrition and other (23.5% , 43.5%) just make

observation only, some (35.3%, 8.7%) observed & well fed and others(23.5% , 43.5%) do not have any care, in intensive and nomadic system respectively.

Table No (19) Handling the female during and after calving

Management system	Handling the female (%)				Chi.α	
	Good nutrition	Observant only	Observant & well fed	Does not have a care	Value	Sig
Intensive	17.6	23.5	35.3	23.5	7.410	.06 NS
Nomadic	4.3	43.5	8.7	43.5		

4-3-11. Care about newborn:

There in no significance different between two systems about newborn care, the majority (70.6%, 87%) in the two immediately stimulated the newborns to suckling and some (11.8%, 13%) protected it's from the direct heat of the sun respectively in intensive and nomadic system. Furthermore in intensive system some (17.6%) doesn't have a care for newborns.

Table No (20) Care about newborn

Management system	Newborn care (%)			Chi.α	
	Stimulated to suckling	Does not have a care	protected from direct heat of sun	Value	Sig
Intensive	70.6	17.6	11.8	4.399	.111 NS
Nomadic	87	-	13		

4-3-12. Culling the female and male from herd:

4-3-12-1. Female Culling:

Majority (52.9% and 36.4%) of herders mentioned that the female exclusion from herd at the age of 23-26 years, some (23.5% and 27.3%) at the age of 19-22 years and little (23.5% and 9.1%) at the age of 15-18 years in intensive and nomadic system respectively. Furthermore in

nomadic some (27.3) herder do not isolate until mortality. They isolate due to old age, weak production& fertility and necessity with high significance difference (P≤ 0.01) and the table below illustrate that. Hence 100% of owner in intensive system using sales as away to isolate, also in nomadic system majority (72.7%) of owners follow the same way, but some (27.3%) do not isolate it from herd until die.

Table No (21) Culled the female from herd

Variables	Sub- Variable	Mean of Variable %		Chi.α	
		Intensive	Nomadic	Value	Sig*
Female age (%)	15-18 year	23.5	9.1	6.593	.086 NS
	19-22 year	23.5	27.3		
	23-26 year	52.9	36.4		
	Do not isolate even mortality	-	27.3		
Reason of cull female (%)	Old age, weak production and fertility	100	45.5	13.394	.001
	Necessity	-	27.3		
	Do not isolate from herd	-	27.3		
Way of cull (%)	Sales	100	72.7	5.479	.019
	Do not isolate from herd	-	27.3		

4-3-12-2. Male Culling:

Majority (50%) of herders mentioned that the male exclusion from herd at the age of 21-25years, some (43.8%) at the age of 16-20 years and little (6.3%) at the age of 10-15 years in intensive system, in contrast, with nomadic system majority (56.5%) of herders exclude the male from herd at the age of 16-20 years, some (26.1%) at the age of 21-25 years and little (17.4%) at the age of 10-15 years. They isolate due to old age, weak production& fertility, necessity, Presence of best male, disease and change the purpose of breeding(e.g: for racing or meat) and some do not

isolate it from herd until die, with no significance difference (P≥ 0.05) and the percentage as in the table below.

Table No (22) Culled the male from herd

Variables	Sub- Variable	% Mean of Variable		Sig
		Intensive	Nomadic	
Male age (%)	10-15 year	6.3	17.4	.256^{NS}
	16-20 year	43.8	56.5	
	21-25 year	50	26.1	
Reason of cull male	Old age, weak production and fertility	73.9	76.5	.494^{NS}
	Necessity	8.7	-	
	Not isolate from herd	4.3	-	
	Present best male	8.7	5.9	
	Change the Purpose of breeding	4.3	11.8	
	Disease	-	5.9	

4-4.Reproductive measurement

4-4-1. Breeding season:

The highest percentage (76.5% in intensive system and 78.3% in nomadic system) of respondent confirmed that the breeding season start in rainy season (June to October) although some mentioned that all over the year. On the other hand end of the season also there are different views in two systems, majority in intensive system at the beginning of the summer and some in intensive (23.5%) and nomadic (21.7%) systems mentioned never end, but conflicting results found were in nomadic system (30.7%) that the season end at the end of winter. Table (23) illustrates that.

Table No (23) The breeding season

management system	Breeding season start (%)		Breeding season end (%)					Sig
	Rainy season (June-October)	All the year	End of Autumn	Beginning of Winter	End of Winter	Beginning of Summer	Never end	
Intensive	76.5	23.5	-	-	17.6	58.8	23.5	
Nomadic	78.3	21.7	13	13	30.4	21.7	21.7	.07^{NS}

4-4-2. Puberty age of the male and female camel:

The results of current study revealed that the near half (58.8% in intensive system and 47.8%in nomadic system) of female camel is attending puberty age less than three years and some of them at 3-4years.but the males ranged between 3-4 and more than 4years and there are no significant difference between the two systems in puberty age for both male and female camels as in table (24) below.

Table No (24) The Puberty age in Camels

management system	Female (%)			Sig	Male (%)			Sig
	less than 3 years	3-4 years	more than 4 years		less than 3 years	3-4 years	more than 4 years	
Intensive	58.8	41.2	0.0	.424^{NS}	17.6	52.9	29.4	**.065^{NS}**
Nomadic	47.8	43.5	8.7		4.3	30.4	65.2	

4-4-2-1. Puberty age of the male/year:

The results of current study revealed that no significant differences (P≥ 0.05) between the two systems. The overall mean Puberty age of the male per year was 3.93± .785 years and 3.85± .279 years in Intensive and Nomadic management system respectively

Table No (25) Puberty age of male camel/year under two systems:

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig^{ns}
Puberty age of the male/year	**Intensive**	3	5	3.93±.785	.647
	Nomadic	3	4	3.85±.279	

NS: Not significant

4-4-2-2. Puberty age of the she camel/year:

The data in table (26) projected that there is no significant difference (p>0.05) between the two systems. The overall mean Puberty age of the she camel per years was 3.12±.574 years in intensive system and 3.37±.376 years in nomadic system.

Table (26) Puberty age of She-camel in the two systems:

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig*
Puberty age of the She Camel / year	**Intensive**	2	4	3.12±.574	.102
	Nomadic	3	4	3.37±.376	

NS: no significant (p≥0.05)

4-4-3. Age of camel at the first breeding season:

The results of current study revealed that the majority (64.7%) in intensive system and (56%) in nomadic system of female camel are attending puberty age at first breeding at 3-4 years in both systems, furthermore in intensive system some (23.5%) females are attending less than 3 years and little (11.8%) at 4-5 years this contrasted with nomadic system as some (39.1%) females are attending at 4-5 years and little (4.3%) less than 3 years with significant affects(P≤0.05), table (30)that.

On the other hand, age of male camel at the first breeding season showed that the differences among the two production systems. As shown in table (28)in intensive system the majority (64.7%) of male camel, are attending age at first breeding at 4-5 years, contrasted with nomadic system, the majority males are attending at age more than 5 years with significant deferent (P≤0.05).

Table No (27) Age at the first breeding season in the two systems:

Management system	Female age (%)			Sig*	Male age (%)			Sig**
	less than 3 years	3-4 years	4-5 years		less than 4 years	4-5 years	more than 5 years	
Intensive	23.5	64.7	11.8	.05	11.8	64.7	23.5	.017
Nomadic	4.3	56.5	39.1		-	34.8	65.2	

* Sig at 5%. Chi.α= 5.648

** Sig at 5%. Chi.α= 8.125

Table No (28) Age of female at the first breeding season in the two systems:

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig*
Age of female at first time of breeding season	**Intensive**	2	6	3.82±.883	.028
	Nomadic	3	5	4.35±.573	
Age of male at first time of breeding season	**Intensive**	3	6	4.81±.785	.05
	Nomadic	4	8	5.13±.694	

*: significant (p≤ 0.05)

4-4-4. Age of female at first calving:

The data in table (29) projected that a significant difference (p≤0.05) between the two systems, the overall mean Age of female at first calf per year was 4.94± 0.659, year in intensive system and 5.35± 0.473 years in nomadic system.

Table (29) Age of female at first calving

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig*
Age of female at first calving	**Intensive**	4	6	4.94±.659	.044
	Nomadic	4	6	5.35±.573	

*: significant (p≤0.05)

4-4-5. Number of Services/consumption:

There were no significant affect (P≥0.05) between the two systems in number of services per consumption, the overall mean was1.47±0.514, in intensive system and1.70±0.559 in nomadic system; table (30) showed that.

Table No (30) Service per conception in the two systems:

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig^{ns}
No of services per conception	**Intensive**	1	2	1.47±.514	.201
	Nomadic	1	3	1.70±.559	

NS: Not significant

4-4-6. Estrus cycle:

4-4-6-1. Duration of Estrus cycle

The results of this study showed there were no significant deferent (P≥0.05) between the two systems in the length of estrus cycle in Khartoum intensive system and Butana region nomadic system, they were 16.57± 1.812, 16.57± 1.399 respectively as in the table below.

Table (31) Estrus cycle in camel

Variables	Management system	Minimum	Maximum	Mean± Std.Error	Sig
long time to return back to estrus period/day	**Intensive**	7	30	16.57± 1.812	.998
	Nomadic	7	30	16.57± 1.399	

4-4-6-2. Number of Estrus cycle during the season:

Table (32) illustrates the results of this study on number of estrus cycle during the season as there were no significant deferent (P≥0.05) between the two systems. The majority (47.1% in intensive system and 56.5% in nomadic system) of herds have 2-5 cycle during the season.

4-4-6-3. Duration of estrus period:

The overall mean of estrus period were 4.29± .513 day in intensive system and 7.09±0 .757 day in nomadic system with high significant difference, table (32).

Table No (32) NO of Estrus cycle during the season and Duration of estrus period

Management system	NO of estrus cycle (%)				Sig	Duration of estrus period/day			Sig
	One	2-5	5-8	More than 8		Minimum	Maximum	Mean± Std.Error	
Intensive	35.3	47.1	11.8	5.9	$.222^{NS}$	1	8	4.29± .513	.007
Nomadic	43.5	56.5	-	-		2	15	7.09± .757	

4-4-7. Reproductive age of female and male & number of litter for female:

There were high significance differences (P≤ 0.01) between the two systems in the average reproduction age of male and female camels were 20.35± 1.300 and 16.45± .772 for female and16.75± 1.101and 13.09± .647 for male in intensive and nomadic system respectively. Furthermore female camels had estimated on average, give 9.47± .412 and 8.27±.417 calves in her breeding life in intensive and nomadic system respectively.

Table No (33) Reproductive age of camel & number of litter for female

Variables	Management system	Minimum	Maximum	Mean± Std.Error	Sig
reproductive age of female/year	**Intensive**	12	27	20.35± 1.300	.01
	Nomadic	10	25	16.45± .772	
reproductive age of male/ year	**Intensive**	8	25	16.75± 1.101	.01
	Nomadic	10	20	13.09± .647	
number of litter for female	**Intensive**	7	14	9.47± .412	.052^{NS}
	Nomadic	5	12	8.27 ±.417	

4-4-8. No of Male for Females and the rate of pregnancies in the she camel:

The data in the table (34) indicate there is very high significant differece between two systems in percentage of number of Male: Female in herds, in intensive system majority (41.2%) of herders put 1 male: (15-20) female but in nomadic system majority (52.2%) of herders put 1 male: (25-30) female.

For pregnancy diagnosis 100% percentage of herders observed that the female camels rise up their tails as sign of pregnancy in both systems. Herders were able to detect pregnancy within 15 days after mating.

Table No (34) No of Male for Female & detect the pregnancy.

Management system	No of male to female for mate (%)				Sig	detect the pregnancy
	1: (15-20)	1: (25-30)	1: (40-50)	1: (60-70)		Raise up the tail (%)
Intensive	41.2	29.4	5.9	23.5	.001	100
Nomadic	17.4	52.2	21.7	8.7		100

** Sig at 1%. Chi.α= 18.036

4-4-9. Females return after mating & the reasons of return to estrus

In nomadic system all herders (100%) mentioned that they have a lot of females in their herds return to estrus after mating, majority(94.1%) of herders are also in intensive system have, but few of them answered negatively.

For the reasons that lead to return some female to estrus after mating were: weakness of the female, weakness of the male, malnutrition, reproductive problems in female, unknown reason. The last was the highest in systems, 68.8% and 78.3% in intensive and nomadic system respectively, as in the table (35).

Table No (35) Females return after mating & the reasons of return to estrus

Management system	Females return (%)		Reasons of return (%)					Sig
	Yes	No	Weakness of the female	Weakness of the male	Malnutrition	Reproductive problems in female	Unknown reason	
Intensive	94.1	5.9	6.3	6.3	6.3	12.5	68.8	.888^{NS}
Nomadic	100	-	8.7	4.3	4.3	4.3	78.3	

4-4-10. Gestation period :

Table (36) indicates that the overall mean of gestation period (GP) was 12.06±.059 and 12.13±.072months respectively in intensive and nomadic system. This trait was insignificantly (P≤ 0.05). On the other hand the open period showed that there was highly significant (P≤ 0.01) affects by the region. It was higher in nomadic system (10.09± .466) than intensive system (6.94± .769 month).

Table No (36) Gestation period / month

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig
Gestation period/ month	Intensive	12	13	12.06± .059	.46^{NS}
	Nomadic	12	13	12.13±.072	

4-4-11.Open period/day:

The data in table (37) illustrates that high significant difference (p≤0.01) between the two systems. The overall mean open period was 212.06±105.919 days in Khartoum intensive system and279.57±97.883 days in Butana regions nomadic system. Furthermore First Services after calving/month showed significant differences between the two systems was 6.94±0.769month in Khartoum state and 10.09±0.466 month in Butana region.

Table (37) Open period in the two systems:

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig*
Open period/day	Intensive	75	365	212.06±105.91	.044
	Nomadic	90	365	279.57±97.88	
First Services after calving /month	Intensive	3	12	6.94± .769	.001
	Nomadic	6	12	10.09± .466	

*: significant (p≤0.05)

4-4-12. Calving Interval:

The data in table (38) projected that significant difference (p≤0.01) between the two systems. The overall mean Calving Interval per months was 18.24±3.507 months in Khartoum (representing intensive system) and, 21.15±2.475 months in Butana regions (representing nomadic system).

Table (38) Calving interval in the two systems:

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig **
Calving Interval	**Intensive**	**11**	**24**	**18.24±3.507**	**.004**
	Nomadic	**15**	**24**	**21.15±2.475**	

**: high significant (p≤ 0.01)

4-4-13. **Season of calving**:

All pastoralists and majority (88.2%) of herders in intensive system mentioned that the calving occurs more in the autumn season, despite the fact that some (11.8%) have said it all year long.

Table No (39) Season of calving

Management system	Season of calving more occur (%)		Sig
	Autumn Season	All the year	
Intensive	88.2	11.8	.091^{NS}
Nomadic	100.0	-	

4-5. Age of calves at weaning:

The age of calve at weaning is highly different between the systems in this study, the overall weaning age more than 10 months. Also in intensive system there are some (35.3%) herders weaning calves at the age less than that, as in the following table.

Table No (40) Age of calve at weaning /month

Management system	Age of calve at weaning %			Sig**
	6-7 months	8-10 months	more than 10 months	
Intensive	35.3	11.8	52.9	.004
Nomadic	-	4.3	95.7	

** Sig at 1%. Chi.α= 11.135

4-5. Reasons of reduced reproductive efficiency:

4-5-1. Abortion:

Majority of herders in the two system mentioned that the abortion occurred in their herds and some answered negatively, as in table (41). Furthermore nomadic system recorded higher percentage in abortion more than in intensive system (P≤ 0.05) although the ratio 1-5% represented the vast majority of two system mortality, as in table (41).In intensive system more than half (53.8%) of herders mentioned that the abortion cases occurs at the beginning of pregnancy, some (30.8%) at the end of pregnancy and the other in middle pregnancy. But in nomadic system herders mentioned that the abortion cases occurs in equal proportions (45.5%) at the beginning and in the middle of pregnancy stages and little (9.1%) at the end.

Table No (41) Abortion

Management system	Abortion cases (%)		Abortion during the year (%)			Sig**	In which stage of gestation (%)			Sig
	Yes	No	None	1-5%	more than 5%		At the beginning	In the middle	At the end	
Intensive	76.5	23.5	29.4	70.6	0	.004	53.8	15.4	30.8	.105^{NS}
Nomadic	95.7	4.3	4.3	56.5	39.1		45.5	45.5	9.1	

** Sig at 1%. Chi.α=11.055

4-5-1-1. Abortion in she-camel during the season:

Majority of herders in two system mentioned that the abortion occurred in their herds and some answered negatively, as in table (42). Furthermore nomadic system recorded an average of 6.13± .636 head abortions in season more than in intensive system 1.53± .355 head. With high significance difference (P≤ 0.01).

Table No (42) No of abortion in she-camel during the season

Items	Management system	Minimum	Maximum	Mean± Std.Error	Sig**
Abortion during the season	**Intensive**	0	5	1.53± .355	.000
	Nomadic	0	12	6.13± .636	

Sig at 1%.

4-5-1-2. Reasons of abortion:

Abortion is one of the factors that reduced reproduction in camel. Also it has been noticed that the biggest problems causing embryonic losses in Sudanese camel are slaughtering of females pregnancy as found in Slaughterhouse at Tumboul area, the mean Age of Foetus per month was 7.5±0.52months. The majority (75%) of slaughtered animals were females and more than half (52.38 %) of them were pregnant, the table bellow illustrate that.

Table (43) Loss of embryos in slaughterhouse at Tumboul area

Items	Minimum	Maximum	Mean± Std.Error
Age of Foetus /month	**3**	**11.5**	**7.5±0.52**
Percentage (%)			
Male slaughtered	**25%**		
Female slaughtered	**75%**		
Pregnant females from all slaughtered female	**52.38 %**		

**: high significant (p≤ 0.01)

Also as discovered in table (44) there are many reasons play a role in the incidence of abortion in she-camels such as: diseases (Brucellosis, Pneumonia), high temperature, stagnant or polluted water, drugs, frightening the female at the beginning of pregnancy stages , hit the whip, weakness of female, female down fall, changing male in herd, thirst, malnutrition, poisoning from Browsing, eating (Om Shemaila) worm and unknown causes, and the percentage of this reasons as in the following tables.

Table No (44) Reasons of abortion

Reason	Intensive	Nomadic
Brucellosis (%)	**23.5**	**4.3**
High temperature (%)	**5.9**	**17.6**
Weakness of female	**5.9**	**-**
Frightening (%)	**11.8**	**4.3**
Pneumonia (%)	**-**	**13.0**
Stagnant or polluted water (%)	**23.5**	**8.7**
Drugs (%)	**5.9**	**-**
Female down fall (%)	**11.8**	**-**
Changing male (%)	**5.9**	**17.6**
Hit the whip (%)	**11.8**	**4.3**
Thirst (%)	**4.3**	**23.5**
Om Shemaila worm (%)	**5.9**	**34.8**
Poisoning from Browsing (%)	**17.6**	**13**
Malnutrition (%)	**11.8**	**8.7**
Disease (%)	**23.5**	**34.8**
Unknown Cause (%)	**-**	**39.1**

4-5-1-3- The Diseases that cause the abortion.

The current study revealed that there are many reasons causing abortion. Brucellosis recorded the highest percentage in intensive system followed by Aljufar disease. But in nomadic system high percentage

(34.8%) of owner mentioned they do not know the reasons and some (30.4%, 17.4%, 13% and 4.3%) said caused by Aljufar, Om Shimaila Worm, Pneumonia and Brucellosis respectively.

Table No (45) Diseases that cause the abortion.

Management system	Disease (%)					Sig*
	Brucellosis	Aljufar	Pneumonia	Om Shimaila Worm	Unknown Reason	
Intensive	35.3	11.8	-	-	-	.014
Nomadic	4.3	30.4	13	17.4	34.8	

** Sig at 1%. Chi.α= 12.456[a]

4-5-2. Fertilization Rate

The results of current study revealed that in intensive system the majority (52.9%) of herders are fertilizing (50%) of females during the season and some (29.4) of them according to females available. In contrast with herders in nomadic system, majority (91.3%) of them according to females available, with very high significant difference (P≤ 0.01).

Table No (46) Fertilization rate:

Management system	No of fertilize female in the season (%)			Sig**
	All female	50% of females	Females are available	
Intensive	17.6	52.9	29.4	.000
Nomadic	-	8.7	91.3	

** Sig at 1%. Chi.α= 16.778

4-5-2-1. Conception rate & Calving rate:

The results of current study indicate high ability of male camel to fertilize great number (27± 3.600 in intensive and 33± 2.114 in nomadic) of female in breeding season with no difference between regions. Also found some females do not fertilize and rate of conceived females from the fertilized one were (23.56± 3.279, 28.39± 2.032) represent about 87%

and 86% in intensive and nomadic system respectively. However not all females give birth. This may be due to abortion at some of them, table (47) illustrate that.

Table No (47) Conception rate & Calving rate

Items	Region	Minimum	Maximum	Mean± Std.Error	Sig
No of fertilized female in the herd in season	**Intensive**	8	60	27± 3.600	NS
	Nomadic	15	60	33± 2.114	
Rate of conceived females from the fertilized one	**Intensive**	6	50	23.56± 3.279	NS
	Nomadic	12	57	28.39± 2.032	
No of calving from the conceived	**Intensive**	4	47	22.00± 3.225	NS
	Nomadic	7	54	22.26± 2.102	

4-5-3. Male ruts:

The table below revealed that there is high significant difference between two systems. In nomadic system duration of rutting males between 3-7 months, contrasted with Intensive system some (35.3%) males continue throughout the year except the summer period, and others (23.5%) throughout the year.

