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The Effects of Management Systems on the Reproductive Efficiency in some Sudanese Camel Breeds

اثرادارة نظم الرعاية علي الكفاءه التناسلية في بعض سلالات الابل السودانية

A Thesis Submitted to Sudan University of Science & Technology in partial Fulfillment of the Requirements for MS.c degree in Reproductive Physiology

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(أفلا ينظرون الى الابل كيف خلقت)

صدق الله العظيم

سورةالغاشية(17)

DEDICATION

To the people who give me the power:

My father and my mother and my grandmother

My uncle (modather)and my aunt

My brothers and sisters

<u>Nafeesa</u>

Acknowledgment

*First of all thanks go to ALLAH for his mercy and giving us reason to research and knowledge and I would like to express my sincere appreciation to Professor:**Abd Aziz Makkawi Abdel Rahman** for his support,and professional supervision ,may Allah bless him.*

*And special thanks from the deep of my heart for A: **Eglal Siddeg Elkhider** without her this study cannot be completed and special thanks for the all animal production department staff*

Also my deep thanks to my Ms.c batch(6) the friends of my road….

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Abstract

A questionnaire survey and group discussions were conducted to characterize the reproductive performances of camels at their natural nomadic region in El butana region, south eastern Sudan and semi intensive management systems in Khartoum state center of Sudan. A total of 40 camels were included to study the camel management dominating in those study areas (nomadic and semi intensive system). Mean age of puberty for she camel in semi intensive was3.12±.376years and 3.37±.537years in the nomadic system. The mean age of puberty for male camel was 3.93±.785 years in semi intensive and 3.85±.279 in nomadic system. Mean age at first mating of male was 5.21±0.785 years in semi intensive and 5.13±0.694 in nomadic system and the age of female at the first calving was 3.82±.883 years in semi intensive system and 4.35±.575 years in nomadic system while number of service per consumption was 1.74±.514 in the semi intensive system and 1.70±.559 in nomadic system and calving interval in the two systems were 18.24±3.507months in semi intensive and 21.15±2.475 months in nomadic system and the first service after calve was 3.93±785 months in semi intensive system and 3.85±.279 months in nomadic system. The open period was 212.06±105.919 days in semi intensive system and 279.57±97.883 days in nomadic system.

Milk production per day was 6.53±.631 in semi intensive system and6.48±.332 liters in nomadic system and number of milking per day was 2.35±.931 times in semi intensive system and 2.61±.583 times and the mean lactation length was 9.29±2.201 months in semi intensive system and11.83±3.822 in nomadic system. Reproductive performances of camels in the study area(butana region) is low which could be attributed to the late age of puberty, long gestation period, 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.

الخلاصة

أجري الاستبيان والمناقشات الجماعية لتميز الكفاءه التناسليه للإبل بين المنطقة البدوية الطبيعية في منطقة البطانة؛جنوب شرق السودان ونظم إدارة شبه المكثف في ولاية الخرطوم وسط السودان. أدرجت مجموعه 40 من الإبل التي تضمنتهم الدراسه في نظام الاداره المراد دراسته الشبه مغلق والرحل.متوسط سن البلوغ في النظام شبه المكثف 3.12±376. سنوات و3.37 ± .537 سنوات في نظام الرحل. وكان متوسط عمر البلوغ للإبل الذكور 3.93 ± 0.785 سنوات في شبه المكثف و3.85 ± 0.279 في نظام الرحل. متوسط السن عند التزاوج الأول من الذكور كان 5.21 ± 0.785 سنوات في شبه المكثف و5.13 ± 0.694 سنوات في نظام الرحل وعمر الإناث عند أول ولادة كان 3.82 ± 0.883 سنوات في النظام شبه المكثف و4.35 ± 0.575 سنوات في نظام الرحل بينما كان متوسط عدد من التلقيحات اللازمه للاخصاب 1.74 ± 0.514 في النظام شبه المكثف و1.70 ± 0.559 في نظام الرحل ومتوسط الفتره بين الولادتين في النظامين كان 18.24 ± 3.507اشهرفي شبه المكثف و21.15 ± 2.475 أشهر في نظام الرحل وأول دوره شبق بعد الولاده 3.93 ± 785 اشهر في النظام شبه المكثف و3.85 ± 0.279 أشهر في نظام الرحل. متوسط الفترة المفتوحة 212.06 ± 105.919 أيام في النظام شبه المكثف و279.57 ± 97.883 أيام في نظام الرحل.

كان إنتاج الحليب يوميا 6.53 ± 0.631 لتر في النظام شبه المكثف ± 6.48 0.332لتا في نظام الرحل وعدد الحلبات في اليوم كان 2.35 ± 0.931 مره في النظام شبه المكثف و2.61 ± 0.583 مرة، وطول موسم الحليب متوسط كان 9.29 ± 2.201 أشهر في نظام شبه المكثف و 3.82 ± 83.اشهرفي نظام الرحل. الاداء الإنجابي للإبل في منطقة الدراسة (منطقة البطانة) منخفضة الأمر الذي قد يعزى إلى تأخر سن البلوغ، فترة الحمل الطويلة، وضعف نظام الإدارة، والعوامل البيئية والأسباب المرضية. لذلك، تحسين نظم الإدارة واستخدام تقنيات تربوية تسيطر قد تسهم في تحسين اداء الإبل.

Chapter one
Introduction

Camels are an important livestock species in the arid and semi-arid zones in Asia and Africa. Camels contribute significantly to the livelihood of the pastoralists and agro-pastoralists living in the environments of the deserts and semi deserts of Asia and Africa. The camel population in Sudan was estimated to be 4.7 millions heads (**MARF 2011**). They are well adapted to the local environmental conditions and can survive in zones which are prohibitive for other livestock species.

They occupy a geographical zone the north of latitude 14º N in the west and 16º N in the east (**Wilson ,1984**).The camels of Sudan belong to the species *Camelus dromedarius*, and are owned and raised by nomadic tribes. Camel herders migrate north in the wet season and south during the dry season. Camels in the Sudan are classified as pack (heavy) and riding (light) types according to the function they perform. These traits were probably developed as a result of selection applied by the various camel owning tribes. The Sudanese heavy type camels constitute the majority of the camels kept by nomads in Sudan. Within this group two subtypes can be identified on the basis of conformation and tribal ownership: The Arabi and Rashaidi camels. The Arabi camel may be further subdivided into Light Pack, Big Arabi and Heavy Arabi. On the other hand, the riding camels are restricted to the north-east of the

country between the Nile and Red Sea. The two main recognized types are Anafi and Bishari camels(RedSea Hills) **El-Fadil (1986).**

The increasing human population pressure and declining per capita production of food in Africa precipitated an urgent need to develop previously marginal resources, such as the semi-arid and arid rangelands, and to optimize their utilization through appropriate livestock production systems among which camel production is certainly the most suitable (**Schwartz 1992**). Despite the camel's considerable contribution to food security in semi dry and dry zones, and its being a major component of the agro-pastoral systems in vast pastoral areas in Africa and Asia, little is known about its production potential and production systems compared to other domestic animals. Camels are slow reproducers since a female camel is sexually mature at the age of 4±5 years.