Table No (48) Duration of male ruts in the season

Management system	Duration of male ruts (%)				Chi.α	
	3-4 months	5-7 months	All the year except Summer	All the year	Value	Sig**
Intensive	35.3	5.9	35.3	23.5	18.176	.000
Nomadic	78.3	21.7	-	-		

** Sig at 1%.

4-5-4. Selection & Problems in fertility of male:

As in the table (49) in Khartoum state the majority owners prefer to select the male for breeding herd according to performance of his mother(52.9%) and purpose of breeding(23.5%), but in Butana region the majority owners prefer selection by morphology (43.5%) and

performance of his mother(34.8%) and little (21.7%) according to purpose of breeding.

On the other side it was found that in the two systems agreed upon that there was no problem in male fertility (94.1% and 91.3% in intensive and nomadic system respectively), nevertheless found different answers indicate the presence of fertility problem, and it is the lack of female fertilization. However there are problems facing the male during the season, such as: Aggressiveness & fighting with other males, weakness Browsing/ malnutrition, the large number of female and sudden illness.

Table No (49) Selection & Problems in fertility of male for herd

Variables	Sub- Variable	Mean of Variable		Sig
		Intensive	Nomadic	
Select the male for herd breeding (%)	Morphology	17.6	43.5	.248^{NS}
	Mother performance	52.9	34.8	
	Purpose of breeding	23.5	21.7	
	Breed	5.9	-	
Found problem in fertility of male (%)	Yes	5.9	8.7	.738^{NS}
	No	94.1	91.	
The problem in male fertility (%)	Do not fertilize the females	5.9	8.7	.738^{NS}
	No problems	94.1	91.	
The problem that face the males during the season (%)	Sudden illness	-	8.7	.094^{NS}
	Aggressiveness & fighting with other males	-	21.7	
	weakness Browsing/ malnutrition	4.3	-	
	The large number of female	5.9	8.7	
	No problems	89.8	60.8	

4-6. problems that face reproduction in camel:

All camel herders in nomadic system mentioned that the main obstacles facing them were shortage of veterinary services, lack of security, Taxes and shortage of Browsing &feeding and the majority of them mentioned that the shortage of Browsing &feeding are the main

problem of camels, in contrast with intensive system herder's just obstacles as shortage of Browsing & high feeding cost with very high significant effects.

Table No (50) The problems that face reproduction of camel in the area

Management system	Problems (%)			Chi.α	
	Shortage of Browsing & feeding	**No problem**	**All the problems** (Littleness of veterinary services - lack of security - Shortage of Browsing &feeding - Taxes)	**Value**	**Sig**
Intensive	47.1	52.9	-	40.0	.000
Nomadic			100		

Sig at 1%.

4-7. Recommendation & suggestion to improve the reproductive efficiency of camel:

Majority of camel herders in two systems mentioned that the good nutrition is the best way to improve the reproduction efficiency of camel. Furthermore in intensive system some herders added presence of the male with the herd and all this factors together. (Good nutrition+ Presence of the male with the herd +Veterinary care).

Table No (51) Recommendation & suggestion to improve the reproductive efficiency of camel

Management system	Recommendation & suggestion (%)			Sig
	Good nutrition	**Presence of the male with the Herd**	**All the Factors** (Good nutrition - Presence of the male with the Herd -Veterinary care)	
Intensive	88.2	5.9	5.9	$.241^{NS}$
Nomadic	100	-	-	

4-8. Blood biochemistry:

Blood biochemical of Sudanese camel were studied at different stages of pregnancy and determined some parameters such as Total Protein, Albumin, Globulin, Glucose, Total Bilirubin, Cholesterol, Urea

Concentration, Uric Acid and Creatinine. The means of results are presented in table (52).

Table No (52) Mean (±Std error) biochemical in serum of Sudanese camel under different systems

Items	Management System	Minimum	Maximum	Mean± Std.Error	Sig
Total Protein(g/dl)	**Intensive**	6.11	9.44	7.34±.124	.000
	Nomadic	6.66	10.28	8.39±.105	
Albumin(g/dl)	**Intensive**	1.72	4.13	3.16±.047	.003
	Nomadic	2.45	3.89	3.34±.034	
Globulin(g/dl)	**Intensive**	2.74	6.61	4.17±.125	.000
	Nomadic	3.56	7.27	5.05±.110	
Glucose (mg/dl)	**Intensive**	31.57	305.26	92.44±5.342	.527
	Nomadic	68.42	194.74	96.48±3.460	
Total Bilirubin(mg/dl)	**Intensive**	1.70	2.82	2.19±.352	.000
	Nomadic	1.89	3.07	2.43±.023	
Cholesterol (mg/dl)	**Intensive**	21.44	113.75	44.68±2.613	.002
	Nomadic	14.45	139.39	57.06±2.908	
Urea Concentration (mg/dl)	**Intensive**	2.26	5.52	4.51±.103	.000
	Nomadic	2.78	5.23	4.04±.083	
Uric Acid (mg/dl)	**Intensive**	1.27	13.97	5.05±.377	.000
	Nomadic	3.81	20.95	7.96±.445	
Creatinine (mg/l)	**Intensive**	29.29	76.19	40.81±1.26	.061
	Nomadic	24.52	62.14	44.03±1.144	

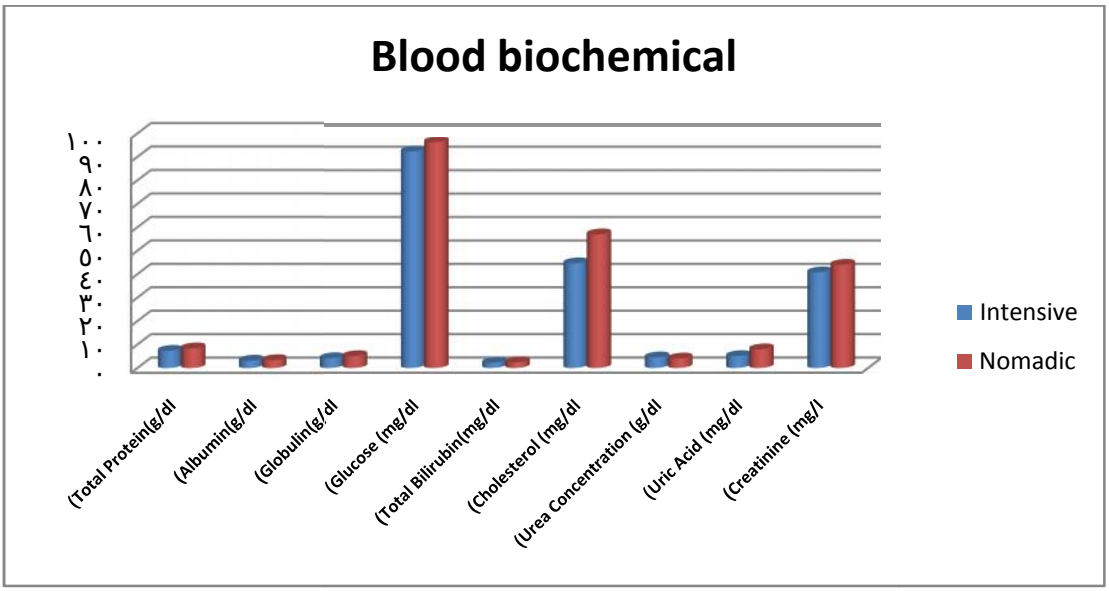


Figure (1) Means of Blood biochemical in serum of Sudanese camel under Intensive and Nomadic system

4-8-1.Total protein

The mean value for total protein in serum of Sudanese camel during the pregnancy stage and after parturition was 7.34±.124 g/dl in intensive system and 8.39±.105 g/dl in nomadic system, and there was a high significant difference between groups ($P \leq 0.0001$), the level of total protein significantly increased in nomadic system management as compared to intensive system management group as in table (52) and figure (1), also an important individual variability through the stages of pregnancy was observed. It was high during the first 8 months and for 4 month after parturitions and then dropped in the last three month before parturition in intensive system. Contrasted in nomadic system it was high during all pregnancy stages and after parturitions except during the first two months of pregnancy. Table (53) and diagram (2) illustrate that.

Table (53) Total Protein (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	7.68±.247 a b c d	6.94±.162 c
2 months	7.36±.646 a b c d	7.08±.140 b c
3months	7.64±.764 a b c d	8.75±.432 a
4 months	6.76±.244 c d	8.82±.210 a
5 months	8.52±.244 a	8.68±.525 a
6 months	7.5±.479 a b c d	7.96±.183 a b c
7 months	7.5±.162 a b c d	8.22±.00 a
8 months	7.22±.162 a b c d	8.82±.693 a
9 months	7.31±.247 a b c d	8.05±.226 a b c
10 months	6.39±.121 d	9.09±.559 a
11 months	6.67±.318 c d	8.61±.00 a
12 months	6.39±.162 d	8.40±.175 a
Empty1month	7.96±.516 a b c	8.33±.359 a
Empty2months	8.33±.317 a b	8.82±.210 a
Empty3months	6.94±.159 b c d	8.05±.159 a b c
Empty4months	6.95±.275 b c d	8.24±.183 a b
Total	7.34±.124	8.39±.106

A,b,c: Values with different letter in the same column differ significantly.

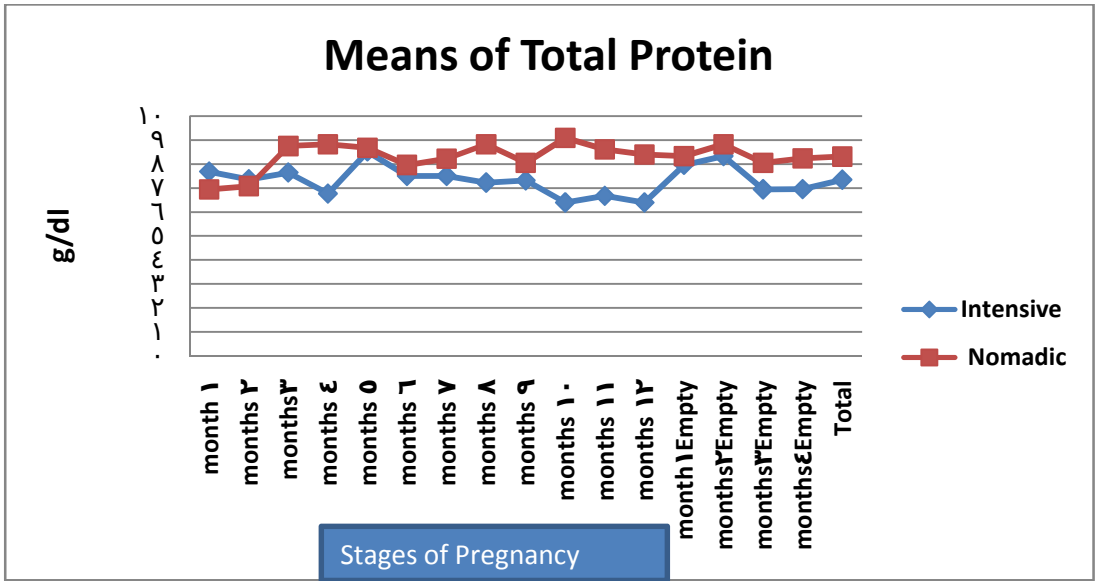


Diagram (2) Effect of management on total Protein (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-8-2. Albumin:

The mean value for Albumin in serum of Sudanese camel during the pregnancy stage and after parturition was 3.16±.047 g/dl in intensive system and 3.34±.034 g/dl in nomadic system, the level of Albumin significantly increased in nomadic system management as compared to intensive system management group as in table (52) and figure (1). In intensive system there are no clear differences between the averages within group during the different stages was observed, furthermore second month showed the highest average while the third and eighth month registered the lowest rate. Also in nomadic system there are no clear differences between the averages within group during the different stages, furthermore it was low during the second month of pregnancy and high during the fourth, sixth and eleventh month. The flowing table and diagram (3) illustrate that.

Table (54) Albumin (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system (Mean ±SE)	
	Intensive	Nomadic
1 month	3.31±.020 a b	3.36±.150 a b
2 months	3.58±.202 a	3.03±.07 b
3 months	2.9±.433 b	3.12±.30 a b
4 months	3.17±.080 a b	3.54±.137 a
5 months	3.32±.165 a b	3.26±.105 a b
6 months	3.25±.049 a b	3.53±.133 a
7 months	2.99±.104 a b	3.26±.039 a b
8 months	2.91±.017 b	3.38±.075 a b
9 months	3.01±.058 a b	3.49±.066 a b
10 months	3.27±.040 a b	3.31±.124 a b
11 months	3.06±.058 a b	3.53±.096 a
12 months	3.01±.040 a b	3.16±.109 a b
Empty1month	3.14±.156 a b	3.39±.172 a b
Empty2months	2.97±.057 a b	3.40±.096 a b
Empty3months	3.39±.096 a b	3.18±.033 a b
Empty4months	3.29±.020 a b	3.42±.081 a b
Total	3.16±.047 a b	3.34±.035 a b

A,b,c: Values with different letter in the same column differ significantly.

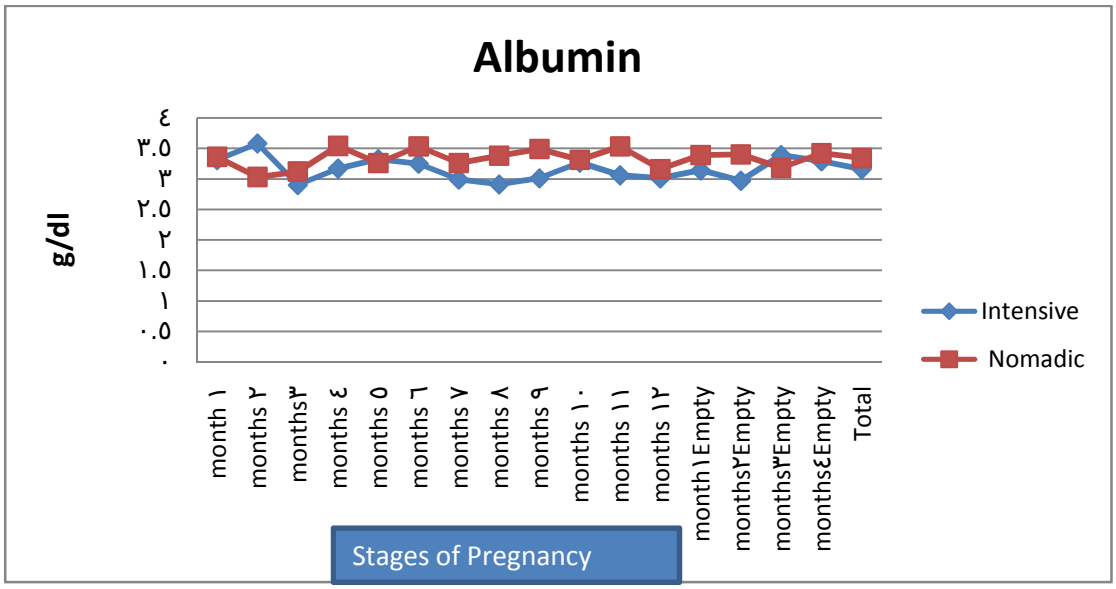


Diagram (3) Albumin (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-8-3. Globulin:

The mean value for Globulin in serum of Sudanese camel during the pregnancy stage and after parturition was 4.17±.125 g/dl in intensive system and 5.05±.110 g/dl in nomadic system with high significance (P ≤ 0.000), the level of Globulin significantly increased in nomadic system management as compared to intensive system management group as in table (52) and figure (1). Also an important individual variability through the stages of pregnancy between the averages within group during the different stages was observed, the fifth month of pregnant stage and the second month after parturition registered the highest averages therefore the tenth month and twelve registered the lowest in intensive system. But in nomadic system the averages convergent within group during the different stages, however it was low during the first month of pregnancy, the flowing table and diagram (4)that.

Table (55) Globulin (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	4.38±.227 a b c d	3.58±.011 d
2 months	3.78±.483 b c d	4.05±.070 c d
3months	4.74±.837 a b c	5.63±.554 a
4 months	3.59±.297 b c d	5.28±.249 a b
5 months	5.2±.247 a	5.42±.572 a
6 months	4.25±.528 a b c d	4.43±.275 a b c
7 months	4.51±.058 a b c d	5.07±.039 a b
8 months	4.31±.179 a b c d	5.45±.767 a
9 months	4.3±.292 a b c d	4.56±.224 a b c
10 months	3.12±.081 d	5.79±.435 a
11 months	3.61±.259 b c d	5.08±.097 a b
12 months	3.38±.121 c d	5.25±.132 a b
Empty1month	4.82±.36 a b	4.95±.526 a b
Empty2months	5.36±259 a	5.42±.117 a
Empty3months	3.55±.123 b c d	4.87±.131 a b c
Empty4months	3.66±.255 b c d	4.82±.115 a b c
Total	4.17±.125	5.05±.111

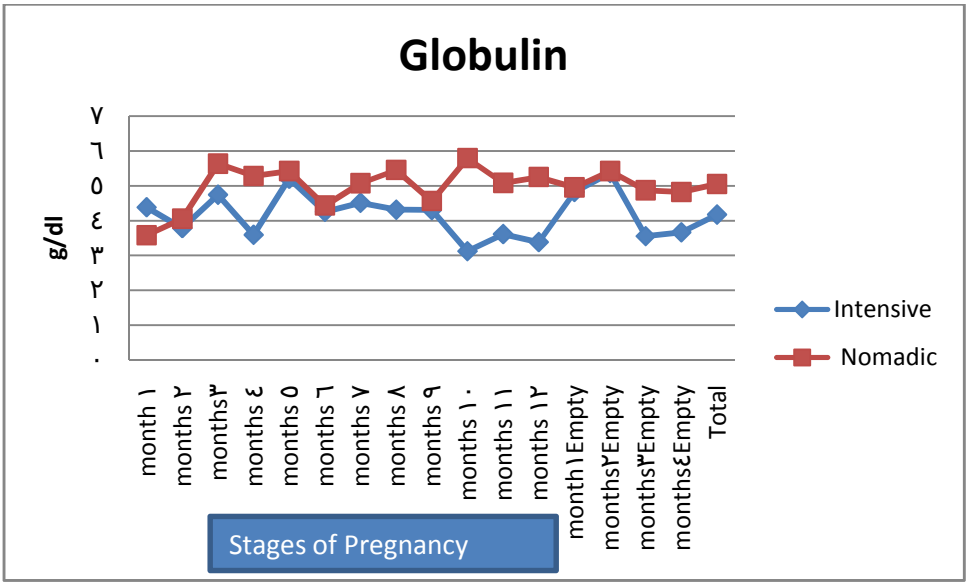


Diagram (4) Globulin (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-8-4. Glucose concentration:

The mean value for Glucose concentration in serum of Sudanese camel during the pregnancy stage and after parturition was 92.44±5.342 g/dl in intensive system and 96.48±3.46 g/dl in nomadic system with no significance ($P \geq 0.05$), the level of Glucose concentration averages convergent within and between groups during the different stages in both systems, the flowing table and diagram illustrate that.

Table (56) Glucose concentration (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	149.12±78.44 [a]	94.74±2.42 [a b]
2 months	67.11±11.84 [b]	84.02±4.76 [a b]
3months	98.69±15.09 [a b]	85.53±2.52 [a b]
4 months	71.23±6.32 [a b]	88.16±12.96 [a b]
5 months	105.26±5.26 [a b]	125.0±19.74 [a]
6 months	89.47±0.0 [a b]	85.97±4.64 [a b]
7 months	94.73±12.16 [a b]	105.26±8.86 [a b]
8 months	102.63±7.59 [a b]	118.42±19.75 [a b]
9 months	89.47±3.04 [a b]	93.42±9.46 [a b]
10 months	82.63±3.15 [a b]	98.68±5.83 [a b]
11 months	78.95±4.76 [a b]	99.99±18.98 [a b]
12 months	94.73±6.07 [a b]	123.68±26.18 [a]
Empty1month	96.49±4.64 [a b]	76.32±2.63 [b]
Empty2months	94.75±6.06 [a b]	84.21±2.15 [a b]
Empty3months	85.97±28.23 [a b]	80.70±3.51 [a b]
Empty4months	49.99±18.42 [b]	84.21±5.26 [a b]
Total	92.44±5.34	96.48±3.46

A,b,c: Values with different letter in the same column differ significantly.

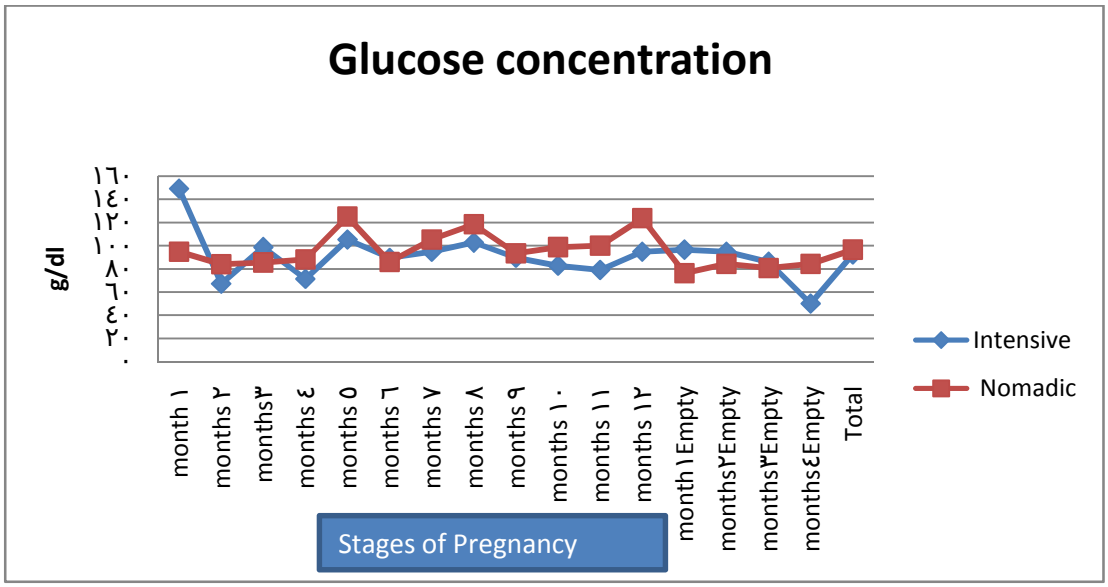


Diagram (5) Glucose concentration (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-8-5. Total Bilirubin:

The mean value for total Bilirubin in serum of Sudanese camel during the pregnancy stage and after parturition was 2.19±.352 mg/dl in intensive system and 2.43±.023 mg/dl in nomadic system. with high significance (P ≤ 0.000), the level of total Bilirubin significantly increased in nomadic system management as compared to intensive system management group as in table (52)and figure (1).also we observed that the level of total Bilirubin concentration averages convergent within groups during the different stages in both systems, the flowing table and diagram illustrate that.

Table (57) Total Bilirubin (mg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	**Nomadic**
1 month	2.08±.05 [b]	2.42±.115 [a]
2 months	2.18±.127 [a b]	2.37±.075 [a]
3months	1.99±.018 [b]	2.44±.08 [a]
4 months	2.01±.141 [b]	2.28±.143 [a]
5 months	2.30±.060 [a b]	2.39±.864 [a]
6 months	2.33±.057 [a b]	2.43±.030 [a]
7 months	2.21±.228 [a b]	2.5±.215 [a]
8 months	2.19±.009 [a b]	2.49±.073 [a]
9 months	2.23±.092 [a b]	2.47±.058 [a]
10 months	2.28±.069 [a b]	2.56±.068 [a]
11 months	2.16±.064 [a b]	2.48±.081 [a]
12 months	2.08±.052 [b]	2.45±.046 [a]
Empty1month	2.60±.184 [a]	2.29±.101 [a]
Empty2months	2.21±.133 [a b]	2.46±.055 [a]
Empty3months	2.21±.317 [a b]	2.35±.067 [a]
Empty4months	1.92±.215 [b]	2.46±.022 [a]
Total	2.19±.035	2.34±.024

A,b,c: Values with different letter in the same column no differ significantly.

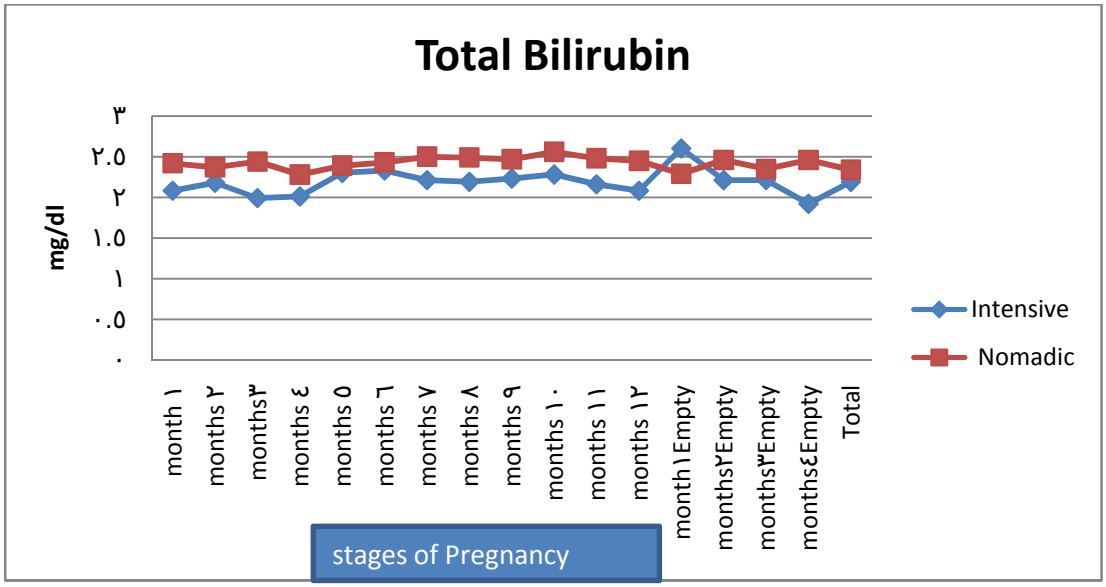


Diagram (6) Total Bilirubin (mg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-8-6. Cholesterol:

The mean value for Cholesterol in serum of Sudanese camel during the pregnancy stage and after parturition was 44.68±2.613 g/dl in intensive system and 57.06±2.908 g/dl in nomadic system, and there was a high significant difference between groups ($P \leq 0.002$), the level of Cholesterol significantly increased in nomadic system management as compared to intensive system management group as in table (52)and figure (1), however was no important individual variability through the stages of pregnancy observed in intensive system and also in nomadic system with little variability, the flowing table and diagram illustrate that.

Table (58) Cholesterol (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	53.92±13.18 [a]	52.4±11.22 [a b]
2 months	59.79±10.63 [a]	47.92±.92 [a b]
3months	57.93±19.72 [a]	41.38±6.29 [a b]
4 months	59.36±15.36 [a]	60.37±13.62 [a b]
5 months	37.76±10.16 [a]	58.39±12.24 [a b]
6 months	38.93±3.09 [a]	47.39±15.69 [a b]
7 months	51.51±1.75 [a]	71.56±6.89 [a b]
8 months	38.23±8.88 [a]	80.07±21.91 [a]
9 months	33.88±4.17 [a]	56.06±6.46 [a b]
10 months	34.03±3.87 [a]	62.70±3.15 [a b]
11 months	39.63±.404 [a]	65.43±4.48 [a b]
12 months	34.73±.941 [a]	67.71±10.82 [a b]
Empty1month	39.63±5.56 [a]	45.69±6.71 [a b]
Empty2months	28.91±.915 [a]	44.87±9.77 [a b]
Empty3months	50.35±7.0 [a]	36.98±19.8 [b]
Empty4months	48.02±18.6 [a] 5	63.86±1.76 [a b]
Total	44.68±2.61	57.06±2.91

A,b,c: Values with different letter in the same column no differ significantly.

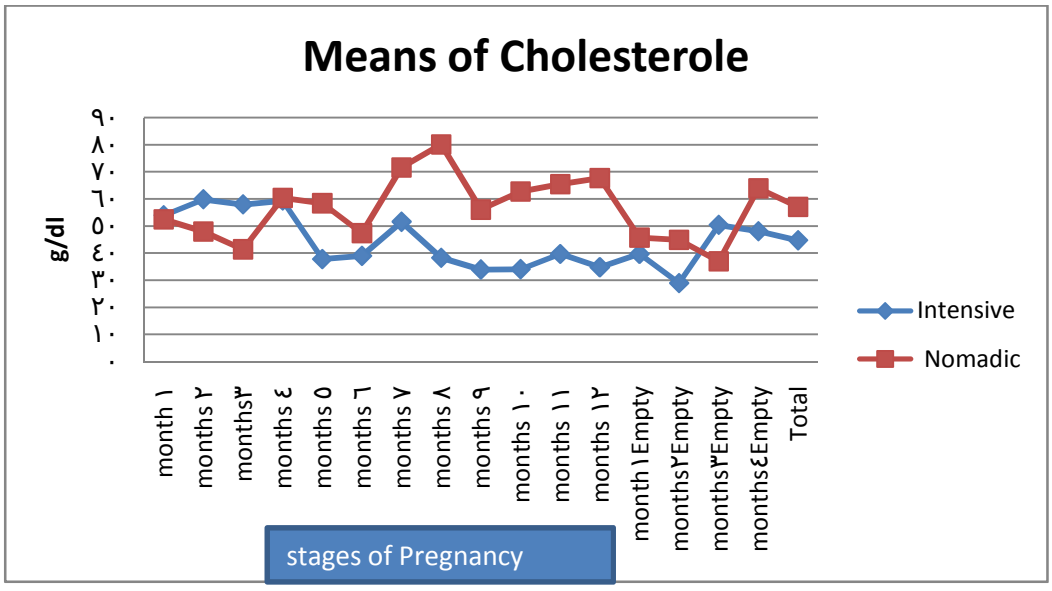


Diagram (7) Cholesterol (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-8-7.Urea Concentration:

The mean value for Urea Concentration in serum of Sudanese camel during the pregnancy stage and after parturition was 4.51±.103mg/dl in intensive system and 4.04±.083mg/dl in nomadic system, and there was a high significant difference between groups (P ≤ 0.000), the level of Urea Concentration significantly increased in intensive system management as compared to nomadic system management group as in table (52)and figure (1), also we observed an important individual variability through the stages of pregnancy in intensive system, contrasted in nomadic system the level of Urea concentration averages convergent within groups during the different stages it was high during all pregnancy stages and after parturitions . Table (59) and diagram (6) illustrate that.

Table (59) Urea Concentration (mg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	3.94±.215 b c	4.0±.173 a
2 months	4.33±.438 a b c	4.05±.09 a
3months	4.06±.61 b c	3.91±.355 a
4 months	4.20±.776 a b c	4.11±.462 a
5 months	4.65±.30 a b c	3.75±.293 a
6 months	4.77±.092 a b c	4.41±.338 a
7 months	4.19±.00 a b c	4.07±.148 a
a 8 months	a 4.72±.343 a b c	3.47±.389 a
9 months	5.03±.179 a b	4.56±.383 a
10 months	4.51±.115 a b c	3.91±.101 a
11 months	3.57±.357 c	4.08±.38 a
12 months	4.45±.369 a b c	3.92±.156 a
Empty1month	5.15±.050 a b	4.17±.562 a
Empty2months	5.20±.179 a b	3.86±.501 a
Empty3months	4.54±.325 a b c	4.39±.251 a
Empty4months	5.42±.10 a	4.09±.11 a
Total	4.51±.103	4.03±.083

A,b,c: Values with different letter in the same column differ significantly.

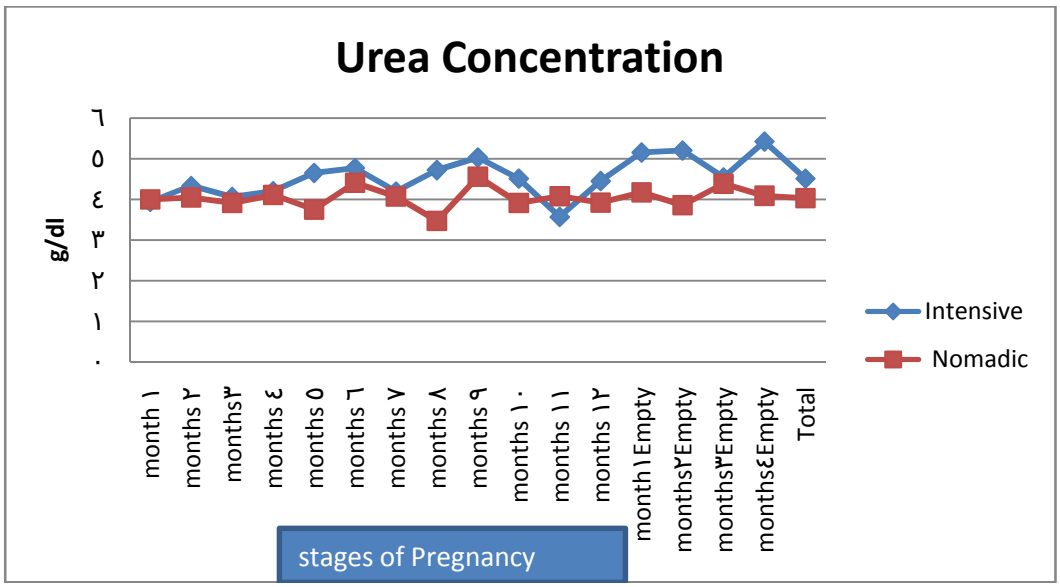


Diagram (8) Urea Concentration (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-8-8. Uric Acid:

The mean value for Uric acid in serum of Sudanese camel during the pregnancy stage and after parturition was 5.05±5.377 g/dl in intensive system and 7.96±.445 g/dl in nomadic system, with high significance (P ≤ 0.000), the level of Uric acid significantly increased in nomadic system management as compared to intensive system management group as in table (52) and figure (1). Also it was observed that the level of Uric acid averages convergent within groups during the different stages in both systems, except in first month after parturition in intensive system it was very high and different from its group the following table and diagram illustrate that.

Table (60) Uric Acid (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	5.29±.561[b]	5.08±.011[a]
2 months	2.85±.549[b]	6.64±.71[a]
3months	2.85±.411[b]	6.66±.755[a]
4 months	6.14±2.15[b]	7.30±.839[a]
5 months	4.66±.423[b]	5.24±.601[a]
6 months	6.35±.733[b]	7.19±.558[a]
7 months	6.34±1.83[b]	10.64±3.53[a]
8 months	4.76±1.28[b]	9.68±2.98[a]
9 months	4.23±1.06[b]	8.73±.947[a]
10 months	5.63±.803[b]	10.79±1.13[a]
11 months	2.75±.763[b]	9.52±.00[a]
12 months	4.76±.185[b]	9.37±2.31[a]
Empty1month	7.43±1.32[a]	5.87±.398[a]
Empty2months	6.35±1.83[b]	7.94±1.88[a]
Empty3months	3.17±1.10[b]	5.71±.366[a]
Empty4months	4.44±1.27[b]	9.73±1.81[a]
Total	5.05±.378	7.96±.445

A,b,c: Values with different letter in the same column differ significantly.

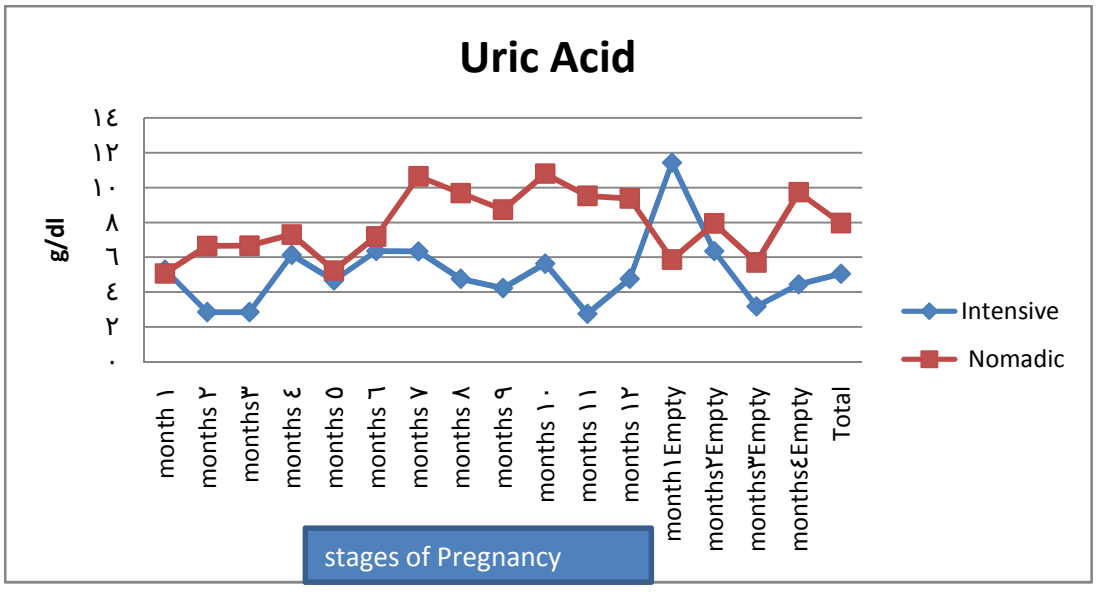


Diagram (9) Uric Acid (g/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-8-9. Creatinine:

The mean value for Creatinine in serum of Sudanese camel during the pregnancy stage and after parturition was 40.81±1.26 g/dl in intensive system and 44.03±1.144 g/dl in nomadic system with no significance difference ($P \geq 0.05$) between groups, nevertheless the level of Creatinine increased in nomadic system management as compared to intensive system management group. Furthermore in intensive system the level of Creatinine averages convergent within groups during the different stages, in contrast in nomadic system, observed an important individual variability through the stages of pregnancy it was high during the last months of pregnancy stages, the flowing table and diagram illustrate that.

Table (61) Creatinine (mg/l) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	38.57±1.26 ^{ab}	40.89±1.77 ^{bcde}
2 months	42.98±3.51 ^{ab}	41.55±5.59 ^{abcde}
3months	51.01±10.86 ^{a}	44.82±7.30 ^{abcde}
4 months	42.14±3.86 ^{ab}	35.89±6.61 ^{de}
5 months	37.94±3.49 ^{ab}	40.71±2.67 ^{bcde}
6 months	33.59±2.06 ^{b}	46.27±3.39 ^{abcd}
7 months	45.24±3.03 ^{ab}	49.41±1.72 ^{abc}
8 months	38.81±4.81 ^{ab}	49.34±4.07 ^{abc}
9 months	39.92±4.59 ^{ab}	49.17±3.12 ^{abcd}
10 months	37.86±1.21 ^{ab}	51.78±2.58 ^{ab}
11 months	33.33±.409 ^{b}	54.53±1.86 ^{a}
12 months	42.50±4.46 ^{ab}	44.68±2.66 ^{abcde}
Empty1month	51.59±3.37 ^{a}	36.07±1.60 ^{cde}
Empty2months	38.81±1.15 ^{ab}	39.70±4.13 ^{bcde}
Empty3months	38.97±1.56 ^{ab}	32.7±.691 ^{e}
Empty4months	32.98±3.69 ^{b}	45.72±1.31 ^{abcde}
Total	40.81±1.26	44.03±1.14

A,b,c: Values with different letter in the same column differ significantly.

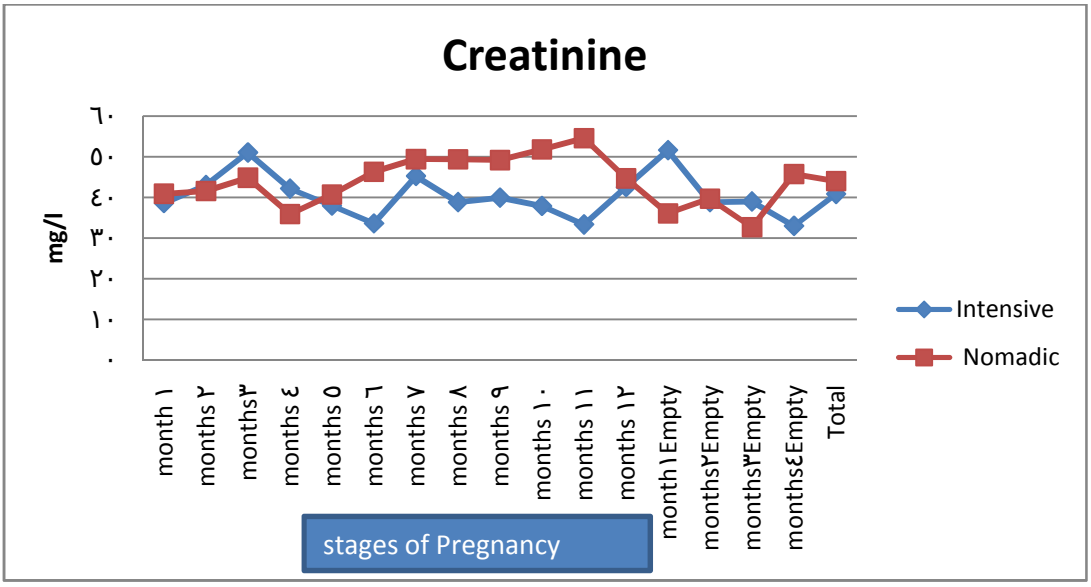


Diagram (10) Creatinine (mg/l) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-9. Minerals:

Blood minerals of Sudanese camel were studied at different stages of pregnancy and measuring some of it such as Calcium, Phosphorus, Magnesium, and Zinc. The means of results are presented in table below.