Pregnancy is just over 12 months (**Kamber *et.al.*, 2001**) and mean calving parameters which include age at first calving (4.76 years), length of calving (29.8 minutes), postpartum oestrus (5.27 months), calving interval (23.8 months), and number of calvings in a lifetime (8.49 calves) **Abdussamad *et al(*2011).**

Among other biological factors, the reproductive performance exerts a major influence on the productivity of the milking animal. Improved reproductive performance will directly lead to increased milk production

(Yagil, 1986). In recent years much research on camels has concentrated on anatomy and physiology of reproduction. In contrast, little emphasis has been given to the practical aspects of reproductive performance **Wilson (1998**).

However, most previous research conducted on camels was oriented towards diseases, reproductive physiology and characterization **Mehari et al (2007**).

The available information on camel production potential and production systems especially in Sudan is inadequate Camel research in the Sudan has been focused mainly on functional anatomy, diseases and reproduction. Research on husbandry and management systems, feeding and nutrition and production performance are scanty **(Majid, 2000; Majid, 2006)**. In the last few years some new modes of camel husbandry practices were developed for the improvement of the traditional systems of camel keeping methods. This study presents data on the current status of nomadism among dromedary herders in Butana region, and compare to those in semi intensive system particularly regarding sources of income and total income and expenditure among dromedary herders in Butana area and Khartoum state. Moreover, the study presents information concerning the indigenous knowledge and practices of camel herders in the study areas.

Therefore, this study is conducted to assess the reproductive performance of camels in the two districts and in so doing contribute to the generation of

knowledge and input into the development of camel production in the study areas.

The objective of the study is to evaluate:

1. The effect of management systems on reproductive efficiency in Sudanese camels to indicate which suitable management system can be adopted.
2. Compare between productive and reproductive trait under the two systems of management.

Chapter Two
Literature Review

2-1-camel:

A **camel** is an even-toed ungulate within the genus ***Camelus***, bearing distinctive fatty deposits known as "humps" on its back. The two surviving species of camel are the dromedary, or one-humped camel (C. dromedaries), which inhabits the middle east and the Horn of Africa; and the Bactrian, or two-humped camel (C. Bactrian's), which inhabits central Asia. Both species have been domesticated; they provide milk, meat, hair for textiles or goods such as felted pouches, and are working animals with tasks ranging from human transport to bearing load (**the new oxford American dictionary-2005).**

2-2camel classification:

Scientific classification	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Artiodactyla
Family:	Camelidae
Tribe:	Camelini
Genus:	***Camelus***
Spp:	***dromaterus*** **Linnaeus, 1758**

2-3Camel Existence:

Most camels surviving today are domesticated **(Taylor etal 2012) (Walker _matt, 2009)** Along with many other megafauna in North America, the original wild camels were wiped out during the spread of Native Americans from Asia into North America, 12,000 to 10,000 years ago (**Worboys, 2010) (Scaree and Chris, 2000)** The only wild camels left are the Bactrian camels of the Gobi Desert (**National geographic society 2012).**

Like the horse, before their extinction in their native land, camels spread across the Bering land bridge, moving the opposite direction from the Asian immigration to America, to survive in the Old World and eventually be domesticated and spread globally by humans.

Dromedaries may have first been domesticated by humans in Somalia and southern Arabia, around 3,000 BC, the Bactrian in central Asia around 2,500 BC(**Mukasa,1981)(Bullit and Richard,1990)** as at Shar-i Sokhta (also known as the Burnt City), Iran **(Cris,2014).**Discussions concerning camel domestication in Mesopotamia are often related to mentions of camels in the Hebrew Bible. The *International Standard Bible Encyclopedia: E-J* for instance mentions that "In accord with patriarchal traditions, cylinder seals from

Middle Bronze Age Mesopotamia showed riders seated upon camels (**Bromiley etal, 1981) (Bullit_richard, 1990)**.

2-4Distribution and Numbers:

There are around 14 million camels alive as of 2010, with 90% being dromedaries(Dolby and Karen,2010) Dromedaries alive today are domesticated animal (mostly living in the Horn of Africa, the Sahel , Maghreb , Middle East and South Asia) . The Horn region alone has the largest concentration of camels in the world (Eitan etal, 1976) where the dromedaries constitute and important part of local nomadic life. They provide nomadic people in Somalia (which has the largest camel herd in the world) and Ethiopia with milk, food, and transportation (FAO, 2012)

Commercial camel market headcount in 2003

The Bactrian camel is, as of 2010, reduced to an estimated 1.4 million animals, most of which are domesticated.(**Koenig,2007**) The only truly wild Bactrian camels, of which there are less than one thousand, are thought to inhabit the Gobi Desert in China and Mongolia(**Hare,2012**).

The largest population of feral camels is in Australia. There are around 700,000 feral dromedary camels in central parts of Australia, descended from those introduced as a method of transport in the 19th and early 20th centuries (**Webster and George, 2010**) This population is growing about 8% per year (**Pople, 2010**) Representatives of the Australian government have culled more than 100,000 of the animals in part because the camels use too much of the limited resources needed by sheep farmers (**Tsai and Vivian, 2012)**

A small population of introduced camels, dromedaries and Bactrian's, wandered through Southwest United States after having been imported in the 1800s as part of the U.S. Camel Corps experiment. When the project ended, they were used as draft animals in mines and escaped or were released. Twenty-five U.S. camels were bought and imported to Canada during the Cariboo Gold Rush (**Mantz and John, 2006).**

2-5-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)

According to (**marf,2011**), camel population in Sudan ranks the second in the world after Somalia with 4.7 millions heads. 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. In spite 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 *grass* form is popular in rural areas where camel is generally reared.

2-5-1-Camel population IN SUDAN:

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**) 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.

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2-5-2Camel Distribution IN SUDAN:

It is known that camel is the animal adapted to the arid lands in the old world, in Africa and in Asia. The north of Sudan is widely included in arid areas of African continent and the camel population is concentrated between approximately isohyets 100 and 300 mm, constituting the “camel belt”. This

area includes the states of North and South-Darfur, North and South-Kordofan, Khartoum, Gezira, Kassel, Red Sea, River-Nile, Northern Sudan, White Nile, Blue Nile and Sinner State.

North Kordofan state only has the highest camel population with more than one million heads, representing approximately 5% of the whole world camel population. However, this population is moving and a slight expansion of the camel belt to the South is observed since one decennial as in other countries of Sahel region **(Faye , 2009).**

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 etal, 2011).**

2-5-3-Camel breeds of the Sudan:

Sudan has the second largest camel population in the world, estimated at nearly 3,000,000 (**Salih, 1988**), and the country 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. The Arab breed of camel is well suited for meat production and transportation. Camel milk is important at the subsistence level but is rarely marketed. The export of camels for slaughter-mostly to Egypt, but also to the Libyan Arab Jamahiriya and other countries, is an important source of foreign currency, which is not overlooked in a country with few roads and a chronic fuel shortage.