Table No (62) Mean (±STD error) Minerals in serum of Sudanese camel under different systems

Items	Management System	Minimum	Maximum	Mean± Std.Error	Sig
Calcium (mg/dl)	Intensive	7.65	17.84	13.05±.33	.000
	Nomadic	9.02	32.74	24.12±.52	
Phosphorus(mg/dl)	Intensive	11.16	17.01	14.93±.193	.000
	Nomadic	13.93	17.31	16.14±.09	
Magnesium(mg/dl)	Intensive	3.46	4.35	3.87±.032	.000
	Nomadic	3.68	7.75	4.19±.071	
Zinc (µg/dl)	Intensive	100.97	642.72	309.6± 18.9	.000
	Nomadic	246.6	819.42	497.9± 20.5	

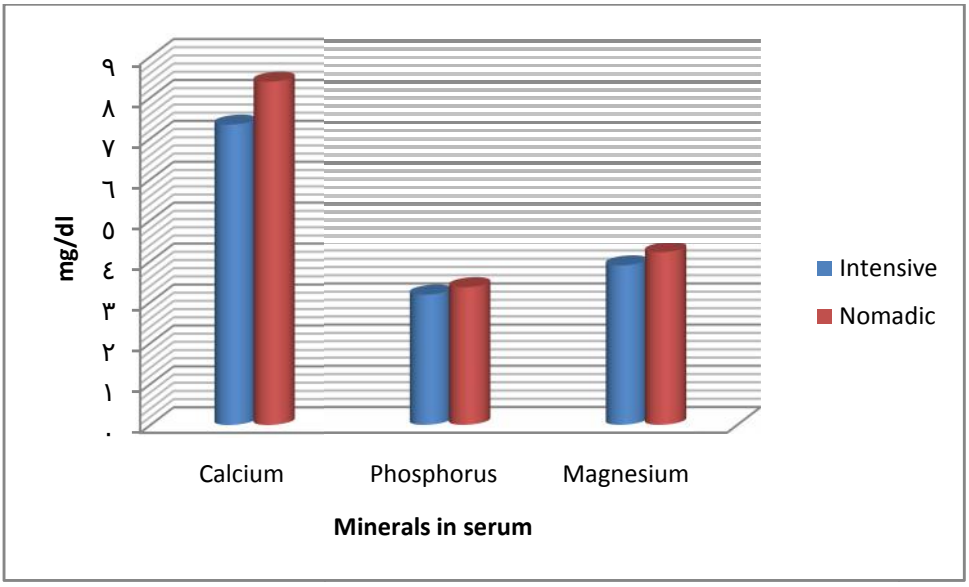


Figure (11) Minerals levels in serum of Sudanese camel under Intensive and Nomadic system

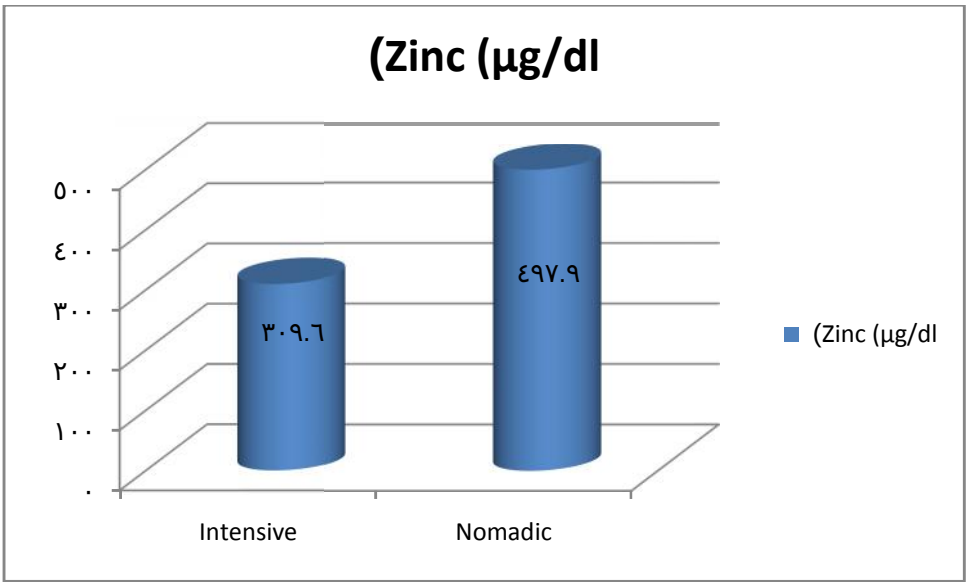


Figure (12) Zinc level in serum of Sudanese camel under Intensive and Nomadic system

4-9-1- Calcium:

The mean value for calcium in serum of Sudanese camel during the pregnancy stage and after parturition was 13.05±.33 mg/dl in intensive system and 24.12±.52 mg/dl in nomadic system, and there was a very high significant difference between groups ($P \leq 0.000$), the level of calcium significantly increased in nomadic system management as

compared to intensive system management group as in table (62) and figure (11), also it was observed an important individual variability in intensive system, it was wobbling during the last stages of pregnancy but it was high during the months in mid-pregnancy. On other side in nomadic management it was low in the first months of pregnancy stages then increased in the last six months of pregnancy and after parturition dropped. Table (63) and diagram (13) illustrate that.

Table (63) Calcium (mg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	**Nomadic**
1 month	12.22±.428 $^{d e}$	23.53±2.185 $^{a b}$
2 months	11.27±.882 $^{d e}$	22.34±1.19 $^{a b}$
3months	9.95±.885 $^{d e}$	21.17±1.924 $^{a b}$
4 months	11.5±1.133 $^{d e}$	18.13±4.083 ^{b}
5 months	15.29±.631 $^{a b c}$	21.91±1.738 $^{a b}$
6 months	17.06±.225 ^{a}	27.26±1.604 ^{a}
7 months	15.09±1.019 $^{a b c}$	27.16±1.21 ^{a}
8 months	16.17±.961 $^{a b}$	27.01±1.37 ^{a}
9 months	13.72±.79 $^{b c d}$	27.2±2.114 ^{a}
10 months	12.16±.00 $^{d e}$	26.62±.426 ^{a}
11 months	14.03±1.057 $^{b c d}$	23.4±1.19 $^{a b}$
12 months	13.23±.961 $^{c d}$	25±.929 ^{a}
Empty1month	13.1±.41 $^{c d}$	23.63±1.37 $^{a b}$
Empty2months	11.8±.178 $^{d e}$	22.99±.378 $^{a b}$
Empty3months	22.24±1.021 $^{d e}$	23.73±1.742 $^{a b}$
Empty4months	12.25±1.275 $^{d e}$	24.44±.471 ^{a}
Total	13.05±.33	24.12± .521

A,b,c: Values with different letter in the same column differ significantly.

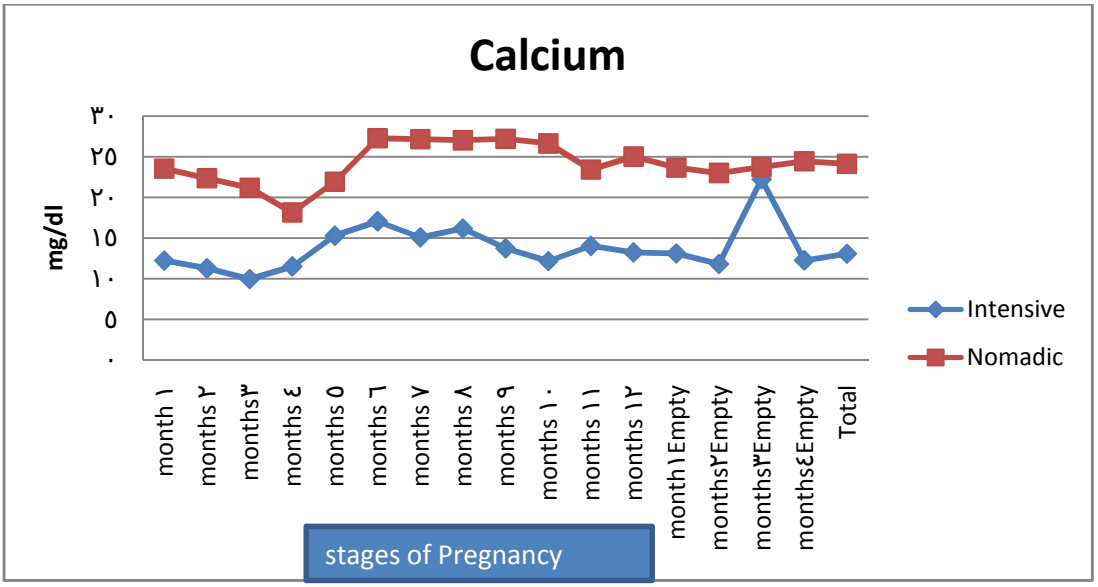


Diagram (13) Calcium (mg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-9-2. Phosphorus:

The mean value for Phosphorus in serum of Sudanese camel during the pregnancy stage and after parturition was 14.93±.193 mg/dl in intensive system and 16.14±.09 mg/dl in nomadic system with very high significance difference ($P \leq 0.000$) between groups, nevertheless the level of Phosphorus increased in nomadic system management as compared to intensive system management group. Furthermore in intensive system the level of Phosphorus averages were high in the last months of pregnancy stages and then dropped in the months after parturition, in contrast in nomadic system, observed an important individual variability through the stages of pregnancy it was high during the last months of pregnancy stages and after parturition, but it was low in the first three months of pregnancy stages. The flowing table and diagram illustrate that.

Table (64) Phosphorus (mg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	14.51± .833 a b c	15.41±.274 d
2 months	15.33± .624 a b c	15.53±.220 c d
3months	15.05± .346 a b c	15.64±.338 c d
4 months	13.93± 1.48 a b c	16.43±.071 a b c d
5 months	14.32± .486 a b c	16.01±.334 a b c d
6 months	15.55±.341 a b c	16.25±.195 a b c d
7 months	15.83±.421 a b	15.73±.467 b c d
8 months	15.56±.009 a b c	15.86±.241 a b c d
9 months	14.87±.873 a b c	16.09±.281 a b c d
10 months	14.46±.00 a b c	16.37±.117 a b c d
11 months	15.92±.234 a b	16.53±.268 a b c
12 months	16.32±.395 a	15.41±.554 d
Empty1month	15.35±.510 a b c	16.82±.221 a
Empty2months	14.72±1.24 a b c	16.71±.137 a b
Empty3months	13.06±1.29 c	16.54±.391 a b c
Empty4months	13.49±.180 b c	16.73±.20 a b
Total	14.93±.194	16.14±.091

A,b,c: Values with different letter in the same column differ significantly.

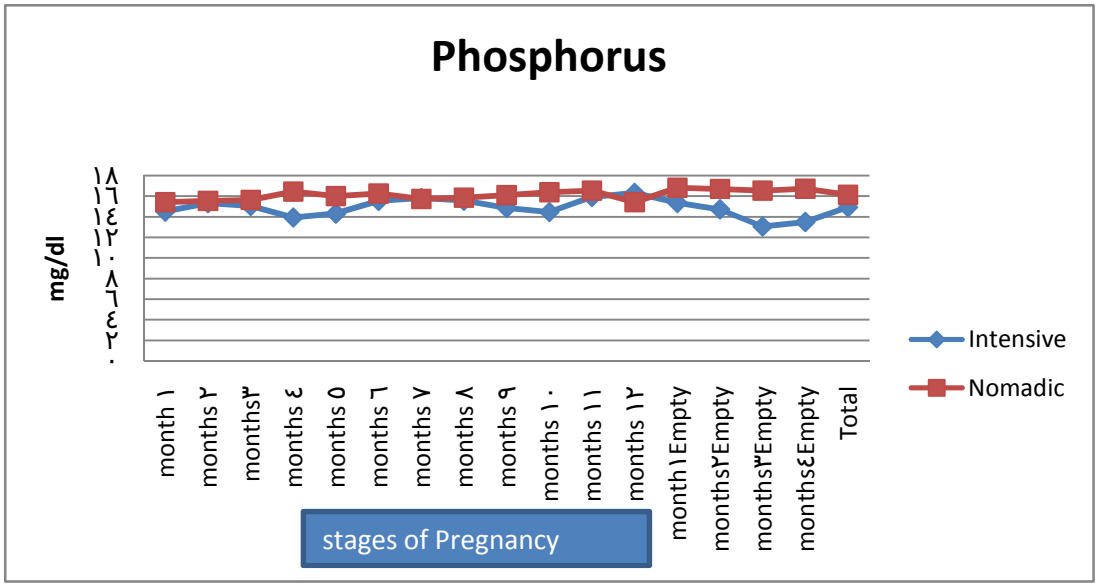


Diagram (14) Phosphorus (mg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-9-3. Magnesium:

The mean value for Magnesium in serum of Sudanese camel during the pregnancy stage and after parturition was 3.87±.032 mg/dl in intensive system and 4.19±.071mg/dl in nomadic system with very high significance difference ($P \leq 0.000$) between groups, nevertheless the level of Magnesium increased in nomadic system management as compared to intensive system management group. Furthermore in intensive system the level of Magnesium was high during the mid-pregnancy stages and it was low in the month's postpartum, but in nomadic system observed that the level of Magnesium averages convergent within groups during the different stages of pregnancy, the flowing table and diagram illustrate that.

Table (65) Magnesium (mg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	**Nomadic**
1 month	3.9±.145 [a b c d]	4.07±.118 [a]
2 months	3.81±.137 [b c d]	4.03±.180 [a]
3months	3.86±.137 [a b c d]	4.0±.129 [a]
4 months	3.98±.183 [a b]	4.11±.122 [a]
5 months	3.95±.127 [a b c]	4.14±.074 [a]
6 months	4.06±.026 [a b]	4.03±.173 [a]
7 months	3.87±.00 [a b c d]	4.15±.075 [a]
8 months	4.22±.035 [a]	4.25±.046 [a]
9 months	3.92±.098 [a b c d]	4.9±.958 [a]
10 months	3.85±.00 [b c d]	4.24±.121 [a]
11 months	3.9±.069 [a b c d]	4.29±.146 [a]
12 months	3.82±.069 [b c d]	4.42±.111 [a]
Empty1month	3.59±.021 [c d]	3.93±.113 [a]
Empty2months	3.58±.026[d]	4.12±.092 [a]
Empty3months	3.93±.118 [a b c d]	3.87±.084 [a]
Empty4months	3.6±.145 [c d]	4.32±.09 [a]
Total	3.87±.031	4.19±.071

A,b,c: Values with different letter in the same column differ significantly.

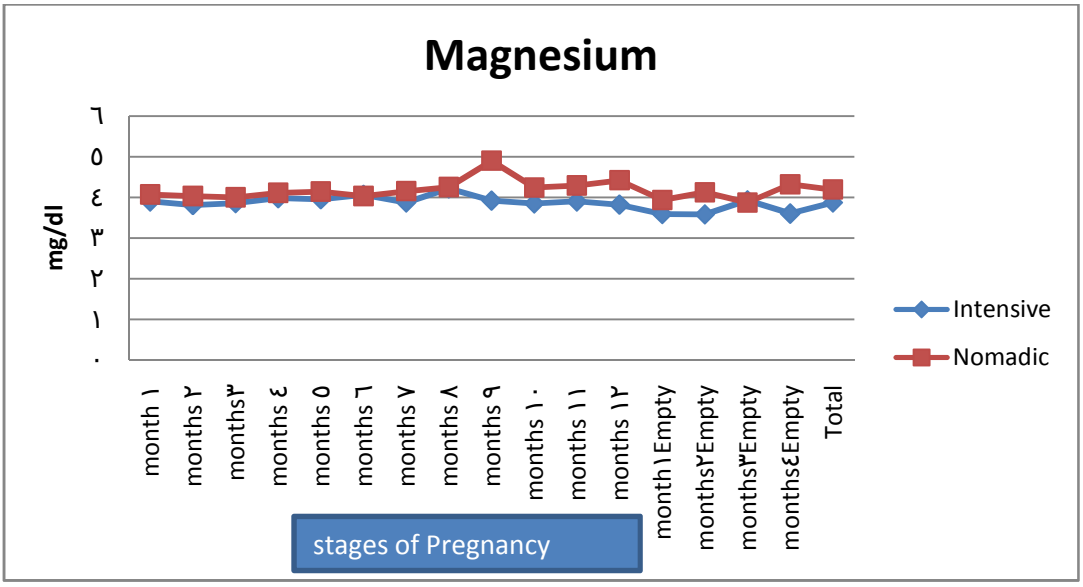


Diagram (15) Magnesium level (mg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition.

4-9-4. Zinc:

The mean value for Zinc in serum of Sudanese camel during the pregnancy stage and after parturition was 305.6±18.95 µg/dl in intensive system and 497.9±20.51 µg/dl in nomadic system with very high significance difference (P ≤ 0.000) between groups**.** Nevertheless the level of Zinc increased in nomadic system management as compared to intensive system management group. Furthermore in intensive system the level of Zinc was high during the last mid-pregnancy stages from 7th to 10th months of pregnancy then dropped in the two last months of pregnancy and raised again in 1st month after parturition and then dropped in the 3rd month's postpartum, but in nomadic system the level of Zinc averages raised from 6th to 11th months and then dropped in last month of pregnancy and 3rd moths after parturition and raised again in 4th month after parturition , the flowing table and diagram illustrate that.

Table (66) Zinc level in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	271.2±13.28^{bc}	441.7±8.4^{cd}
2 months	253.9±45.13^{bc}	409±13.59^{cd}
3months	345.6±106.13^{bc}	365±33.61^{d}
4 months	220.1±47.49^{bc}	423.3±113.47^{cd}
5 months	225.9±64.88^{bc}	355.8±60.13^{d}
6 months	278.3±65.07^{bc}	493.2±74.61^{bcd}
7 months	342.7±74.55^{bc}	605.3±26.09^{abc}
8 months	414.6±74.55^{ab}	518.9±26.05^{bcd}
9 months	419.5±70.6^{ab}	592.7±56.18^{abc}
10 months	425.2±14.57^{ab}	682.5±54.13^{ab}
11 months	349.5±2.2^{bc}	748.2±48.21^{a}
12 months	230.1±1.68^{bc}	503.4±59.87^{bcd}
Empty1month	577.9±42.81^{a}	328.1±21.53^{d}
Empty2months	249.8±64.26^{bc}	506.3±86.37^{bcd}
Empty3months	222±60.64^{bc}	351.4±27.48^{d}
Empty4months	180.6±52.43^{c}	644±11.28^{ab}
Total	305.6±18.95	497.9±20.51

A,b,c: Values with different letter in the same column differ significantly.

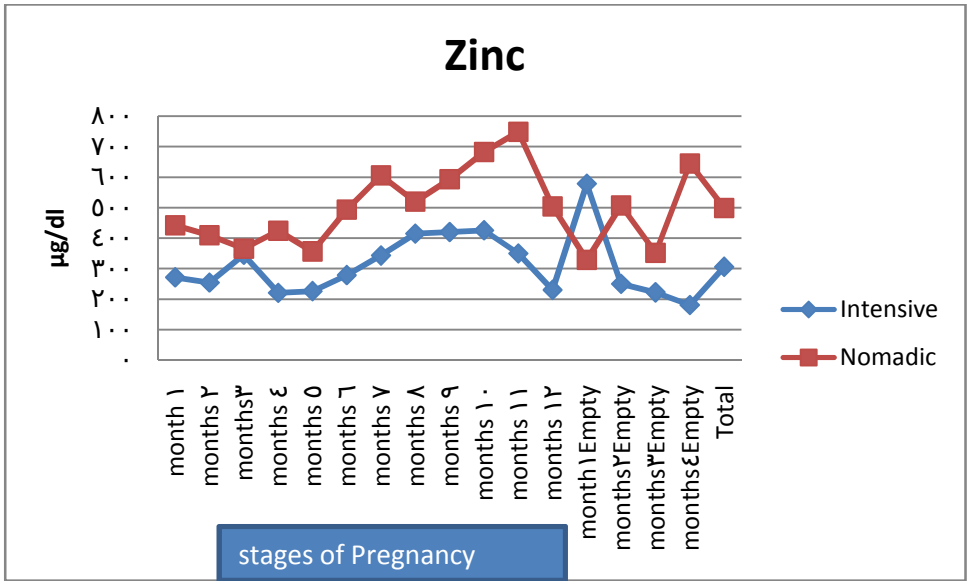


Diagram (16) Zinc levels (µg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition.

4-10. Hormonal assay:

Serum samples of Sudanese camel were analyzed for concentrations of steroid hormones including estradiol-17 (E2), progesterone (P4) and thyroid hormones; Triiodothyronine (T3) and thyroxin (T4). They were determined by ELISA reader (Clindiag MR-96 Belgium) using the standard kit(USA) methods. The means of results are presented in table (67) and are as following:

Table No (67) Mean (±STD error) Hormones in serum of Sudanese camel under different systems

Items	Management System	Minimum	Maximum	Mean± Std.Error	Sig
T3 ng/ml	Intensive	0.5	1.481	0.739±.035	.138^{NS}
	Nomadic	0.501	2.479	0.828±.046	
T4 µg/ml	Intensive	0.439	1.210	0.895±.028	.000**
	Nomadic	0.246	1.196	0.727±.025	
P4 ng/ml	Intensive	0.109	62.825	8.606±1.794	.043*
	Nomadic	1.445	78.896	14.487±2.162	
E2 Pg/ml	Intensive	1.167	272.862	27.887±8.613	.305^{NS}
	Nomadic	9.0	296.27	42.006±10.307	

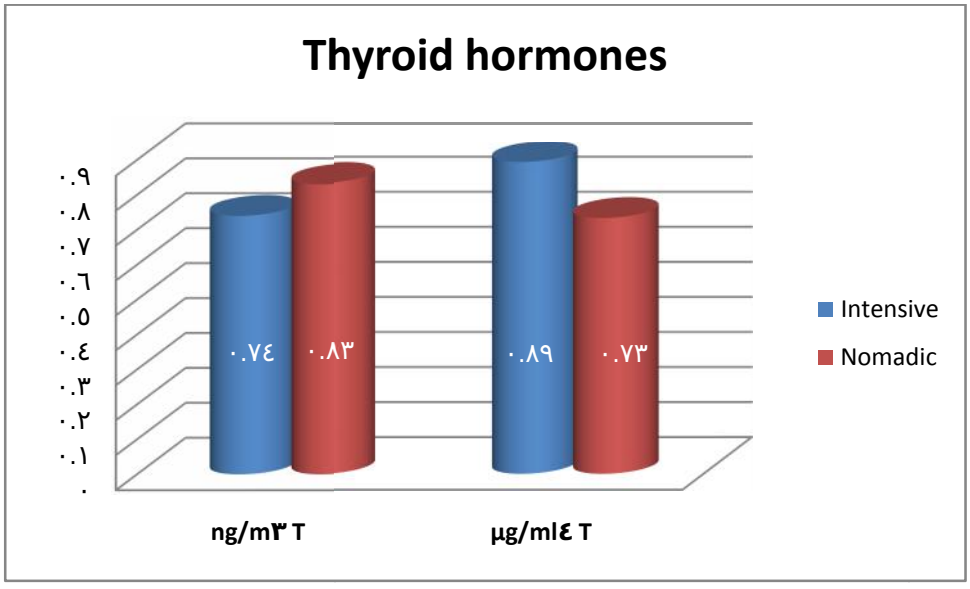


Diagram (17) Mean Levels of Thyroid hormones in serum of Sudanese camel

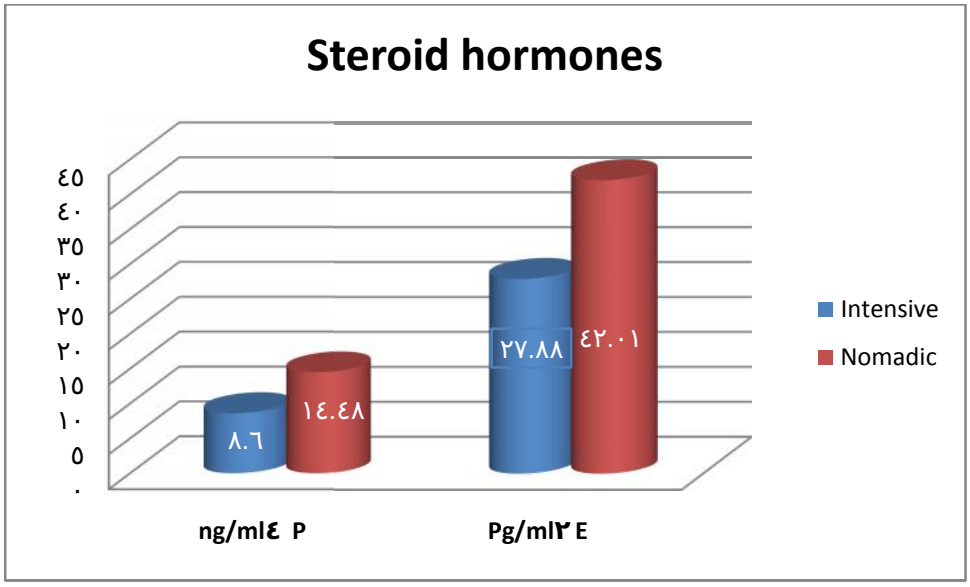


Diagram (18) Mean Levels of Steroid hormones in serum of Sudanese camel

4-10-1. Triiodothyronine (T3):

The mean value for **T3** in serum of Sudanese camel during the pregnancy stage and after parturition was 0.739±.035ng/ml in intensive system and 0.828±.046ng/ml in nomadic system with no significance difference (P≥0.05) between groups, nevertheless the level of **T3** increased in nomadic system management as compared to intensive system management group. Furthermore in intensive system the levels of **T3** averages convergent within groups during the different stages of pregnancy, but the nomadic system observed that the level was high during the first seventh months of pregnancy stages and it was low in the last month of pregnancy, the third and fourth months after parturition, the flowing table and diagram illustrate that.

Table (68) Triiodothyronine ng/ml in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	0.919 ±0.215 [a]	0.679 ±0.092 [b c d]
2 months	0.702 ±0.121 [a]	1.0 ±0.279 [a b c d]
3months	0.585 ±0.043 [a]	1.198 ±0.43 [a b]
4 months	0.552 ±0.03 [a]	1.30 ±0.067 [a]
5 months	0.769 ±0.141 [a]	1.034 ±0.144 [a b c]
6 months	0.751 ±0.005 [a]	0.713 ±0.107 [b c d]
7 months	0.623 ±0.018 [a]	0.877 ±0.174 [a b c d]
8 months	0.712 ±0.12 [a]	0.654 ±0.029 [b c d]
9 months	0.835 ±0.323 [a]	0.926 ±0.016 [a b c d]
10 months	0.84 ±0.247 [a]	0.6 ±0.031 [c d]
11 months	0.77 ±0.162 [a]	0.819 ±0.135 [a b c d]
12 months	0.843 ±0.146 [a]	0.526 ±0.163 [d]
Empty1month	0.995 ±0.088 [a]	0.795 ±0.17 [a b c d]
Empty2months	0.71 ±0.112 [a]	0.724 ±0.791 [b c d]
Empty3months	0.576 ±0.066 [a]	0.554 ±0.026 [c d]
Empty4months	0.688 ±0.096 [a]	0.658 ±0.126 [b c d]
Total	0.739 ±0.035	0.828 ±0.0465

A,b,c: Values with different letter in the same column differ significantly.

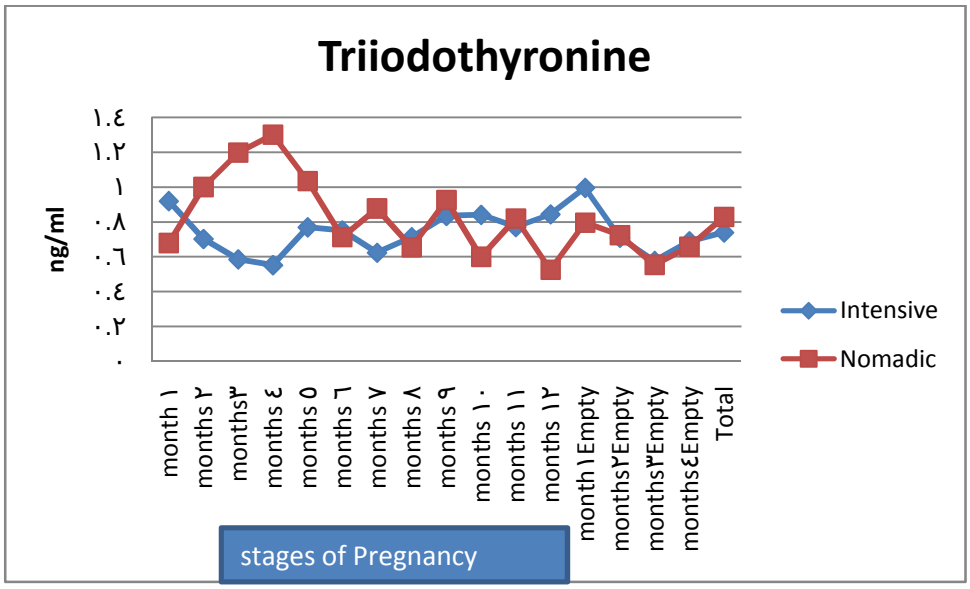


Diagram (19) Triiodothyronine (ng/ml) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-10-2. Thyroxine (T4):

The overall mean value of T4 in serum of Sudanese camel during the pregnancy stage and after parturition was 0.895±.028ng/ml in intensive system and 0.727±.025ng/ml in nomadic system with significance difference (P≤0.05) between groups, nevertheless the level of T4 increased in intensive system management as compared to nomadic system management group. Furthermore in intensive system the levels of T4 averages convergent within groups during the different stages of pregnancy, also in nomadic system observed that the levels were wobbling during the pregnancy stages. In both systems lower levels were in the sixth month of pregnancy, moreover it was observed that the levels were lower in the first two month of pregnancy in nomadic system but in intensive were in the months after parturition, but the higher levels were in the last months of pregnancy, flowing table and diagram illustrate that.

Table (69) Thyroxine (µg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	**Nomadic**
1 month	0.982 ±0.057 [a]	0.54 ±0.077 [d]
2 months	0.928 ±0.107 [a]	0.572 ±0.011 [c d]
3months	0.956 ±0.129 [a]	0.608 ±0.078 [b c d]
4 months	1.002 ±0.133 [a]	0.683 ±0.056 [a b c d]
5 months	0.877 ±0.02 [a]	0.768 ±0.089 [a b c d]
6 months	0.794 ±0.187 [a]	0.571 ±0.174 [c d]
7 months	0.977 ±0.011 [a]	0.611 ±0.116 [b c d]
8 months	1.045 ±0.028 [a]	0.804 ±0.037 [a b c d]
9 months	0.919 ±0.242 [a]	0.77 ±0.061 [a b c d]
10 months	0.848 ±0.198 [a]	0.875 ±0.047 [a b]
11 months	0.885 ±0.093 [a]	0.685 ±0.166 [a b c d]
12 months	0.888 ±0.076 [a]	0.87 ±0.034 [a b c]
Empty1month	0.821 ±0.029 [a]	0.919 ±0.101 [a]
Empty2months	0.785 ±0.147 [a]	0.627 ±0.032 [a b c d]
Empty3months	0.752 ±0.122 [a]	0.897 ±0.067 [a b]
Empty4months	0.803 ±0.053 [a]	0.698 ±0.123 [a b c d]
Total	0.895±0.028	0.727 ±0.025

A,b,c: Values with different let ter in the sam e column differ significantly.

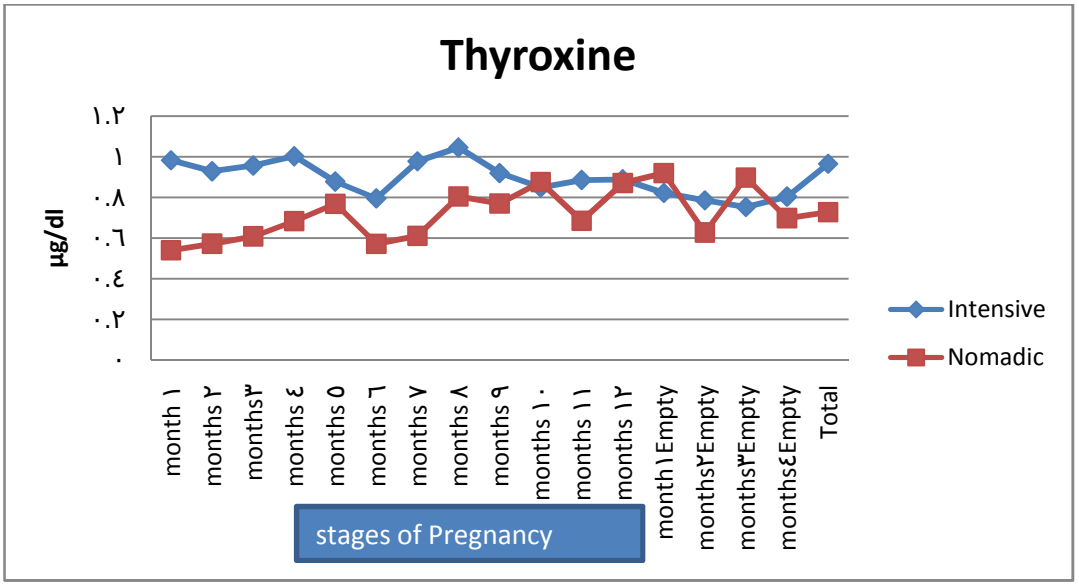


Diagram (20) Thyroxine (µg/dl) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-10-3. Progesterone (P4):

The overall mean value of P4 in serum of Sudanese camel during the pregnancy stage and after parturition was 8.606±1.794ng/ml in intensive system and 14.487±2.162ng/ml in nomadic system with significance difference (P≤0.05) between groups, nevertheless the level of P4 increased in nomadic system management as compared to intensive system management group. Furthermore in intensive system the levels of P4 averages were higher during the second; third and the last four months of pregnancy and it were lower after parturition and first month of pregnancy, also the nomadic system observed that the levels were wobbling during the pregnancy stages, it began to rise from the second month until the seventh and then decline in the eighth, ninth and tenth and then rose again in the eleventh month, it fell sharply in the last month of pregnancy. Diagram (21) illustrates that.

Table (70) Progesterone ng/ml in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	Nomadic
1 month	1.003 ±0.806 [b]	9.255 ±1.422 [a b]
2 months	17.569 ±11.523 [a]	14.085 ±2.815 [a b]
3months	12.121 ±4.633 [a]	24.653 ±9.464 [a b]
4 months	5.195 ±1.511 [a b]	17.947 ±8.846 [a b]
5 months	5.627 ±2.738 [a b]	18.429 ±6.166 [a b]
6 months	6.953 ±1.31 [a b]	32.779 ±23.492 [a]
7 months	5.056 ±0.199 [a b]	27.576 ±12.359 [a b]
8 months	7.454 ±1.878 [a b]	8.995 ±1.005 [a b]
9 months	17.264 ±12.819 [a]	12.189 ±2.092 [a b]
10 months	23.988 ±19.436 [a]	9.368 ±1.462 [a b]
11 months	9.666 ±3.313 [a b]	26.70 ±20.984 [a b]
12 months	11.786 ±4.981 [a]	7.668 ±0.915 [a b]
Empty1month	0.961 ±0.199 [b]	3.566 ±0.527 [b]
Empty2months	3.246 ±1.529 [b]	9.72 ±2.276 [a b]
Empty3months	1.124 ±0.862 [b]	1.629 ±0.153 [b]
Empty4months	2.482 ±2.289 [b]	8.684 ±4.633 [a b]
Total	8.606 ±1.794	14.487 ±2.162

A,b,c: Values with different letter in the same column differ significantly.

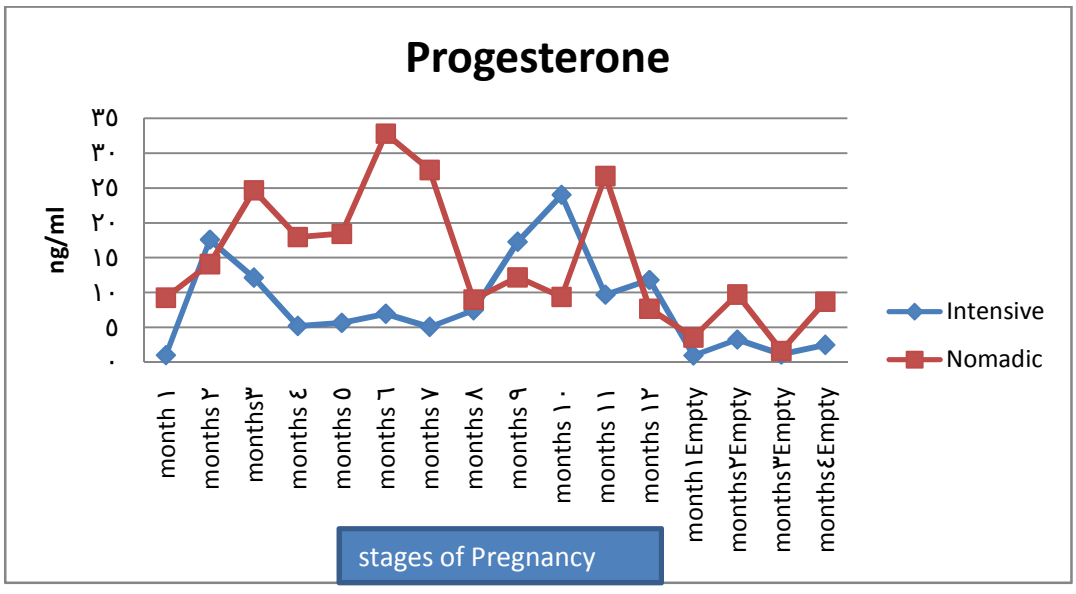


Diagram (21) Progesterone (ng/ml) in serum of Sudanese camel during the stages of pregnancy and after parturition

4-10-4. Estradiol (E2):

The mean value for **E2** in serum of Sudanese camel during the pregnancy stage and after parturition was 27.88±8.6pg/ml in intensive system and 42.0±10.3pg/ml in nomadic system with no significance difference ($P \geq 0.05$) between groups, nevertheless the level of **E2** increased in nomadic system management as compared to intensive system management group. Furthermore in two systems the level of **E2** averages convergent within groups during the different stages except the last month and two last months of pregnancy in intensive and nomadic system respectively, it was very high and then decline after parturition in both systems. The flowing diagram illustrates that.

Table (71) Estradiol pg/ml in serum of Sudanese camel during the stages of pregnancy and after parturition

Pregnancy Stage	Management system Mean ±SE	
	Intensive	**Nomadic**
1 month	10.495 ±0.206 $^{c\,d}$	11.907 ±0.177 ^{d}
2 months	11.01 ±3.955 $^{b\,c\,d}$	13.231 ±0.441 ^{d}
3months	9.78 ±2.921 $^{c\,d}$	15.375 ±1.419 ^{d}
4 months	11.476 ±0.503 $^{b\,c\,d}$	15.244 ±1.464 ^{d}
5 months	5.237 ±3.405 ^{d}	17.471 ±0.745 ^{d}
6 months	13.255 ±1.065 $^{b\,c\,d}$	15.587 ±2.125 ^{d}
7 months	11.25 ±0.423 $^{b\,c\,d}$	79.735 ±64.544 $^{b\,c}$
8 months	9.318 ±3.936 ^{d}	15.914 ±0.632 ^{d}
9 months	22.084 ±4.679 ^{b}	22.517 ±0.803 ^{d}
10 months	22.203 ±1.903 ^{b}	16.06 ±1.357 ^{b}
11 months	21.258 ±5.406 $^{b\,c}$	252.02 6 ±11.057 ^{a}
12 months	260.065 ±7.389 ^{a}	151.59 ±76.117 ^{d}
Empty1month	12.174 ±0.273 $^{b\,c\,d}$	12.747 ±0.278 ^{d}
Empty2months	11.811 ±0.979 $^{b\,c\,d}$	14.141 ±0.374 ^{d}
Empty3months	10.678 ±0.339 $^{b\,c\,d}$	13.062 ±1.18 ^{d}
Empty4months	9.701 ±4.369 $^{c\,d}$	15.655 ±1.918 ^{d}
Total	27.887 ±8.613	42.006 ±10.307

A,b,c: Values with different letter r in the same column differ significantly.

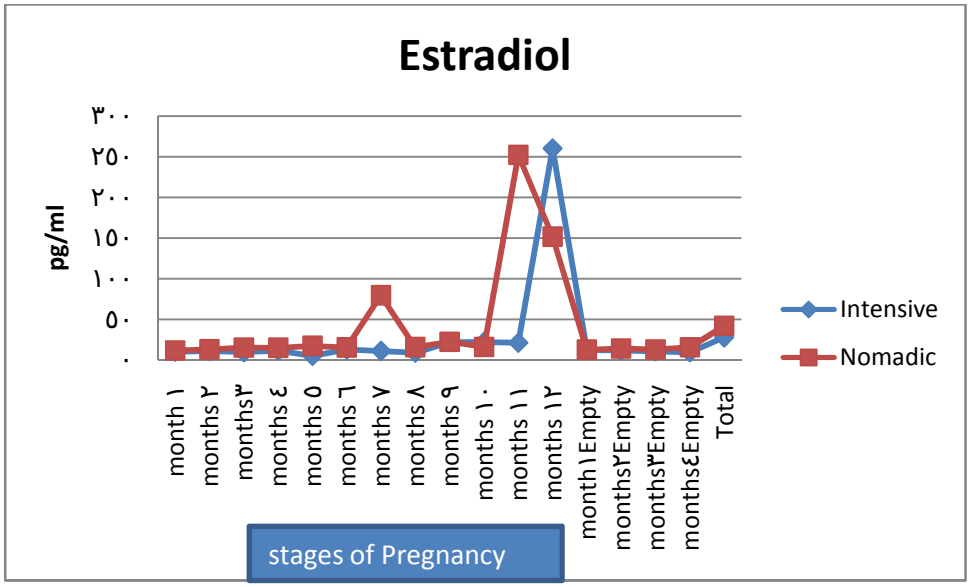


Diagram (22) Estradiol (pg/ml) in serum of Sudanese camel during the stages of pregnancy and after parturition

Chapter Five

Discussion

This study has been conducted to investigate the effect of management system on reproductive efficiency, production, calf mortality & embryonic losses and blood constituents of one-humped camel (*Camelus dromedarius*), kept under tropical nomadic and intensive conditions in Sudan.

5-1-General Information about Herd:

The results of this study display that high percentage of herd size in Butana region 87% of owners have more than 50head, but in Khartoum herd size divided near half recorded 58.8% for more than 50head. Those results are near to the Ishag and Ahmed (2011) who reported that the average camel herd size was 75.3 heads, the highest found in Gedaref State and also Dowelmadina, et al, (2015) reported mean herd size was 70 head of camels.

Arabi camel breeds are the most composed of camel herds in two regions. The result reflecting the Arabi breed is preferable among the owner in Sudan.

5-2-Reproductive performance of camel:

Puberty age of camel depend on body weight condition and nutritional factor, the reproductive performance of camel is affected by many factors, including mal nutrition which result in low body condition (Abdel-Rahim and Nazier, 1990) High energy dietary intake could be the main factor in enhancing the early onset of puberty and efficient reproductive performance (Nolan et al, 1991) In young camels the food denial result in the retarded growth and delayed maturity. Molash (1990)

reported factors such as adequate nutrition, body weight, photoperiod, and temperature and might attribute to such management activity.