2-5-4-Camel Management System:

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 B and Others, 2011)**

For the nomad who inhabit the desert and semi dessert region. in the Sudan camels plays 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).**

2-5-5-Camel Production System in Sudan:

2-5-5-1- Traditional Nomadic System:

This system is dominant inthe geographical zone between 13°N to 16°N (Northernpart of the camel belt) **(Alkori and Majid, 2000)**. This is typically practiced bythe Kababish tribe in Northern Kordofan State. The camel herders are continuously on the move in response to availability of grazing and water supplies. 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 **(Alkori and Majid, 2000)**.

2-5-5-2 Transhumant or Semi- Nomadic System:

This system is found in eastern and southern regions of the camel belt And is practiced by semi-nomadic tribes **(Alkori 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 **(Bakhiet, 1999)** Several tribes in Eastern Sudan practice a transhumant mode of range utilization **(Abaas et al, 1992)** They move from one area to another following certain migratory routes,

2-5-5-3 Sedentary and semi-Sedentary System:

This system is practiced in the eastern region of Sudan (East of River and small part of wood). Nile and west of the Red Sea hills).it is also practices in the agricultural areas in the central and southern parts of the camel belt (**alkori and majid, 2000**)

2-5-5-4- Intensive System:

In the past this type of production was practiced in all camel area but it was limited fir racing camel only (very small number of animal) recently intensive system of camel meat and dairy production exists as a kind of commercial investment in Khartoum state(**Eissa and Mustafa,2011).**

2-6-Reproduction of Camel:

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).**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 is up to 40years **Mukas and mugerwa(1981**).

2-6-1- Reproduction 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)**

2-6-1-1-Puberty & Maturity (male):

Puberty age in the male camel is generally defined as time when he is capable of successful mating and getting her 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**) 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).**

2-6-1-2-male for breeding:

The average age to select breeding male was 5.94±0.81 years **(Simenew et al,2013)** Males begin to mate at around three years of age, too, but still are not sexually mature until six years of age**Naumann(2012).**

2-6-2-Reproduction in Female of Camel:

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)**

2-6-2-1Puberty & Maturity (she camel):

Puberty of female occur at the 3-4 age **Hartely** report at 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; Khetami,**

1970), but it can be bred at 3-5 years of age (**Matharu, 1966; Williamson and Payne, 1978**).

Yasin and Abdul-Wahid (1957) reported that the female camel would breed until 30 years of age.

2-6-2-2-Service per conception:

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 etal(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.

2-6-2-3Age at the first calving:

First parturition generally occurs at five years **(Moslah and Megdiche, 1989).**In semi intensive improved state in somalian state first calve (57±5.52) month that's mean all most 5 years **(Simenew etal, 2014)**

the mean age of first calving in **Mayouf at 2014** is 4.66 years **Mayouf etal(2014)** age at the first calving in western Sudan is 52.44±7,74 month(4.37 years)(**Musa etal,2006)also abdalgader and falah** report that first calving

occur between 36-85month the mean is 54.8 month (**Abdalgader and Falah,2010).**

Age at the first Calving according to**(Zubair etal,2015)is** $4.34^{b}\pm0.73$ in semi intensive and $5.32^{a}\pm0.45$in traditional nomadic.

2-6-2-4 Open period:

Days open: The time from when a she camel calves until when it conceives The open period for 135 camels examined verged 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**).

2-6-2-5Calving 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 were5.17±0.94and2.82±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 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 etal2015)** is19.09^{b}±1.76 in semi intensive and 25.01^{a}±0.00in traditional nomadic .

2-6-3-The camel milk production:

The milk production is one of the main objectives of the camel producers. According to the scientific literature, the milk productivity of camels in Sudan is low: between 820 and 2400 liters/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 liters in semi-intensive system vs. 1204 liters only in traditional system (**Bakheit et al, 2008**) i.e. on average 6.9 vs. 3.1 liters per day. (**Faye, 2008**) said that the total production varies between 1000 and 12,000 l during an 8–18 month lactation period.

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**).

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**).

2-6-3-1 Milking frequency:

The milking frequency in the study of (**Zubair etal 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 etal2015)** is three time in semi intensive and two times for traditional nomadic.

2-6-3-2Lactation period:

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) the average length of lactation in the camel is 12-18 months **(FAO, 2014)** 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).**in other study lactation period per day was 303-306 days **Aboulella,(1994)Musa etal(2006).**

In other side was 15-18month according to **Dmitrez and Ernest (1989)** and 567 days in study by **Bekele et al (2002)**

Chapter Three

Material and Methods

3-1-Areas of the study:

This study conducted in two places of concern:

A-The Butana region.(kassla-Algedaref) representing nomadic system.

B-Khartoum state camel farms representing semi intensive system.

3-1-1-Description of the study area:

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 ar ea 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)**

2. Khartoum features a hot desert climate (Köppen climatclassification) 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. **(wikipedia2016)**

3-2-Structure of the herd:

The herds under study were local breed Purposive sample from ten different Farms for both Intensive &Nomadic Systems and then the female camels were at different stages of lactation and different stages of parity order to know the effect of management systems in reproductive efficiency in Sudanese camels.

3-3-Research methodology:

Questionnaires were used to collect information from a total of 40 Farms in different sites between the two systems by guided interviews. Focused group discussion was the other approach to gather information about the production system and reproductive performances of camels. The questionnaire was previously used in Sudan. The questionnaires were designed to obtain information on herd management, breeding practice.

3-4-Parameters to be use:

The main reproductive parameters considered include:

1-Breeding systems

2-calving interval

3- Numbers of services per consumption,

4-age at the first calving

5-milking frequency

6-milk per day

7-lactation period

8-open period

9- Male for breeding

10-breeding systems

11-Female at the first breeding season

Statistical Analysis:

The data analyzed by (SPSS) using Descriptive Statistics for mean by T test, C.V, STD error. While Inferential Statistics were using the correlation, Regression& t test.

Chapter Four

Results

4-1- Breeding system:

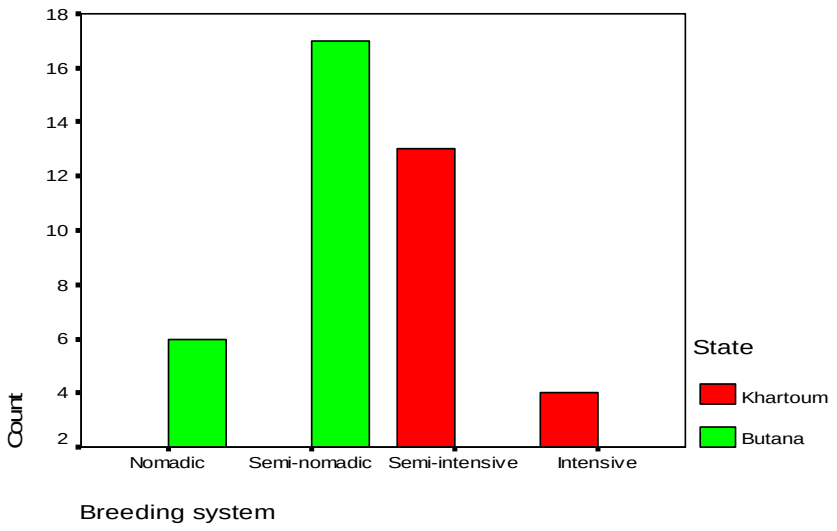
The data in table (1) and figure (1) projected that the overall mean breeding system was35.3-64.7%in Khartoum semi intensive system and26.1-73.9% in Butana regions representing nomadic system respectively with significant effect($p \leq .001$).