Puberty age of the male in this results were less than ages which mentioned by Ahmed et al,(2006), .(Naumann, 2012), Leonard (1984) , Mares (1954) ,Wahid (1957) Evans and Powys(1959), Wiltbank(1974), Evans and Powys (1959). and they agreed with Novoa (1970),Leonard (1984). This difference might refer to difference in management practices by the owner of the herd. the male camel continuous to show sexual interest from one year of age and the reproductive organ continues to develop until six or even seven year according to Hartley(1979). **Puberty age of the she-camel** in this results coincided with the same records with, Yasin and Abdulwahid (1957) whom reported the puberty age of she-camel ranged between 3-4 years. Puberty age of the she camel in this results coincided with the same records with, Yasin and Abdulwahid (1957) that all reported the puberty age of she-camel ranged between 3-4 years. And less than (Hartly, 1979) who reported 4-5 years. On other hand more than (Molash1990, Arther et al, 1985, Yagil 1985,Chen and Yuen 1979) 2-3 years. Factors such as adequate nutrition, body weight, photoperiod, and temperature might attribute to such management activity.

Age at the first breeding season first based on puberty age and both depend on nutritional factor, second management, this in line with Skidmore (2005) who reported this differences might be due to many factors affecting age at puberty including nutrition, season of birth and breed of camel. The current results of Age of the male and she-camel at the first breeding season agreed with Farah, (2004) who mentioned that camels are mated for the first time at the age of 3-4 years, also with Wardeh, (1989) female camel reaches sexual maturity at the age of 3

years, but usually ready for fertility at the age of 4 to 5 years. It were less than ages which mentioned by Skidmore (2005) who reported the female camel has its first calf at 6-7 years under normal conditions, Also Saini et al, (2007), were said that the average age of mating is 5-6 and 4-5 years, respectively, in male and female camel. On the other hand, age of male camel at the first breeding season showed that the differences among the two production systems. As shown in table (28)with significant deferent ($P \leq 0.05$) and this result was similar to Simenew et al, (2013), Naumann (2012), (Wiltbank1974) and disagree with Novoa, (1970) who recorded reproductive prowess is not developed until six years, or even seven years (Hartley, 1979), and Ahmed et al,(2006) . Those differences might be due to many factors affecting age at puberty including nutrition, season of birth and breed of camel as Skidmore (2005) reported.

Age of female at first calving depend on several factors including Age at the first breeding season, the breed, management system and age at puberty. As were observed, there was a strong relationship between age of female at first calving and Age at the first breeding season. Result about Age of female at first calf were similary Dowelmadena, (2015) reported that the mean of age at first calving of she camels were Significantly ($P<0.05$) lower ages at first calving were found for camels reared in Khartoum State (Kenani camels; 4.34±0.73 years) and Sennar State (Nefidia camels; 5.16±1.03 years), while significantly ($P<0.05$) higher ages at first calving were recorded for camels in Gezira State (Butana camels) (5.32±0.45years). Similarly Simenew et al, (2013) reported that the mean of age at first calving was 5.36±0.74 years and range from 4-8 years in Afar camel (Ethiopia) according to management systems. Also our result disagreed with abdalgader and falah (2010) who reported that first calving occur between 36-85month the mean is 54.8

month (represent 5.66 years). Mayouf et al, (2014) and Musa et al,(2006) whom all reported in range 4.5years. From these results find out by proper husbandry and health care we can minimized this period.

Variation in **reproductive age** of male and female could be explained by the method of husbandry management and the main reasons for animals culled out as observed and pastoralists mentioned, were due to income, for replacement and disease, old animal, infertile and sick female camels. On the other hand, in nomadic system it was found that herds also contained a number of older females that had never produced a living calf, or had given birth only once. Such animals are kept on, not out of a desire for large herds or for reasons of prestige, but because they often continue to produce milk, even without becoming pregnant again. In the current research reproductive ages were 13 - 16 years for male and 16-20 years for female in nomadic and Intensive management respectively. It is shorter than Sumar, (2000) who reported male and female camels usually served as long as possible and kept up to 18 years. But longer than Farah et al,(2004) who reported; sires were kept in the herd for an average of between 4.5 and 7 years. Also Simenew, et al, (2013) found in Somali camel Service year of breeding males 11.81±5.03 Years. From my own point of view reproductive age of camel depend on management and number of female in a herd and mood of owner. In very rare cases, female camels were sold and slaughtered otherwise they are kept in the herd until they die (Simenew *et al,* 2013).

Number of **Males to Female** in the current study was less than Ahmed et al,(2006) reported; that the male reaches capable of serving 10 females, 10 services per day (including the night). A single male can successfully serve 60 to 67 females in breeding season, Majid and Sakr (1998); Adam et al, (2011) all said; male to female percentage of 25.6 %

and 74.4 %.Simenew et al, (2013) mentioned that mature female camels were dominant (54.87%) in the camel herd. as they found in that result the **ratio of male to female** camel was 1:13. According to respondents 59% of Somali pastoralists kept only one breeding male camel in their herd and very few with three breeding male camels(Simenew, et al, 2013). This agrees with the finding of Melaku and Gebreah (2001). the number of male in herds of camel in both systems were different between one to three heads, the most herds of camel in both systems are involved only one male camel as in a table (37). The reasons that pastoralists keep only one bull as respondents reported were to avoid fighting an d to get similar types of offspring with good performance.

Duration of follicular dynamic (Estrus cycle) were 16.57± 1.812, 16.57± 1.399 days in Intensive and Nomadic system respectively this period is agrees with Elias et al,(1984)who mentioned the length of the estrous cycle was 17.2 days. On the other hand disagreed when compared with (Musa and Abu Sineina, 1978) who reported the mean duration of the estrous cycle has been reported to be 28 days in Sudan. And it was in range in Chen and Yuen, (1984) who mentioned: the Bactrian camel, a mean cycle length of 19 days and a range of 14-24 days. Further this information is less than.(FAO,1990). which said the female gets mated when the dominant follicle measures between 1.3 and 1.7 cm in diameter and the corpus luteum that develops has a lifespan of only 10-12 days. These differences may be due to Estrous behavior with highly variable in duration and intensity and is therefore unreliable for the detection of estrus and difficult to relate to follicular activity in the ovaries, Acordind to FAO(1990) report. The wide variation in the estrous cycle observed is dependent upon the time of the estrous cycle during the breeding season. Moreover, it is interesting to note that the shortest estrous cycle coincides with the shortest photoperiod, lowest ambient temperature, and luxuriant

vegetation available for grazing (Elias et al, 1984). **Number of Estrus cycle** during the season was has 2-5 cycle during the season. There are no previous results for comparison.

The overall means of **estrus period** were 4.29± .51day in Khartoum state and 7.09±0 .75 day in Butana region with high significant difference this period depend on estrus detection by the breeder or male. The findings of this study agree with the values reported by Elias et al,(1984) in nonmated camels, estrus was prolonged and libido was present for a longer time (4-5 days). Also our result was less than Skidmore, (2008) who reported; all camelids are induced ovulators, usually ovulating only after mating, and if the camel does not conceive the corpus luteum has a very short lifespan of only 8 – 10 days. no enough data is available in estrus period for comparison of our results.

Number of Services/consumption as we know it depends on the state of animal physiological health and nutrition. as we found it was comparable with those (Hermas and Sharieha,1991-Wilson ,1986) reported the number of service per conception is 1.8±0.1. and this result was in range of Saini et al, (2007)whom reported reprted that the number of service per conception varied between 1 to 3. Also lower than Guptalal, 1968 registered 1.78 - 2.72. These differences may be due to environment and nutrition. Females return after mating, this is the first search for reasons of return to estrus therefore; no data is available for the comparison of our results.

Gestation period depends on breed and genetics As Mohamed Hammadi,et al,(2001) reported that the duration of gestation in female of dromedary is not affected by dietary level. Also in gestation length could be due to the genetic factor as was observed during our research that the Arabian camel characterize by the shortest period than any breeds. in

agreement in Ahmed et al, (2012) who reported that the variation in gestation length could be due to the breeds, contrary to the Novoa, (1970) who reported variation in gestation length could be due to the method of husbandry. As we found in this research gestation period were 12.06± .059 and 12.13±.072 months (equal 361±1.77 days and 363±2.16 days) this information is less than Rao et al,(1970) which says the gestation period is between 370 -375 days and Mohamed Hammadi,et al,(2001) 384.8 ±14.0 days Also Khanna et al, (1990) founded in Indian camel. The average gestation length was 389.3 ± 0.0781 days, 383±9 day as Agarwal et al,(1989) found . Mean values are also slightly lower than Ahmed et al, (2012) whom reported that the gestation period ranged between 365-398 days.This variation in gestation length could be due to the breeds, contrary to the Novoa,(1970) who reported variation in gestation length could be due to the method of husbandry. Also Mohamed Hammadi,et al,(2001) reported that the duration of gestation in female of dromedary is not affected by dietary level.

The variation of **open period** between two systems of the present study may be due to the strategy followed by the manager that allowed females in nomadic system to mate once a year after calving. Thus, in order to get lots of milk, lactating females were re bred after 1-year lactation, a minority of females actually become pregnant within two months of parturition. Open period in current study were shorter than Aboul-Ela,(1994) who reported 319 and 352 days and first services after calving it was in range with Sallal et al, , (2010) who mentioned the open period averaged 10.6 month it range from 1 to 23 month after calving. This agreed with report of Williamson and Payne, (1978); a few females come back into heat as early as 1 month after parturition. This variation possibly due to earlier weaning of calves as Aboul-Ela, (1994) reported.

Mean values of **Calving Interval** were 18.24±3.507 months (1.52±0.29 years) in intensive system and 21.15±2.47 months (1.76±.47 years) in nomadic system this difference might be due to open days which it depends on first services after calving as found it was long in nomadic system when campered with intensive system and calves weaning also due to nutritional status of animal. This was in line with Richard (1985) who mentioned calving intervals can be shorter when the animals were well fed. This is in agreement with the reports of Simenew et al, (2013); calving interval can be minimized by proper husbandry and health care. On the other hand in Butana region it is generally observed that the normal calving intervals for camels is two years or more and that camels conceive no earlier than one year after giving birth. While this appears to be the prevailing pattern, a minority of females actually become pregnant within two months of parturition, resulting in calving intervals as short as 14 to 15 months and some females reproducing almost every year. This agreed with Mukasa-Mugerwa, (1981) who mentioned to the long calving interval was attributed to lengthy gestation, limited breeding season and late postpartum estrus. The results of this study were excellently agree with Dowelmadena, (2015) who found calving interval 19.09±1.76 months in Khartoum and 25.01±0.00 months in Butana and also come in line with Simenew et al, (2013) who mentioned that calving interval can be minimized to 21.84±4.8 months by proper husbandry and health care. It's nearly to Abaas et al,(2000) whom reported Calving interval per month 23.28±3.36 in the nomadic system. All these findings were in line with the results reported by Knoess, (1979) who mentioned the calving interval can be shortened to 18 months. Also agree with report of Bakheit, et al, (2012); the calving interval was shortened under semi-intensive system. The calving interval is varying between 17 to 20months. In traditional system the calving interval varying between 23 to 26 months,

this information is contrary to the levels of Saini et al, (2007), Wilson, (1984); Arthur et al,(1985) who all reported calving in practice occurs every two years, also The mean age at calving interval was 2.82±0.77years as kella et al,(2008) reported. Also Schwarz et al, (1983) recorded calving intervals 28.4 months. Calving interval per month 23.28±3.36.also 2–2.5 years as Tibary et al,(2005) mentioned. Ishag and Ahmed (2011) reported that the average of calving interval 23.09±2.20 months, respectively) under different management systems. However, shorter gestation periods have been reported in Kenya and in corralled camels a calf every year is possible (Yagil, 1985).and also this information is less than Richard (1985) which said calving intervals of 15 months, when the animals were well fed.

5-3- production performance of camel:

Our mean values of lactation period in nomadic system were longer than intensive system. The reasons might be to calve weaning it is about I year but in intensive system herders weaning calves at the age less than 10 months. This study found that the camel appears first estrus cycle after weaning directly. Tibary et al,(2005) said that the differentiate depended mostly on management, feeding, and survival of the calf and farming management has a high impact on the expected productivity, Musaad et al, (2013) mentioned the lactation length values differed according to season of calving. Thus, in order to get lots of milk, lactating females were bred after 1-year lactation. The result of this study in range of (Skidmore, 2008) (8 – 10month) and Faye, (2008) found 8–18 month and Abdalgadir et al, 2012) who mentioned the length of lactation ranged from 6 to 19 months, with an average of 12.5 months. The lactation length in this study also is in agreement with the pervious findings of that reported by Babiker and El Zubeir (2014) that reported a lactation length of 9 to 18 months. In contradictory to Dowelmadina, et al, (2015) who

reported as 18 and 14 months/lactation for the she camels in semi-intensive and traditional nomadic (Butana) systems, respectively. But on the other side some studies have different results for those whom mentioned as Mayouf, (2014) registered lactation length is 12 month, Musaad et al, (2013) found that the overall mean for the lactation length for she camels kept in the intensive system was 12.5 months and the values differed according to season of calving.

Numbers of milking per day depend on the usages and culture, camel herders are using hired labor for milking. The overall mean number of milking per day was two (2.35±.931) times in intensive system and three (2.61±.583) times in nomadic system and this information contrasted with Dowelmadina, et al, (2015); Zubair et al, (2015); Mehari et al, (2007) Babiker and El Zubeir, (2014) whom all mentioned it is three time in semi intensive and two times for traditional nomadic. But Shuiep et al,(2014) had near result with two times milking per day in both systems. There was little information about Number of milking per day As Cardellino et al,(2004) reported; most of the authors did not specify the number of milking per day.

Milk production per day in intensive system produce more milk ($P>0.05$) than the traditional system. This could be attributed to the forage availability and the supplementary diets, water availability and health care that oriented to the camels in the intensive system. This agree with Ahmed, et al, (2015) and Simenew, et al, (2013) who said; high yield of milk in intensive system may be due to the supplementary feeding and improved of nutritive value of the feeds offered and water access, also Khan and Iqpal, (2001) who mentioned that the great variation in camel milk production might be attributed to nutrition and the methods employed to determine yield. Wafa et al,(2014) attributed to the

forage availability and the supplementary diets, water availability and health care that oriented to the camels in the semi intensive system. On the other hand, in nomadic system, we found that herds also contained a number of older females that had never produced a living calf, or had given birth only once, because they often continue to produce milk, even without becoming pregnant again. Milk production per day in this research in an excellent agreement with Bakheit et al, (2008) and Ahmed, et al, (2015) found in intensive system in his research the value were 6.85 ± 1.32 l/day but he had different value in nomadic system (and 3.14 ± 0.66 l/day).also our valve in range of Ayman et al,(2011) who reported; In Sudan camel, average milk production was 5-10 kg/day On the other hand, camel milk yield in Butana area can reach 8 liters per day. This finding supported the finding of. Eisa and Mustafa (2011) who had value supported the finding of Ayman Balla,(2011) but more than in our results it was 10 kg/day. this results were less and more than Bakheit et al, (2008) whom found average 6.9 liters in semi-intensive vs. 3.1 liters per in traditional system day.

5-4- Management:

5-4-1- Number of litters for female:

Female camels had estimated on average give 9.47± .412 and 8.27±.417 calves in her breeding life in intensive and nomadic system respectively. The finding in this study is near to Williamson and Payne, (1959) found that The female can produce 9 to 10 calves.

5-4-2- Weaning:

The age of calve at weaning is highly different between the two systems in this study, the overall weaning age more than 10 months. Also in intensive system there are some (35.3%) herders weaning calves at the

age less than that. This result is near to Pilters and Dagg, (1981) who reported weaning is generally done at 1 year of age, when enforced by man. If left undisturbed, a camel will occasionally still try to suckle a 2- to 3-yr-old calf

5-5. Constraints of Camel Reproductive

5-5-1. Problems in the fertility of male, there was no problem in male fertility (94.1% and 91.3% in intensive and nomadic system respectively), nevertheless found different answers to indicate the presence of fertility problem, it is the lack of female fertilization, this in line as Simenew, et al, (2013) who reported; the main constraints and problems for the Somali pastoralists, diseases, lack of veterinary services, lack of governmental or private drug stores, , lack of Browsing, security and lack of professionals support towards improvements of production and productivity of their camels. Furthermore in intensive system some herders added presence of the male with the herd and all this factors together. (Good nutrition+ Presence of the male with the herd +Veterinary car) is best way to raise the reproduction efficiency of camel. However there are problems facing the male during the season, such as: Aggressiveness & fighting with other males, weakness Browsing/ malnutrition, the large number of female and sudden illness, there is the first search for Problems in fertility of male during the season therefore; no data or information available for comparison of our results.

5-5-2. Nutrition

All camel herders in nomadic system mentioned that the main obstacles facing them were littleness of veterinary services, lack of security, Taxes and shortage of Browsing &feeding and the majority of them mentioned that the shortage of Browsing &feeding are the main problem of camels, in contrast with intensive system herder's said

obstacles facing shortage of Browsing & high feeding cost were very high significance. As was found the majority of camel herders in the two systems mentioned that the good nutrition is best way to raise the reproduction efficiency of camel. This result agrees with Aiman, (2011) who said; more pressing problems of Browsing, veterinary services, security water shortages received proper attention. Also as Skidmore, Adams, (2003) reported factor contributing to low fertility in camels are many and complex :the advanced age at puberty (3-4years).in addition poor pastoral management system which include poor feeding and handling prevail in regions where camels are raised adversely affecting camel reproduction and productivity. This result in line with Farah et al,(2004) who mentioned climate as well as feeding have considerable effects on the fertility of the animals, improved nutrition would increase the health and so the fertility of the animals, as we recommended that improvement of nutrition and health increase the improve the reproductive efficiency and production of camel.

5-5-3. Seasonality:

The highest percentage (76.5% in Khartoum and 78.3% in Butana) of respondent confirmed that the breeding season start in rainy season (June to October) .The two seasons when breeding peaks are: the main one during and immediately after the rainy season, lasting from July to September; and another occurring in December and January, although some mentioned that all over the year. This result comes in line with the report of Vyas et al, (2001) Camels (Camelus dromedarius) are seasonal breeders, with mating occurring during the coolest months of the year; indeed, this short breeding season is one of the main factors limiting reproductive performance.

As found in our results about male ruts there are three different views; first group said 3-7 months and this similarly to (Williamson G, Payne. 1978) who reported the camel breeding season (rut) often lasts about 3 to 6 month on average. And also Rao et al, (1970) reported that camel bulls show their sexual cycle during 3-4 months in winter season, beginning in December also Noakes et al,(2001) mentioned that the period of maximum breeding activity for the male (winter and spring seasons) is known as the “rutting period. Second group said; all the year except summer and last group said all the year comparable with those reported by Arthur et al,(1985) who suggested that camel can reproduce throughout the year. Curasson (1947) also expressed similar views that camel can breed all round the year provided food supply is abundant. As reporting of Hegazy et al,(2004), rutting period in camel may be partly due to the nutritional status of the animal which is considered high during rainy seasons. That result is in good agreement with Bakheit, et al, (2012) who reported; in equatorial regions forage and water availability is the major factor governing seasonality of mating and births in camels. Male camel husbandry has recently been changing toward a more intensive system where they are kept isolated and used for programmed mating or artificial insemination (Skidmore et al, 2013).

5-4-4. Culling of females and males from the herd:

Majority (52.9% and 36.4%) of herders mentioned that the female exclusion from herd at the age of 23-26 years, some (23.5% and 27.3%) at the age of 19-22 years and little (23.5% and 9.1%) at the age of 15-18 years in intensive and nomadic system respectively. Furthermore in nomadic some (27.3) herder do not isolate until mortality. They isolate due to old age, weak production& fertility and necessity. This result is agreed with findings of Simenew et al, (2013). In very rare cases, female

camels were sold and slaughtered otherwise they are kept in the herd until they die. The major reasons to cull female camels in the Somali society were diseases, old age and poor production performances. Male camels were frequently sold due to different reasons; the main reasons for selling as pastoralists mentioned were due to income, buying animal for replacement and disease. More over some herders exclude the male from herd due to presence of best male, disease and change the Purpose of breeding and some do not isolate it from herd until die.

5-6. Embryonic Losses:

The results of this experiment about embryonic losses (ratio 1-5%) in camel is coincided with the findings of Ayman et al, (2014) who reported in their research greater number (80%) conformed that 1-5% of abortion in camel herd was occurred yearly in Butana region. but at other side contrastingly Tibary and Anouassi, (1997) mentioned high rate of embryonic death up to 35% was reported in dromedary camels, it was very high than our finding. That findings supported by AL-Rawi, (2014) who recorded that the incidence of early embryonic death is 33.3%. Tibary et al, (2006), they reported that the early embryonic death usually ranged from 8 and 32%. On the other side the result of Nagy and Juhasz, (2008) (fet al, loss rate was 6.8 %) was near to our finding.

As was found in this research, abortion cases occurs in all stage of pregnancy as well as In intensive system more than half mentioned occurs at the beginning of pregnancy, In intensive system more than half (53.8%) occurs at the beginning , some (30.8%) at the end of pregnancy and the other in middle pregnancy. But in nomadic system the abortion cases occur in equal proportions (45.5%) at the beginning and in the middle of pregnancy stages and little (9.1%) at the end. This is consistent with the findings of other authors (Tibary and Anouassi, 1997) Early

pregnancy loss between day 20 to 90, post breeding. But at other side some studies have different results as Babiker (2011), who reported that all the aborted cases occurred during the last trimester of pregnancy. And in nomadic abortion cases occurs at the beginning and in the middle of pregnancy stages this is in good agreement with the data of (Bakhat et al, 2003), whom reported abortion can occur in pregnant animals, particularly during mid pregnancy.