Table (1) illustrate management system in the two systems:

Region	**Breeding system (%)**				**Sig****
	Intensive	Semi-intensive	Nomadic	Semi-nomadic	
Khartoum	35.3	64.7	-	-	.000
Butana	-	-	26.1	73.9	

** Sig at 1%. Chi's= 40

Figure (1) management system in Khartoum state and butana region:



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

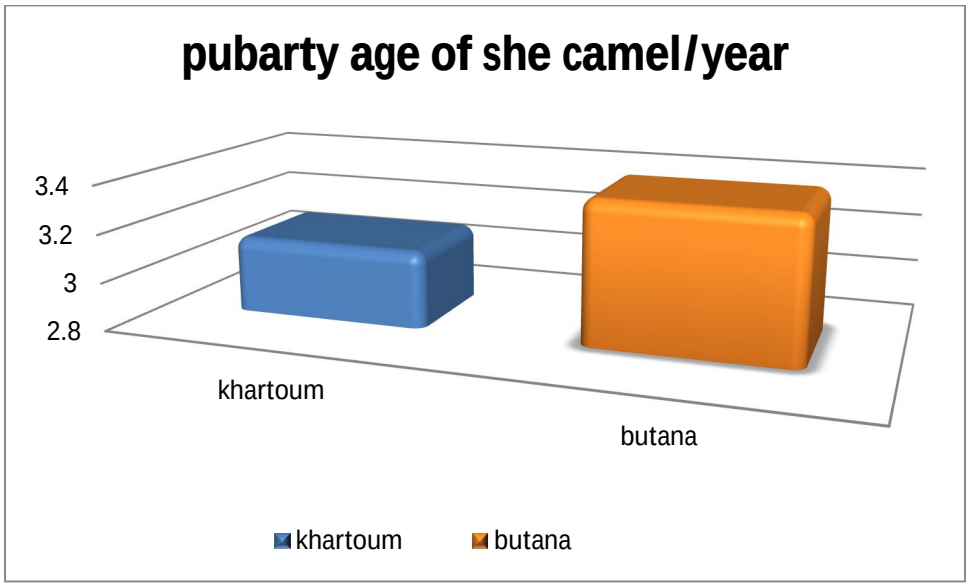
The data in table (2) and figure (2) projected that significant (p≤0.05)difference between the two systems. The overall mean Puberty age of the she camel per years was 3.12±.574 years in Khartoum semi intensive system and3.37±.376 years in Butana regions nomadic system.

Table (2) illustrate puberty age of she camel in the two systems:

Items	**Region**	**Minimum**	**Maximum**	**Mean± Std.Error**	**Sig***
Puberty age of the She Camel / year	Khartoum	2	4	3.12±.574	.102
	Butana	3	4	3.37±.376	

*: significant (p≤0.05)

Figure (2) puberty age of she camel\year:



4-3-Puberty age of the male/year:

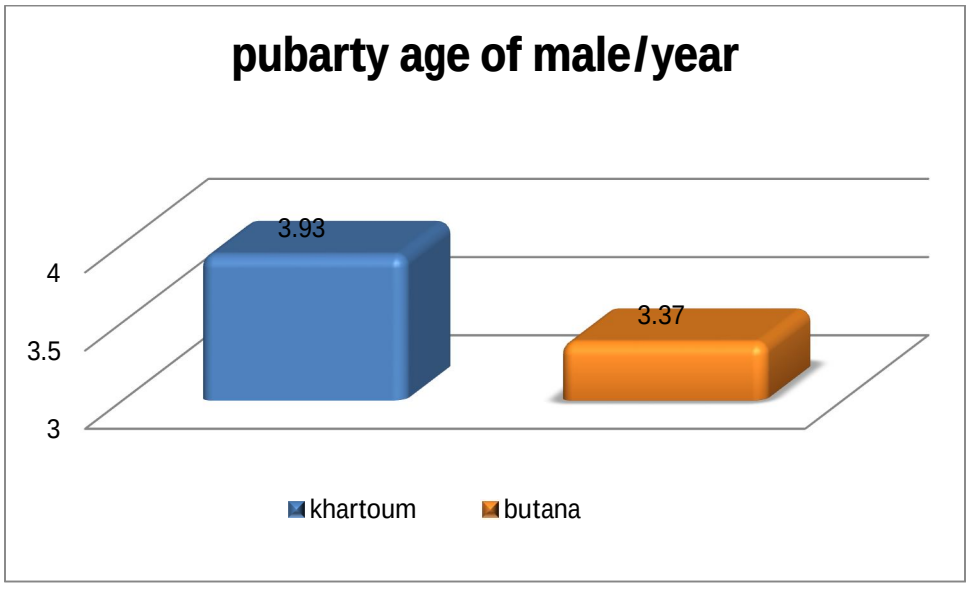
The data in table (3) and figure (3)projected that no significant effect between the two systems. The overall mean Puberty age of the male per years was 3.93± .785 years in Khartoum semi intensive system and3.85± .279 years in Butana regions nomadic system .

Table(3) illustrate puberty age of male camel/year in the two systems:

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

NS: Not significant

Figure (3) puberty age of male camel/year:



4-4-Age of male at first time of breeding season:

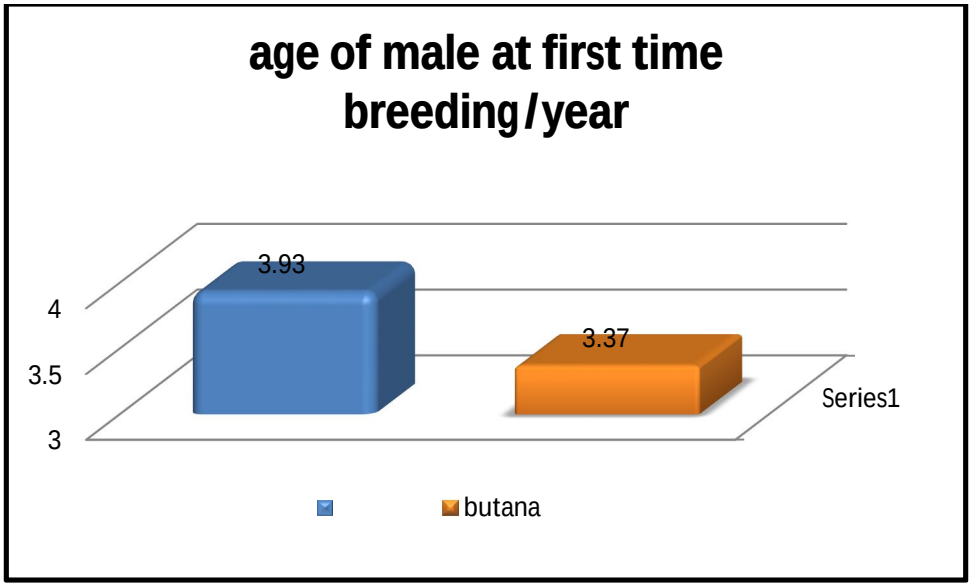
The data in table (4) and figure (4) projected that not significant effect between the two systems. The overall mean Age of male at first time of breeding season per years was 5.21±.785 years in Khartoum semi intensive system and 5.13±.694 years in Butana regions nomadic system.