We noticed that the biggest problems caused embryonic losses in Sudanese camel are slaughtering of pregnant females as we found in Slaughterhouse at Tumboul area, 75% of slaughtered animals were females and 52.38 % of them pregnant and age of foetus were 7.5±0.52months, This is the first research about embryonic losses from Slaughterhouse and there in no available data to compare such results. Also discovered there are many reasons play a role in the incidence of abortion in she-camels such as: **first** diseases (Brucellosis, Pneumonia, Aljufar) This finding was in line with the results reported by Babiker (2011) who reported that a abortion in camels associated with various pathological conditions such as brucellosis, trypanosomiasis, toxoplasmosis, campylobacteriosis and Salmonellosis. Also Kudi et al,(1997) reported Abortion due to brucellosis should not be entirely ruled out since there were reports of Brucellosis in camels in Nigeria previously. **Second** unknown reasons as Kalla, et al, (2008), Tibary et al, (2006) and (Tibary & Anouassi, 1997) said; The reason for such a high incidence of embryonic mortality is not clear. Pratap et al, (2012) said the reason is due to genetic factors, corpus luteum insufficiency or hostile uterine environment, however, no single factor can be manipulated to improve embryo viability.**Third** poisoning from Browsing the last one come in line with report of Kalla, et al, (2008) ,

the nomads seem to indicate that pregnant camels in the first trimester that feed on some plants such as the pods of *Leptidonia lacifolia* that are believed to cause abortion. And forth as (Mukasa-Mugerwa, 1981) registered; management practices, as well as disease, emerge clearly as a crucial factor in the high calf mortality rate and doubtless also affect embryonic and foet al, losses,this report near to the reasons that we found; bad management practices which is represented in some of the things that have been discovered through this research such as: high temperature, stagnant or polluted water, drugs, frightening the female at the beginning of pregnancy stages , hit the whip, weakness of female, female down fall, changing male in herd, thirst, malnutrition, eating Om-Shemaila worm and Aljufar disease. This is the first research in the Sudan about abortion reasons; therefore, no enough data is available as specific in abortion reasons and percentage for more comparison of our results, just the data were found as general in abortion.

5-7- Calves Mortality:

Calves Mortality is obvious that it is the most serious problem for the farmer, as found in this research the majority of mortality occurs in small ages followed by old ages, the mortality occurred more through the first three weeks both in two systems, however in Butana mortality continues until after one year, but in Khartoum mortality decreases after the first three weeks and little occurred after one year.This result also agreed with Khanna et al, (1990), they found in Indian camel was high mortality risk age group was from birth to 3 months of age. Also this goes in accord with Farah et al,(2007). Who found that the deaths and losses of newborn and calves up to one month were six fold compared to the grown up camels with 3% of losses. Also in line with Faye et al, (1995) who reported that the mortality rate was high before l-month of age.

In addition to that number of mortality in herds/year between two systems, it was10± 1.396 head/ year(calves mortality more than 5% of herd ratio) in Butana and 3± 0.468 head/year (calves mortality 1-5% of herds ratio) in Khartoum, in new born 7± 1.219 head/year in Butana and 3± 0.4445 head/year in Khartoum, this results are very lower than Bissa et al, (2004) reported In literature, calf losses have been noted in the range of 20-40%. The female calf mortality from birth to age at first calving at different ages 0 to 3 month (8.6%), 3 months to 1 year (3.3%), 1 to 2years (5.3%), 2 to 3 years(4.7%) and 3 years(5%), total mortality was 21.89% before they reached the age at first calving. Also Adam et al, (2011) have found through their study high mortality rate among young calves (76.5 %) compared to adult camels (18.9 %). This goes in accord with Wilson, (1984) who mentioned 50 % mortality rate in one year of age. Also Mehta et al, (2012) reported The mortality was maximum in adults above 3 years of age followed by 0-1 year and 1-3 years age group.Of the total camels died, 38.4% died in the first year of their life followed by 13.8% in 2nd Year, 5.5, 5.5 and 5.2%, respectively in the 3rd to 5th year, Of the camels that succumb to death in the first year, 49.5% died in the first month of their life followed by 15.3% in the 2nd month, 11.7% in the 3rd month. Coincided with the same records with Faye et al, (1995) were reported that the mortality rate before 1year was 42%. A total of 90% of mortalities occurred within 30 days after birth.

This study revealed that there are **variety of reasons** have a role in the calves' mortality such as follows: negligence or bad management, diarrhea, malnutrition, disease, Tick, high temperature, toxicity From Range, unexpected mortality, pneumonia , Weak born, quantity of suckling and dystocia.

Diarrhea and diseases have the largest quota and observed diarrhea and disease are considered the biggest problem facing calves.

This agreed with Kalla, et al, (2008) reported; the main causes of calf mortality are calf diarrhoea in the rainy season and Mange, Diseases and predators were reported as the main causes of calf mortality, Diseases (66%), lack of Browsing (59%) and security (47%) were the main constraints in camel production of his study areas. This is consistent with claims of (Ismaïl, 1990); calf mortality appear to be the major constraints to increase productivity of dromedary herds, also Adam et al, (2011) have found through their study The major threats during first year of life were identified as pneumonia, heat stroke and enteritis. As well coincided with same record of Faye et al, (1995) who reported that the diseases, emaciation, acidosis, titubation and diarrhoea were the most frequent disorders, and most of them could be linked to metabolic disorders.

In nomadic system majority of camel herder's eliminated the **colostrums** before allowing new borns suckling because they have belief that it may cause disturbance and also there is relation between mortality of newborn from more or little suckling, higher percentage from this relation due to large quantity and some of them mentioned that it is due the little suckling. Those results agree with Schwartz and Dioli (1992) who observed that the majority of the herders did not allow their calves to access initial colostrums, but instead milked it out. This arises from a common belief that colostrums will result in ill-health to newborn calves. According to Yagil (1994), the above mentioned belief is probably due to the normal powerful laxative effect of colostrums. It is highly possible that the high calf mortality usually reported could be attributed to this practice of denying the calves' access to colostrums. This is contrary to what said Kamber et al,(2001); the main reasons for the high postnatal mortality found to be poor management practice and diseases. The newborn calf has no natural protection against diseases, as there is no antibody transfer from the mother during fet al, development. The calf

can obtain immediate immunization soon after birth only through the colostrums, which has a very high concentration of antibodies. Therefore, it is vital for the calf to suckle as soon and as much as possible. This goes in line with Mukasa-Mugerwa, (1981) who reported that management practices, as well as disease, emerge clearly as a crucial factor in the high calf mortality rate and doubtless also affect embryonic and foet al, losses as well as other aspects of fertility. Therefore, no data is available for comparing the various reasons as found in our results**.**

Calf mortality rate among Somali camels can be reduced at least to 7% only by preventing predators attack and if other disease prevention and management cares are in place. It can be reduced to maximum (Simenew et al, 2013). For the better productivity of camels, the major constraints such as disease problems, lack of Browsing and tribal conflicts should be mitigated. Calf mortality rate 10.7%. Respondents reported that since there is feed shortage in the area the only main feed which camels feed during dry season was Cactus which caused mortality and poor production for the camels (Simenew et al, 2013). The multifactorial diseases (calf diarrhea, respiratory diseases, reproduction diseases, infertility) are not properly studied because yet mainly based on the research of pathogenic agents (Ali et al, 2005; Yagoub 2005). Infection rate, disease prevalence and severity of clinical signs are dependent on animal management conditions (Anna et al, 2012).

5-8-Blood Analysis:

5-8-1- **Hormonal assay:**

5-8-1-1- Steroid Hormones:

It has been observed that the steroid hormones are significantly higher in the nomadic system compared to the intensive system; this might be due to browsing hobbit of nomadic camels and open range

where the shrubs herb may contain some Alkaloid steroid substance that increase the level of steroid hormones in the blood of nomadic camels.

The level of progesterone (**P4)** increased in nomadic system management (14.487±2.162ng/ml) as compared to intensive system management group (8.606±1.794ng/ml). This results are in agreement with the findings of Babiker et al, (2011) who reported the highest **P4** level (13.75 ng/ml) but were in disagreement with the findings of Agarwal et al, (1991), Sallam et al,(2016), Agarwal and Khanna, (1990) who all found less values between 3-7 ng/ml. Moreover Sallam et al, (2016) reported that the P4 concentrations attained a higher value (3.83 ± 0.08 ng/ml) in the semi-intensive system as compared with the traditional system (1.46 ± 0.82ng/ml). The level of the P4 hormone in the semi-intensive system increased significantly ($P<0.05$) on the 5th month postpartum till reach the peak on the 14th month postpartum after that decreased gradually during the remaining on the experimental period. On the contrast, the progesterone concentrations in the traditional system showed non-significant difference during 11th months postpartum, but there were obvious increasing start at the 12th month postpartum.

Furthermore in intensive system the levels of **P4** averages were slightly higher during the second; third and the last four months of pregnancy and it were lower after parturition and first month of pregnancy. This results were on line with findings of many authors (Babiker et al, (2011), Agarwal et al, (1991), who demonstrated that the Progesterone levels were higher during the last month of pregnancy, in contrast some authors (Bakheit et al, 2012), Skidmore, (2005), Agarwal et al, (1991) and Sallam et al, 2016) mentioned the levels of progesterone concentration was slightly higher during early pregnancy and then gradually declined in the last month before calving. This might be

attributed to Parturition which could be elicited by hormonal changes, and this agrees with Elias et al, (1984) and Al-Bisher, (1998);who mentioned; It appears that expulsion of the foetus in the camel is preceded by the attainment of a minimum level of plasma progesterone and high levels of estrogen. In nomadic system it was higher in the eleventh month and fell sharply in the last month of pregnancy, this result is in line with the findings of Zeidan, (2011); who reported that the Progesterone concentration falls just before parturition.

The level of Estrogen (**E2)** increased in nomadic system management (42.0±10.3pg/ml) as compared to intensive system management group (27.88±8.6pg/ml). Furthermore in the two systems the level of **E2** averages convergent within groups during the different stages of pregnancy except the last month and two last months of pregnancy in intensive and nomadic system respectively it was very higher. This result were on line with findings of Edqvist et al,(1972) who observed the rapid rise in serum E2 concentration during the third trimester of pregnancy. The increase in the level of E2 occurring during the third trimester of pregnancy coincides with the gradual decrease in the level of progesterone (Ismail, 1987). The high levels of E_2 in camels during months l0- 12 of pregnancy are in agreement with the substantial increase in the weight of the fetus between 9 and 12.5 months of pregnancy and the dramatic increase in the volume of fet al, fluids. (Elias et al, 1984). This increase could be a signal to stimulate pituitary luteinizing hormone synthesis and subsequent resumption of ovarian activity after calving (Ismail, 1987). Our information of level of **E2** is less than Agarwal et al, (1987) which say the mean Estradiol levels increased progressively from a basal level of 20pg/ml at 2 to 3 month of pregnancy to about 450pg/ml at the final stages of gestation. Also Ahmed et al, (2016) reported the highest level of E2 concentration in serum camel was 1793±1295.1pg/ml.

5-8-1-2- Thyroid Hormones:

Thyroid hormones, including Triiodothyronine (T3) and Thyroxin (T4), are mainly associated with general body metabolism. The gradual increase in their level may be associated with the increasing energy balance later in the postpartum period Zia et al, 2007). In general, serum levels of thyroid hormones in camels are mainly affected by general body metabolism, season and water availability (Nazifi et al, 2009). Nazifi et al, (1999) also recorded higher serum T3 and T4 concentrations in the summer than the winter in dromedary camels. **Thyroid** hormones increase metabolism in almost all cells of the body. If carbohydrates and fats are insufficient for energy, thyroid hormones cause a rapid degradation of proteins for energy. If, however, adequate substrates for energy are available, thyroid hormones can enhance the rate of **protein** synthesis (Hyyppa 2005)

The level of **T3** increased in nomadic system management (0.828±.046ng/ml) as compared to intensive system management group (0.739±.035ng/ml), this information within the range when compared with previous study of Agarwal et al, (1989) who reported that the mean T3 concentrations varied from 0.73 to 1.32 ng/ml during various stages of gestation, But it was less than Yousef et al, (2015) (T3 were1.8±0.5 in pregnant and 1.9±0.5ng/dl in non-pregnant camels), and Nazifi et al,(2009)(1.56± 0.19 and 1.40 ± 0.21 ng /ml), in serum of camels. Furthermore in intensive system the levels of **T3** averages convergent within groups during the different stages of pregnancy, but in nomadic system we observed that the level was high during the first seventh months of pregnancy stages and it was low in the last month of pregnancy, this founding as such the claims of Agarwal et al, (1989) (T3 levels were higher during early pregnancy, with lowest values in the tenth month).

The level of **T4** increased in intensive system management (0.895±.028ng/ml) as compared to nomadic system management group (0.727±.025ng/ml).This result was expected since camels during summer suffer from water shortage and consequently dehydration. This agreed with Yagil et al,(1978) who mentioned that the there is inhibition of thyroxin production during periods of dehydration which decreases pulmonary water loss and reduced metabolism. Levels in this study were lower than **Agarwal** et al, (1989) who reported that the mean T4 concentrations varied from 76 to 116ng/ml during various stages of gestation. Also less than Yousef et al, (2015) who found in his study (14.8±2.4 in pregnant and 17.9±1. 9µg/dl in non-pregnant), such results indicate the stability of body and/or energy metabolism in camels regardless of reproductive status, as thyroid hormones are known as important modulators of general metabolism in which carbohydrates and lipids are the major constituents. As we observed in this study both systems lower levels were in the sixth month of pregnancy, moreover we observed the levels were lower in the first two month of pregnancy in nomadic system but in intensive were in the months after parturition, but the higher levels were in the last months of pregnancy. This is contrary to the report of **Agarwal** et al, (1989) that the T4 level was higher during early pregnancy, with lowest value in the tenth month.

5-8-2- Trace Elements:

The mean value for **Calcium** (Ca) in serum of Sudanese camel during the pregnancy stage and after parturition was 13.05±.33 mg/dl in intensive system and 24.12±.52 mg/dl in nomadic system. It has been observed that the **Ca** is significantly higher in the nomadic system compared to the intensive system; this might be due to browsing hobbit of nomadic camels and open range with diversity of shrubs herb and also as

MVM, (2015) said **Ca** level increases due to dehydration (which is also associated with increased albumin).

This result were disagrees and varies higher than all those authers; Nermala et al, (2014) (10.39±1.14 in rangeland grazing and 10.93±1.14 mg/dl in supplementary stall feeding), Ahmed et al, (2016), Raida and Zuhair (2014) and Yousef et al, (2015) (8.9±0.4 in pregnant and 9.1±0.2 mg/l in non-pregnant) Also Patodkar et al,(2010) reported the mean value of serum calcium was 9.67± 0.339 mg/dl. Nermala et al, (2014), Mutassim and Akram, (2014)(6.85±0.16 mg/dl during spring, 6.17±0.11 mg/dl in summer season). Khaled, (2010) reported Ca concentration in lactating camel was 11.4 ± 0.32 mg/dl. Also it was 10.48±0.30 mg/dl in adult camel as Barri et al,(2005) reported in their research. Such differences might be due to difference in nutritional quality and diversity of the vegetation and soil in which the plants grow on it, as Osman and Al-Busadah, (2003); Kuria et al, (2006); Ahmed et al, (2013) reported that the increase in Ca concentration in serum during spring may be attributed to the availability of range plant with high levels of minerals and other nutrients.

The mean value for **Phosphorus** in the serum of Sudanese camel during the pregnancy stage and after parturition was higher in nomadic system (16.14±.09 mg/dl) than in intensive system (14.93±.193 mg/dl) this disagrees with Bhakat et al, (2006) who reported the levels of phosphorus was slightly higher in intensive system as compared to semi-intensive system management. also it was very higher than all authers such as Alia et al, (2007), Mohamed and Hussein (1999) Al-Ali et al,(1987) Found that the Concentration of (P) in camel serum (mean ± SEM)was 8.4±1.7 mg/dl. His result in line agreement with those authors as Ahmed et al, (2016) reported P concentration in serum camel was

7.11±0.59mg/dl. Also Khaled, (2010) and Barri et al, (2005) have the same near results 6.2± 0.51mg/dl and 6.12 ± 0.47mg/dl in adult camel.

The mean value for **Magnesium** in serum of Sudanese camel during the pregnancy stage and after parturition was 3.87±.032 mg/dl in intensive system and 4.19±.071mg/dl in nomadic system. This result is the highest level compared with the results obtained by all researchers as; Slightly higher than Nermala et al, (2014) registered in their research Magnesium concentration in camel serum was 3.57 ±0.28in rangeland grazing and 3.74±0.28mg/dl in supplementary stall feeding. And Mohamed and Hussein,(1999) (2.50+0.64mg/dl), Ahmed et al, (2016) (2.33±0.2mg/dl), Raida and Zuhair (2014) (2.7±0.63mg/dl) and the lowest levels were in results of Mutassim and Akram, (2014) and Khaled, (2010) have near same results (1.75±0.04mg/dl and1.6 ± 0.12mg/dl).

The mean value for **Zinc** in the serum of Sudanese camel during the pregnancy stage and after parturition was 305.6±18.95 µg/dl in intensive system and 497.9±20.51 µg/dl in nomadic system with very high significance difference ($P \leq 0.000$) between groups**.** Nevertheless the level of Zinc increased in nomadic system management as compared to intensive system management group**.** When we compare our result with results of other outhers we find it is the highest than any result such as Zia et al, (2007) who reported Zn level in serum of male camel during rutting and non-rutting periods was 208±14µg/dl and 180±20µg/dl respectively. Also **Ali et al, (2009)** reported Zn level in serum of camel was 1.07±0.114µg/ml. Faye et al,(1995) who found Zn in serum 34.6 ± 7.8 µg/l00 ml.

5-8-3-Blood biochemical:

Apart of this study has been conducted to investigate the effect of management system on blood constituents of one-humped camel (*Camelus dromedarius*), kept under tropical and intensive conditions in Sudan. Blood is an important index for many metabolic functions and metabolites disorder in farm animals. The concentrations of blood metabolites are sensitive to seasonal changes in nutrient supply. Therefore, they could be used as indicators of nutritional status (Pamba–Gollah et al, 2000)

Our finding regarding **total protein** was higher in nomadic than intensive system, this might be related to good Browsing as we observed most of the land assigned for sorghum cultivation by the Mechanized Farming Corporation had previously been used by pastoralists to graze their animals. By using sorghum byproducts to feed their camels or related to low food and water intake. Camel can conserve and recycle urea for protein synthesis when food is low in protein or when growing or pregnant. This agrees with (Valtonen, 1979) who found in Rendeer (confirming Schmidt- Nielsen finding in camels) that the recycling mechanism of urea is coupled to a decrease in water intake. The kidneys of the camel excrete small amounts of urine when it is necessary to conserve water, the animal can also produce urine with extremely low concentration of urea, when fed a diet low in proteins (Schmidt-Nielsen et al, 1957). The urea in the camel formed during protein metabolism is thus not necessarily excreted. It may pass back into the rumen from the blood plasma via the saliva and through the rumen wall. Camel can conserve and recycle urea for protein synthesis when food is low in protein or when growing or pregnant This mechanism of recycling urea is also found in true ruminants. This agreed with Schwartz (1992) who

reported camels feeding on low protein forages can recycle and utilize body urea for microbial protein synthesis more efficiently than true ruminants. In addition Warden and Farid, (1990) reported the protein content of plant species consumed by camels would satisfy most of the protein requirements of camels to perform their various physiological functions.

Valtonen (1979) reported protein level agreed with Patodkar et al,(2010) and Mutassim and Akram, (2014), also agreed with Alia et al, (2007) who reported serum total protein concentrations was significantly ($p<0.05$) higher during the dry season (8.43±0.08 g/dl) than green season (7.08±0.08 g/dl). But at other side some studies have difference between two system and disagreed with our results, **Bhakat et al, (2006)** who reported the level of total protein significantly increased in intensive system management as compared to semi- intensive system management group. Also **Saini et al, (2010)** reported in his study the concentration of total protein was significantly higher in supplementation group (intensive system) (6.69 mg%) compared to control (traditional system) (5.95 mg%).Those differences might be due to difference in the feeding conditions and diversity of vegetation in Browsing. This agree with Warden and Farid, (1990) they reported; the protein content of plant species consumed by camels would satisfy most of the protein requirements of camels to perform their various physiological functions.

The Albumin level was within the range when compared with previous studies the higher level of (Mutassim and Akram, (2014), Faye et al, (1995); and Haroun, (1994)). Also agree with. Alia et al, (2007) who found serum albumin concentrations was significantly ($p<0.05$) higher during the dry season than green season. Fischbach et al,(2004) explained that High **albumin** levels may be caused by severe

dehydration, Low albumin levels may be caused by a poor diet (malnutrition). Our result is more than result of the Nermala et al, (2014) which reported the Albumin in camel serums was 2.72±0.095 g/dl in rangeland grazing and 3.02±0.095 g/dl in supplementary stall feeding. Also more than Ahmed et al, (2016) who reported 2.95±1.56g/dl. And less than Patodkar et al,(2010) who reported the mean values of serum Albumin was 4.13± 0.208g/dl. **Globulin** concentration is higher as comparable with Nermala et al, (2014) and Patodkar et al,(2010) who reported the mean values of serum Globulin was 3.36± 0.198g/dl. our finding was in line with the results reported by Alia et al, (2007) who reported the serum globulin concentrations was significantly ($p<0.05$) higher during the dry season (5.83±0.39 g/dl) than green season (4.0±0.38 g/dl).