Table (4) illustrate age of male at the first breeding season in the two systems:

Items	**Region**	**Minimum**	**Maximum**	**Mean± Std.Error**	**Sig** ns
Age of male at first time of breeding season	Khartoum	3	7	5.21±.785	.759
	Butana	4	8	5.13±.694	

NS: Not significant

Figure (4) age of male at the first breeding season:



4-5-Age of female at first breeding season:

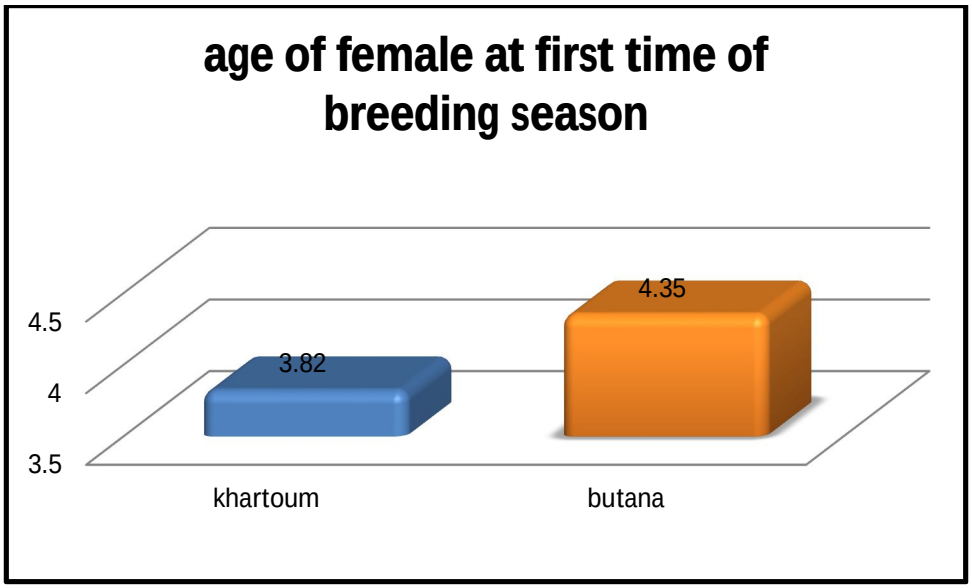
The data in table (5) and figure (6) projected that a significant($p \leq 0.05$) different between the two systems systems. The overall mean Age of female at first time of breeding season per year was 3.82±.883 years in Khartoum(representing semi intensive system) and4.35±.573 years in Butana regions(representing nomadic system).

Table (5) illustrates age of female at the first breeding season in the two systems:

Items	**Region**	**Minimum**	**Maximum**	**Mean± Std.Error**	**Sig***
Age of female at first time of breeding season	Khartoum	2	6	3.82±.883	.028
	Butana	3	5	4.35±.573	

*: significant ($p \leq 0.05$)

Figure (5) age of female at the first breeding season



4-6-Age of female at first calving:

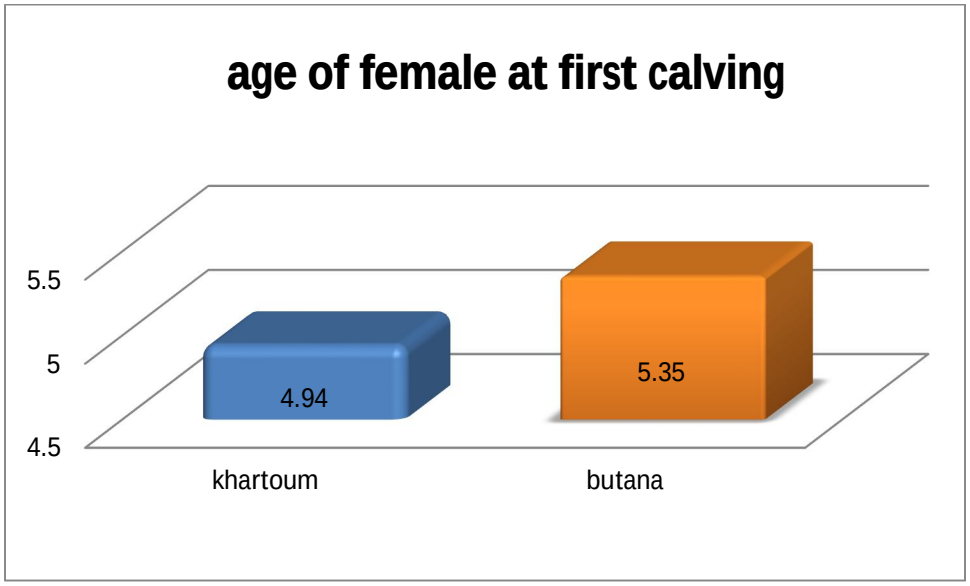
The data in table (6) and figure (6) projected that a significant difference ($p \leq 0.05$) between the two systems .The overall mean Age of female at first calf per year was 6.53± .631, year in Khartoum semi intensive system and6.48± .332 years in Butana regions nomadic system.

Table (6) illustrates age of female at the first breeding season:

Items	Region	Minimum	Maximum	Mean± Std.Error	Sig*
Age of female at first calving	Khartoum	4	6	4.94±.659	.044
	Butana	4	6	3.85±.573	

*: significant ($p \leq 0.05$)

figure (6) age of female at the fist breeding season:



4-7-No of services per conception:

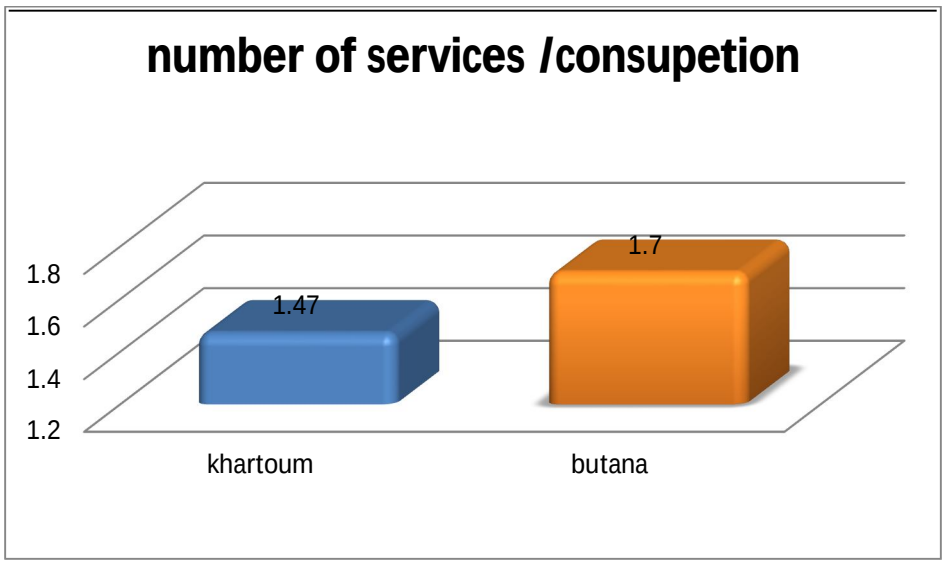
The data in table (7) and figure (7) projected that no significant difference between the two systems. The overall mean No of services per conception was 1.47±.514, in Khartoum semi intensive system and1.70±.559 in Butana regions nomadic system.

Table (7) illustrate service per conception in the two systems:

Items	**Region**	**Minimum**	**Maximum**	**Mean± Std.Error**	**Sig^{ns}**
No of services per conception	Khartoum	1	2	1.47±.514	.201
	Butana	1	3	1.70±.559	

NS: Not significant

Figure (7) service per conception:



4-8-Calving Interval:

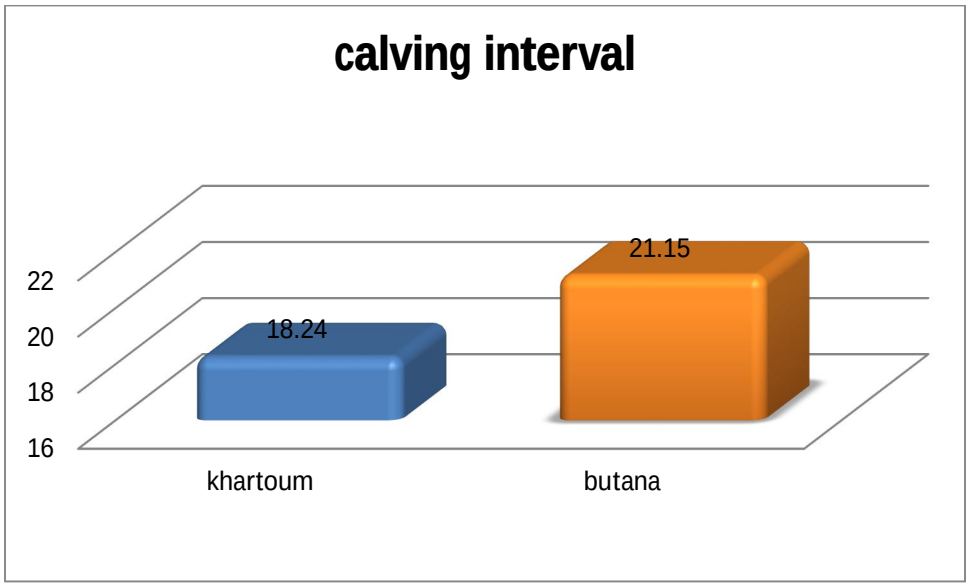
The data in table (8) and figure (8) projected that significant different ($p \leq 0.01$) between the two systems. The overall mean Calving Interval per months was 18.24±3.507 months in Khartoum (representing semi intensive system) and, 21.15±2.475 months in Butana regions (representing nomadic system).

Table (8) illustrate calving interval in the two systems:

Items	**Region**	**Minimum**	**Maximum**	**Mean± Std.Error**	**Sig ****
Calving Interval	Khartoum	11	24	18.24±3.507	.004
	Butana	15	24	21.15±2.475	

**: high significant ($p \leq 0.01$)

figure (8) calving interval



4-9-First Services after calving /month:

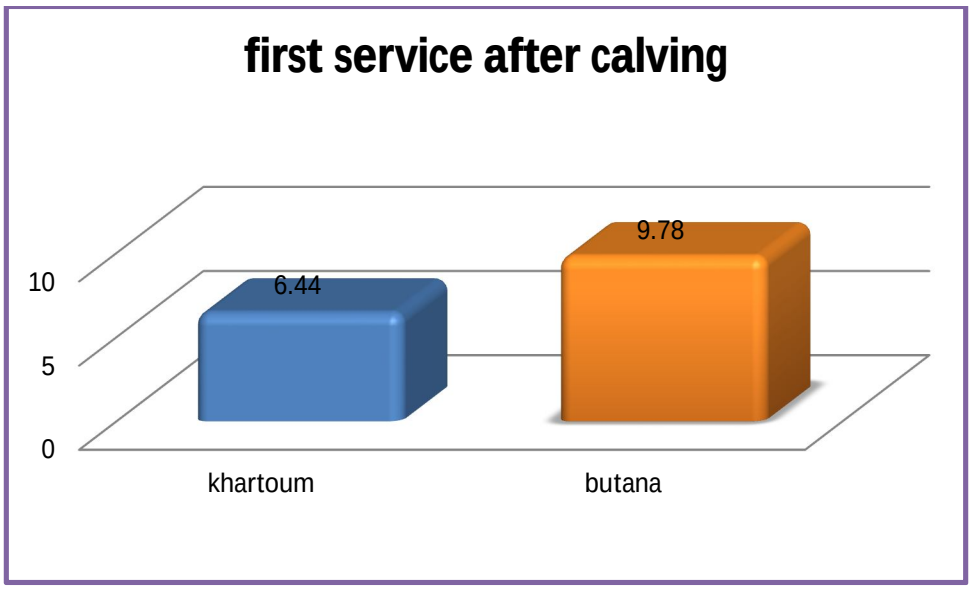
The data in table (9) and figure (9) projected that high significant difference ($p \leq 0.01$) between the two systems. The overajll mean at First Services after calving per month was 3.93±.78 months in Khartoum semi intensive system and 3.85±.279 months in Butana regions nomadic system.