Glucose level increases due to high-carbohydrate meals, sprint exercise, stress or excitement (MVM, 2015). Our Glucose value is in excellent agreement with the data of several other authors, including Barakat and Abdel-Fattah (1970) (80-140mg/d) and Mohamed and Hussein (1999) (97.8±18.77 mg/dl). And it is slightly higher than the value reported by Nermala et al, (2014) (94.06±3.84mg/dl). In our finding Glucose concentration is also higher than the mean value reported by Babeker et al, (2013), Mutassim and Akram, (2014)and Nermala et al, (2014) in his grazing group. but less than Al-Ali et al,(1987), Chandrasena et al, (1979) and Faye et al, (1995)who all found the concentration of glucose in the serum more than 110 mg/dl. The dehydrated dromedary reduces water loss by maintaining its high glucose (Bengoumi, 1992).The camel will respond to hot arid conditions by reducing urine production, concentrating urine, sweating economically,

by increasing body temperature and by the ‘storage’ of CO2 and glucose in the blood (Oujad and Kamel, 2009).

The mean total **Bilirubin** value in this study is the highest from all values which reached by those researchers Yousef et al, (2015), Abdel Gadir et al, (1979), Al-Ali et al,(1987) , Hassan et al,(1983) and Haroun, (1994). Bilirubin level increases due to fasting may be caused by hepatic lipidosis, hemolytic disease, liver dysfunction. (MVM, 2015)

Cholesterol in camels in the current study disagreed with the findings of Mohri et al, (2008), Al-Ali et al,(1987), and Mohamed and Hussein (1999) all of them mentioned lower values than our result. but was near to the results of Nazifi and Malek(1998) and Ghoneim et al, (2013).and also lower than Ahmed et al, (2016) who conducted 76.03±9.76mg/dl. Cholesterol level increases due to fatty meals, hepatic or biliary disease, protein-losing nephropathy, hyper adrenocorticism, and hypothyroidism. It decreases in some cases of severe liver dysfunction and occasionally in hyperthyroidism.(MVM,2015)

Mean **uric acid** concentration is lower than the values reported by Abdel Gadir et al, (1979) for adult male Sudanese camels (31.48 ± 8.92 mg/dl). Also lower than the mean value reported by Abdalla et al, (1988) for adult racing camels in the United Arab Emirates (11.9 ± 2.60 mg/dl) and McGrane and Kenyon (1985) who reported uric acid value (15.6-48.4 mg/dl). But on the other side our value was higher contrary to the levels of Babeker et al,(2013) which reported the value during dry hot summer (2.99±0.08mg/dl) as compared to other environmental and physiological conditions was the highest, also their report in agreement with the findings reported by Al-Ali et al,(1987)(, 0.16± 0.03 mg/dl) and Haroun. EM (1994), acid concentration in camel serum 232±35.77umol/l. Uric acid showed significance for increased values during Dry hot summer as

compared to other environmental and physiological conditions(Babeker et al, 2013).

Creatinine concentration in the present study was higher during extreme hot which indicated increased muscle metabolism during hot condition. The Creatinine level in this study was near to Alia et al, (2007) who registered 74.26±4.42 µmol/l in dry season. On the other hand our value is lower than Mohri et al, (2008), Mohamed and Hussein (1999) were found in their research Nazifi and Malek(1998).Mean Creatinine concentration is also higher than the mean value reported by Mutassim and Akram, (2014), Patodkar et al,(2010), Ahmed et al, (2016)and Yousef et al, (2015)The Creatinine level (marker of kidney function) is dependent on the dietary intake, synthesis rate of Creatinine. Therefore, the high Creatinine levels in animals during gestation could be as a result of higher protein needs and this is associated with late stage of pregnancy due to the lower rate of kidney elimination (Omidi et al, 2014b). Creatinine level increases due to renal dysfunction, blocked urethra, and ruptured bladder (MVM, 2015). Creatinine showed significance for increased values during Dry hot summer as compared to other environmental and physiological conditions, could be attributed to the availability and quality of forage during the green season.(Babeker et al, 2013).

The mean value for **Urea Concentration** in the serum of Sudanese camel during the pregnancy stage and after parturition was 4.51±.103 mg/dl in intensive system and 4.04±.083 mg/dl in nomadic system, and there was a high significant difference between groups ($P \leq 0.000$), the level of Urea Concentration significantly increased in intensive system management as compared to nomadic system management group**.** It has also been reported that; usually, urea in blood increases when protein

content rises in the diet (Emmanuel et al, 1976). The increase of uremia after a long period of low protein feeding (2 months) indicates excessive catabolism. According to Schwartz (1992) camels feeding on low protein forages can recycle and utilize body urea for microbial protein synthesis more efficiently than true ruminants. Level of urea in this study was lower than Yousef et al, (2015) who found the blood urea nitrogen was 14.6±1.5 mg/dl in pregnant and 16.0±1.8mg/dl in non-pregnant and there were non-significant differences, this agreed with Mohamed and Hussein (1999) who mentioned in normal Hijin'racing camels the serum Urea nitrogen concentration was 15.4+4.52mg/dl. Also Nermala et al, (2014) registered the highest level was 53.52 ± 1.15mg/dl in rangeland grazing and 42.64 ± 1.15mg/dl in supplementary stall feeding with a high significance. Mean value of urea concentration is higher than the mean value reported by Alia et al, (2007) found in their research serum Urea concentration was significantly ($p<0.05$) higher during the green season (9.18±0.29 mmol/l) than dry season (5.66±0.30 mmol/l). It seems that feeding conditions are more diversified which can explain the variation observed in urea in different studies**.**

Usually, urea in blood increases when protein content rises in the diet (Emmanuel et al, 1976). On the other hand the increase of uremia after a long period of low protein feeding (2 months) indicates excessive catabolism values of up to 45 mg/l00 ml were observed (Faye et al, 1992). Also Schwartz (1992) reported camels feeding on low protein forages can recycle and utilize body urea for microbial protein synthesis more efficiently than true ruminants. It has also been reported that the level of serum urea is related to the forage intake and consequently the energy and crude protein concentration (Firings et al, 1991).

Chapter Six

Conclusion & Recommendations

6-1. Conclusion:

- Reproductive performances of camels in the study area(Butana region) is low which could be attributed to the late age at first mating, Calving interval, poor management system, environmental factors and pathological reasons. Therefore, improvement of management systems and the use of controlled breeding techniques might contribute to reproduction improvement of camel under nomadic conditions.
- This study reported no significant variations in the number of services per conception and gestation period but we found significantly differences ($P \leq 0.05$) in duration of estrus cycle and estrus period, first estrous after parturition, day's open and calving interval in intensive system than the results obtained from traditional system.
- Camels may have the potential to breed all year around, but are constrained by the environmental signs. Whether daylight duration or food supply is the key factor inducing seasonality in camels remains to be clarified. the study suggest that food supply may be more important
- For production we observed that there were no significance differences ($P \geq 0.05$) between the two systems in both Number of milking /day and Milk production per day although she-camels under intensive system produce slightly higher milk production (with no significance) than those raised under traditional system, with significance differences ($P \leq 0.05$) in Lactation period.

- In the present study, the differences in weaning age of the calves born to the (Intensive &nomadic system) groups were statistically significant.
- The study indicated the importance of the nutritional status of She-camels to improve production and reproduction performance of the animals.
- Most camels in Butana region though are generally considered to be in good health and excellent condition, doubtless because of the ample availability of feed in the form of durra byproducts. Access to harvested durra fields, however, does not come cheaply indicated that; availability of feed for she camels under nomadic system increased and improved blood biochemical.
- The results found in this study indicated that camels in nomadic system show high adaptability to environmental conditions and management system (Intensive and nomadic) this undoubtedly is ascribe as well as blood metabolites, liver and kidney function.
- The results of the present study showed there were no variation in the concentrations of serum Creatinine and Glucose of dromedary camels under two management systems.
- The current study demonstrated there were significant changes in the level of Total Proteins, Albumin, Globulin, Total Bilirubin, Urea Concentration and Uric Acid and all observed were higher in nomadic system except Urea Concentration was higher in Intensive system.
- For micro elements it was observed that there were significance differences ($P \leq 0.05$) between the two systems in concentrations of serum Calcium, Phosphorus, Magnesium, and Zinc in favour of nomadic system.

- This study reported variations were found in the concentrations of E2, P4 and T3 in the serum of camels in favour of nomadic system and T4 in favour of intensive system.

6-2. Recommendation:

- ✓ As the camel sector in Sudan has a high potential and will increase in the future because: The separation of the South Sudan will reinforce the place of camel in the livestock economy and the climatic changes with the risk of desertification process, may add to the value of camels.
- ✓ The present study confirmed that the performance of She-camels at semi-intensive system was better in comparison to the nomadic management systems; therefore initiation of the semi-intensive system should be encouraged at the different states of Sudan.
- ✓ For future prospects, more research should be conducted to delineate management practices and requirements for the camels to improve the milk yield in order to make camels rearing economical (milk, meat and/or dual purpose.
- ✓ Further and deep investigations on camel calving interval under different farming conditions and controlled environmental factors to illuminate the potential of camel.
- ✓ The modernization of the camel production and processing for a better correspondence with the urban demand could be a way for the development of the camel sector in Sudan.
- ✓ A veterinary advisory programmed should be drawn up to decide how to control and prevent prevalent diseases.
- ✓ Breeding practices should be modernized and improved.
- ✓ The Government should enforce a low to prevent female slaughter.
- ✓ We recommended that improvement of nutrition and health increase the efficiency of reproduction and production of camel.

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Appendix

1- Questionnaire

بسم الله الرحمن الرحيم

Sudan University of Science & Technology

College of Agricultural Studies

Department of Animal Production

The Effects of management System on the Reproductive Efficiency, Calf mortality & Embryonic losses in Sudanese Camels

1- General Information

Herd

No.....State .....

2- Owner of herd

- Age :

  1-less than 20 years ( ) 2- between 20-40 years ( ) 3- More than 40 years ( )
- Level of Education:

  1 -Illiterate ( ) 2- Khallwa ( ) 3- Primary ( )

  4-Secondary ( ) 5-University ( )

3- ***Information about Herd:***

1- Breeds Camel:

1-Bishari ( ) 2- Anafi ( ) 3- Arabi ( ) 4-Rashaidy/Deaily ( )

5- Arabi + Anafi ( ) 6- Arabi + Rashaidy ( ) 7- Arabi + Bishari ( )

2- Herd Size?

1- less than 20( ) 2-between 20-50 ( ) 3 -more than 50( )

3- How many she-camels in your herd?

1- less than 15( ) 2-between15-40 ( ) 3 -more than 40( )

4- How many adult male in your herd?

1- None ( ) 2- One ( ) 3-between 2-3 ( ) 4 -more than 3 ( )

5- What is the purpose of breeding camels :

1- Inherited job( ) 2- Trading & profit ( ) 3-Livinghood ( )

4 -Social prestige and hoppy ( ) 5- Research ( )

6- What are the types of breeding system adopted?

1-Nomadic ( ) 2- Semi-nomadic ( ) 3- Sedentary ( )

4-Semi-intensive ( ) 5- Intensive ( )

7- What are the main sources of camel nutrition?

1-Browsing ( ) 2- Browsing & fodders ( )

3-Fodders ( ) 4-Fodders & concentrate ( )

5- Browsing & fodders& concentrate ( )

8- Herd composition:

Total	Adult male more than 4 years	Female more than 4 years	1-4 years	No of newborn

9- Mortality:

- Do you have mortality in your herd?

  1- Yes ( ) 2- No ( )
- What is the No of dead animals per year?

  No……..
- In which group the mortality occur more?

  1-Small ages ( ) 2- Old ages ( ) 3- Both Small & old ages ( )

  4-No Mortality ( )
- **From point of your view what are the reasons?**

  1-Negligence/bad management ( ) 2-Diarrhoea ( )

  3- Malnutrition ( ) 4- Disease ( ) 5- High temperature ( )
- The No of mortality in adult camels ……
- No of newborn mortality……..
- The reasons of Mortality:

	Disease	**Malnutrition**	**Dystocia**	**Maladministration**	**Unexpected mortality**	**Toxicity from rang**	**Diarrhoea**	**High temperature**
IN adult								
In Small								

- Do you leave the newborn suckling the colostrums directly after birth?

  1- yes ( ) 2- No ( )
- For how long it will take colostrums nutrition?

  1) 3-4 days ( ) 2) 5-6 days ( ) 3) More Than 6 days ( )
- Do you milk some of colostrums (for using or elimination)

  1- yes ( ) 2- No ( )
- Do you leave the newborn suckling its mother (any amount) at any time without prevent it?

1- yes ( ) 2- No ( )

- Do you believe that there is any relation between newborn mortality & less or more suckling of milk?

1- Yes ( ) 2- No ( )

- If yes, what is the relative cause of mortality?

1- Less of milk suckling ( ) 2- More of milk suckling ( )
3- More & Less of milk suckling ( )

- Which age period that the mortality more occurs in calves?

After year	7-12 months	4-6 months	3rd months	2nd Months	4) 1st month (weeks			
					4	3	2	1

- The percentage of calves mortality rate in the year?

1-None ( ) 2- 1-5% ( ) 3- more than 5%( )

- What are the reasons of mortality?

1- Disease ( ) 2-Diarrhoea ( ) 3- Tick ( )
4-Negligence/bad management ( ) 5- Weak Born ( )
6- More & Less of milk suckling ( ) 7- Malnutrition ( )
8- High Temperature ( )

10: Reproductive measuremen

1-When the breeding seasons start?

*1-Rainy season (*June - *October) ( )* *2- winter season (*November-*February) ( )*

*3-Summer (*march to may *)* ( ) *4-All the year ( )*

2-*When the breeding season end?*

1- End of Autumn ( ) 3- End of Winter ( )
2- Beginning of Winter ( ) 4- Beginning of Summer( )
5- End of Summer ( )

3-What is puberty age of the she camel?

1-less than 3 year ( ) 2-between 3-4 year ( )
3-more than 4 year ( )

4-What is puberty age of the male?

1-less than 3 year ( ) 2- between 3-4 year ( ) 3-more than 4 year ( )

5-Age of male at first time of breeding *season*?

1-less than 4 year ( ) 2- between 4-5 year ( ) 3-more than 5 year ( )

6-Age of female at first time of breeding *season*?

1-less than 3 year ( ) 2- between 3-4 year ( )
3- between 4-5 year ( ) 4- more than 5 year ( )

7-Age of female at first calf?

1-less than 4 year ( ) 2- between 4-5 year ( )

3- between 5-6 year ( ) 4- more than 6 year ( )

8-No of estrus cycle during the season?

1-One ( ) 2- between 2-5( ) 3-between 5-8 ( )

4-more than 8 ( )

9-No of Services per consumption?

1-One ( ) 2- Two ( ) 3-three ( ) 4-more than three ( )

10- No of male to female (No of female that the rutting male camel can mate)?.....

11-How do you detect the pregnancy in your camel herd?

1-Raise-up tail of She-camel ( ) 2-Refuse the male ( )

3-Other ( ) ……

12-Gestation period ……

13-In which season calving more occur? ……

14-Calving Interval?

1-Less than 15 months ( ) 2- 15-19 months ( )

3-20-24 months ( ) 4- more than 24 months ( )

15-First Service after calving.

1- 3-5 Months ( ) 2- 6-11 months ( ) 3- 12 month ( )

16-Open period per Month.

1- 3-5 Months ( ) 2- 6-11 months ( ) 3- 12 month ( )

2-19- What is the age of calf at weaning?

1) 6-7 moths( ) 2) 8-10 months( ) 3) more than 10 months( )

11- <u>Reasons of reduced reproductive efficiency</u>

1- Are there any abortion cases in your herd?

1-yes ( ) 2- No ( )

2- If Yes at which stage of gestation?

1- At the beginning ( ) 2- In the meddle ( ) 3- At the end ( )

3- What are the reasons of abortion?

1- Disease ( ) 2-Malnutrition ( ) 3- Poisoning from Browsing ( )

4- Om Shemaila Worm ( ) 5- Cause unknown ( ) 6- Thirst ( )

7- Hit the Whip ( ) 8- Changing male ( ) 9- Female down fall ( )

10-Drugs ( ) 11- Stagnant or Polluted Water ( ) 12-Pneumonia ( )

13- Frightening ( ) 14- Weakness female ( )

15- High Temperature ( ) 16-Brucellosis ( )

2- What is the No of abortion in your herd during the year?

1- None ( ) 2- between1-5% ( ) 3- more than 5% ( )

3- What is the No of abortion in she-camel during the season? ……

4- Do you fertilize all females in the season or you follow specific system for mate?

1-All female ( ) 2- 50% of females ( ) 3-Females are available ( )

5- The No of fertilized female in the herd in season? .....

6- Rate of conceived females from the fertilized ones?…… …….

7- The No of calving from those conceived? ……

8- The diseases that cause the abortion?

1- Aljufar disease ( ) 2- Pneumonia ( ) 3- Brucellosis ( )

4-Om Shimaila Worm ( ) 5- Unknown Reason ( )

12-<u>Role of management:</u>

1- Who is taking care of the herd?

1-the owner ( ) 2- hired person ( ) 3- Family labour ( )

4 - Other ( ) ……..

2- Number of milking per day/Liter

1-Once ( ) 2- Two time ( ) -Three Time ( )

3- What is average quantity of milk production per day per pound?.....

4- How long is the lactation period?

1) 4-6 months ( ) 2) 7-9 months ( ) 3) 10-12 months ( ) 4) more than one year ( )

5- Age of calves at weaning.

1) 6-7 moths( ) 2) 8-10 months( ) 3) more than 10 months( )

2) Time number of feeding the herd per day? …….

1- Once ( ) 2- twice ( ) 3- All day ( )

3) Is there any nutritional care for pregnant females?

1-yes ( ) 2- No ( )

4) If yes, how do you care about it?

1-Good Nutrition ( )

2- Prevented from grazing in the early months of pregnancy ( )

3-Prevented from grazing in the last months of pregnancy ( )

5) Is there any specific place for calving?

1-yes ( ) 2- No ( )

6) How do you manage the female during and after calving?

1- Good nutrition ( ) 2 - Observant only ( )

3- Observant & well fed ( ) 4- Does not have a care ( )

7) How do you care about newborn?

1- Stimulated to suckling ( ) 2- Does not have a care ( )

3-protected from direct heat of sun ( )

13-<u>Reproductive in Female</u>

1- How long the duration of estrus period per day? ……

2- Are there any females returns after mating?

1-yes ( ) 2- No ( )

3- If yes, how long time to return back to estrus period?

Duration by day …….. Duration by week…….. Duration by month…..

4- What are the reasons?

1- Weakness of the female ( ) 2- Weakness of the male ( )

3-Malnutrition ( ) 4- Reproductive problems in female ( )

5- Unknown reason ( )

5- What is reproductive age of female? ……

6- What is the number of calves born by she-camel in her reproductive age?……..

7- When do you cull the female? Age by year.

1- 15-18 year ( ) 2- 19-22 year ( )

3- 23-26 year ( ) 4- Do not isolate even mortality ( )

8- Why do you cull it?

1- Old age, weak production and fertility( ) 2-Necessity ( )

3- Do not isolate from herd ( )

9- How do you cull it?

1- Sales ( ) 2- Do not isolate from herd ( )

10- If you slaughter it, do you find some of them are pregnant?

1-yes ( ) 2- No ( )

11- If yes, what is the pregnancy percentage from the culled female?

……

14-<u>Reproduction in Male</u>

1- How do you select the male for herd breeding?

1-Morphology ( ) 2- Mother performance ( )

2- Purpose of breeding ( ) 3- Breed ( )

3- Are there any problems in fertility of males?

1-yes ( ) 2- No ( )

4- If yes, tell us.

1- Do not fertilize the females ( ) 2- No problems ( )

5- What are the problems that face the males during the breeding season?
1-Sudden illness ( ) 2-Aggressiveness & fighting with other males ( )
3-weakness Browsing/ malnutrition ( ) 4-The large number of female ( )
5- No problems ( )

6- For how long the ruts in the male continue?
1- 3-4months ( ) 2- 5-7months ( ) 3- All the year except Summer ( )
4-All the year ( )

7- What is the reproductive age of male? ……

8- When do you cull the male (Age/year)?
1) 10-15 year ( ) 2) 16-20 year ( ) 3) 21-25 year ( )
4) 26-30 year ( ) 5) Do not isolate even death ( )

9- Reasons for culling?
1- Old age & weak fertility ( ) 2- Necessity ( ) 3-Not Isolate ( )
4- Disease ( ) 5- Present best male ( ) 6- Change the Purpose of breeding ( )

10- What are the problems that face reproduction of camel in the area?
1- Littleness of veterinary services ( ) 2-lack of security ( )
3-Shortage of Browsing &feeding ( ) 4-Taxes ( ) 5-All the problems ( )

11- From your point of view what are recommendation and suggestion to improve the reproductive efficiency of camel?
1- Good nutrition ( ) 2- Presence of the male with the Herd( )
3-Veterinary care ( )

2-Photographs

The intensive system

The nomadic system

Team work in Butana region

Questionnaire: Interview with owners/Herders

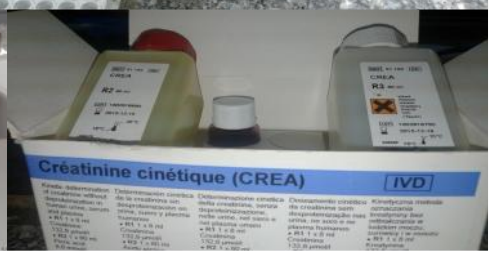
Case study of embryonic losses at Tumboul Slaughterhouse

Collection and separation the blood samples

Blood Analysis in NRC- Cairo - Egypt

Spectrophotometer **ELISA Reader**

Kits for blood Biochemical



Kits for Hormones

Kits for minerals