Table (9) illustrate First Services after calve /month in the two systems:

Items	Region	Minimum	Maximum	Mean± Std.Error	Sig**
First Services after calving /month	Khartoum	2	12	3.93±.785	.002
	Butana	3	12	3.85±.279	

**: high significant ($p \leq 0.01$)

Figure (10) First Services after calve /month:



4-10-Open period/day:

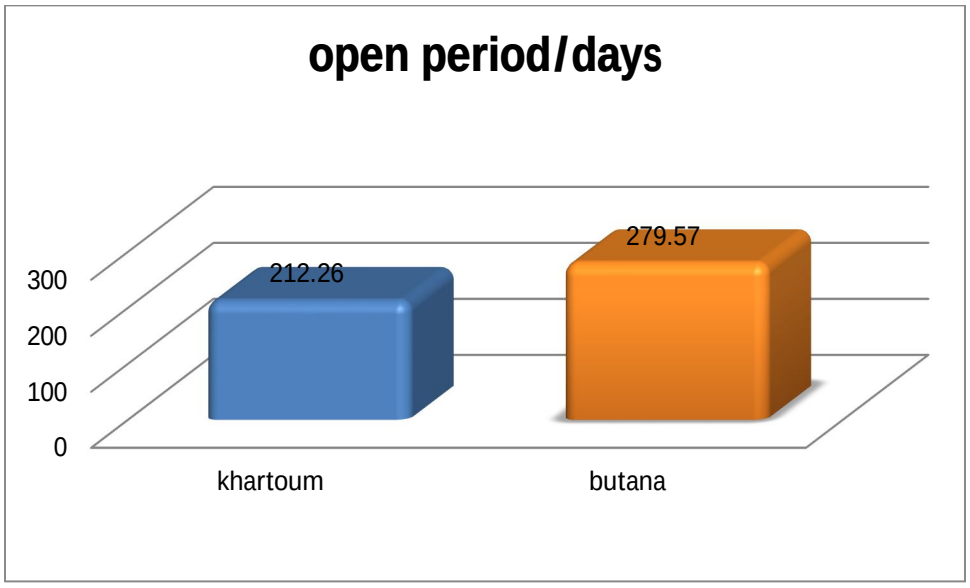
The data in table (10) and figure (10) illustrates that high significant difference ($p \leq 0.01$) between the two systems. The overall mean open period was 212.06±105.919 days in Khartoum semi intensive system and279.57±97.883 days in Butana regions nomadic system.

Table (10) illustrate open period in the two systems:

Items	**Region**	**Minimum**	**Maximum**	**Mean± Std.Error**	**Sig***
Open period/day	Khartoum	75	365	212.06±105.919	.044
	Butana	90	365	279.57±97.883	

*: significant ($p \leq 0.05$)

Figure (10) open period:



4-11-Number of milking per day:

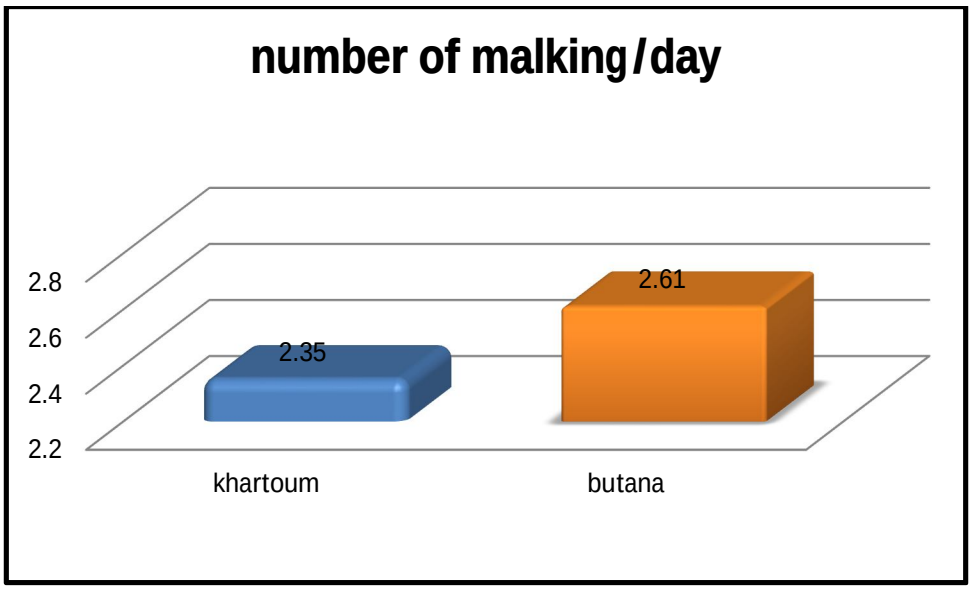
The data in table (11) and figure (11) projected that not significant different between the two systems.The overall mean number of milking per day was 2.35±.931, 2.61±.583 times in Khartoum semi intensive system and2.61±.583 times in Butana regions nomadic system.

Table(11) illustrate the number of milking in the two systems:

Items	**Region**	**Minimum**	**Maximum**	**Mean± Std.Error**	**Sig^{ns}**
Number of milking per day:	Khartoum	1	4	2.35±.931	.293
	Butana	1	3	2.61±.583	

NS: Not significant

Figure (11) number of milking:



4-12-Milk production:

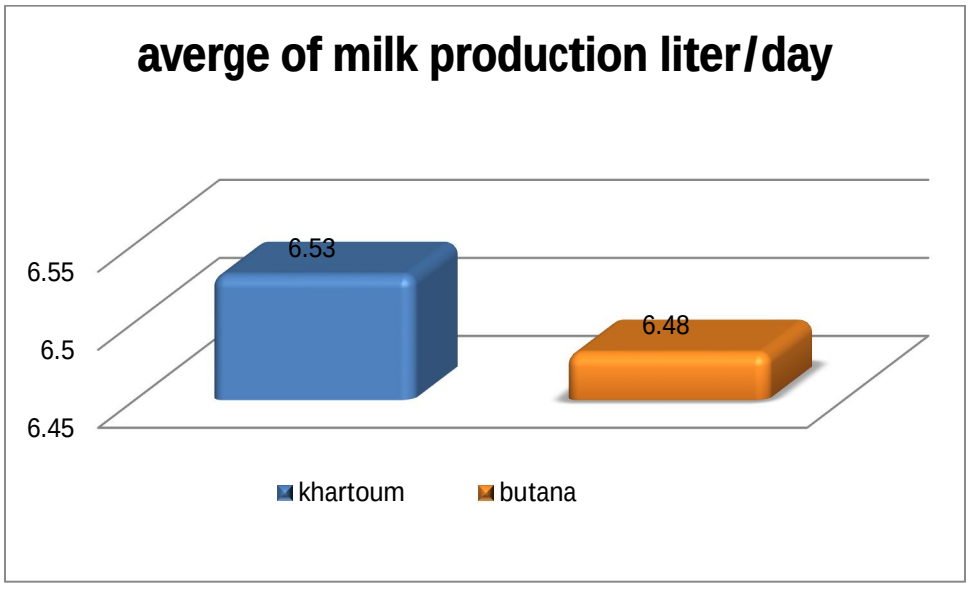
The data in table (12) and figure (12) projected that significant different ($p \leq 0.05$) between the two systems.The overall mean milk production per day was 6.53± .631 liters in Khartoum semi intensive system and6.48± .332 liters in Butana regions nomadic system.

Table (12) illustrate milk production per day/liter in the two systems:

Items	**Region**	**Minimum**	**Maximum**	**Mean± Std.Error**	**Sig***
milk production per day/Liter	Khartoum	4	12	6.53± .631	.05
	Butana	4	11	6.48± .332	

*: significant ($p \leq 0.05$)

Figure (12) a verge of milk production per day /liter



4-13-Lactation period:

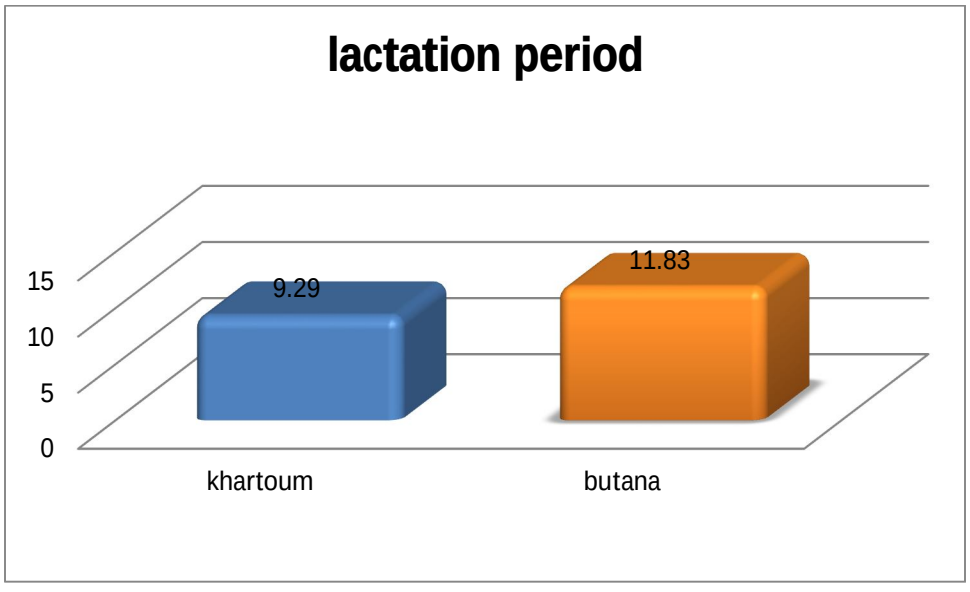
The data in table (13) and figure (13) projected that significant different ($p \leq 0.05$) between the two systems. The overall lactation period was 9.29±2.201 months in Khartoum semi intensive system and11.83±3.822 month in Butana regions nomadic system.

Table (13) illustrate lactation period in the two systems:

Items	Region	Minimum	Maximum	Mean± Std.Error	Sig*
Lactation period:	Khartoum	5	12	9.29±2.201	.019
	Butana	5	18	11.83±3.822	

*: significant ($p \leq 0.05$)

Figure (13) Lactation



Chapter five

Discussion

5-1-Reproductive performance of she camel:

5-1-1-puberty age:

The overall mean number in the present study show significant different($p \leq 0.05$) in puberty age of she camel under two management system nomadic in butane(3.37±,537)years and semi intensive in Khartoum(3,12±,376) years coincided with the same records with **,Yasin and Abdulwahid (1957), Market(1990),Molash(1990),** who 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 etal 1985,Yagil 1985,chen and yuen 1979)**2-3 years**.** Factors such as adequate nutrition, body weight, photoperiod, and temperature and might attribute to such management activity.

5-1-2-service per conception:

The information in the present study showed there were no significant different between two system in number of service per conception (1.74 ±, 514_1, 7±, 559) and this result was nearly to the Guptalal-(1986)(1, 87±2, 72) and to Wilson (1986) Hermas andSherieha (1991) and and Buol and Ella (1991)

who reported the number of service per conception is 1, 8±1 but more than Arther etal (1985)which reported one service per conception.

5-1-3-age at the first calving:

The data in table (5) and figure (5) indicated that the overall mean of age at the first calving was 3.82±.883 years for the semi intensive system and4.35±, 575 years for nomadic system this trait was significant ($p \leq 0.05$) according to this information of she camels in semi intensive system where the age at the first calving is less than nomadic system and this information is less than **Moslah and Medgiche (1989) - Simenew etal (2014)** which say the first parturition at the 5 years and similarly to **Myouf etal** 4.66 years **(2014) and Alzabuair etal** 4.34years for semi intensive and 5.35 yearsfor nomadic system such controversial might refer to breeds or management system.

5-1-4-open period:

The overall mean length of open period was 212.06±105.919 days in semi intensive system (Khartoum state) and 279.57±97.883 days with significant defferance between two systems ($p \leq 0.05$) and this is similar to **Sallal et al (2010)** and lower than (**Aboul-Ela, 1994**) possibly due to earlier weaning of calves 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 3 years **Williamson and Payne (1978**).

5-1-5calving interval:

The overall mean of calving interval was 18.24±3.507,21.15±2.475 months in semi intensive and nomadic respectively with no significant effect ^{ns} and this intervals is shorter than **Kella et al (2008) and Baumann-Zessin (1992)** and similar to the study of **Simenew etal (2013)** such difference could be attributed in seasonal effect and difference in nutritional status . Long calving intervals can occur during droughts when neither female nor male camels restart sexual activity and eventually may lead to repeated service

2- Reproductive performance of male camel:

5-2-1-puberty of male camel:

The present result showed that the puberty age of male camel was3.93±.785years in semi intensive (Khartoum state) and 3.85±.279 years in nomadic (butana region)with no significant effect between two systems but are younger than ages which mentioned by **Leonard (1984)** , **Mares (1954) ,Wahid (1957) Evans and Powys(1959),Wiltbank(1974),Evans and Powys(1959).**and the agreeed 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 **Romero (1927),Koford (1957),Hartley(1979)**.

5-2-2-male at the first breeding season:

As seen in table (4)and figure (4) there are no effect of management system on the age of the male at the first breeding season where the overall mean was 5.21±.785 years for semi intensive system (Khartoum state)and 5.13±.694years in nomadic system (butana region) and this result was similar to **Simenew et al 2013, Naumann (2012).**

5-3-milk production:

5-3-1-daily milk production:

As mention there are a significant difference ($p \leq 0.05$) in daily milk yield between the two type of systems .The overall mean was 6.53±.631liters in Khartoum state where the semi intensive system prevail and 6.48±.332 liters in butana region where nomadic system is present and this quantity is equally comparable with **Faye 2004)** (2400 liter /lactation 12-18) and **Bakheit et al(2008)** who reported the reason of the difference (better health care ,adding a concentrate in the diet vitamins and minerals supplementation in semi intensive

system as general) and this result is more than result of the **Zubair 2015** who reported the milk yield in tradional nomadic were 3.30±1.12 liters and 3.49±0.89 liters in semi intensive system.

5-3-2-frquency of milking:

The number of milking per day wasn't affected by the management system ^{ns} and this is clearly in the data of the study where is the overall mean 2.35±.931times for semi intensive system(Khartoum state) and 2.61±.583 times in nomadic system in butana region) and the same record in **Mehari etal (2007) Zubair et al(2015) ,** but at other side some studies have difference between tow system like **Sheip etal (2014),Babkir and Alzubair (2014) Zubair etal (2015),** who reported number of milking in semi intensive was three times and in traditional nomadic two times .The effect might be due management practices.

5-3-3-lactation length:

The particular in table (13) and figure (13) portrayed that the over all of lactation period length in the studied herds was 9.29±2.201 months in semi intensive (Khartoum state) and11, 83± 3.822 months in nomadic system (butana region).The trait refrected significantly different ($p \leq 0.05$) between two different system and this numbers is shorter than **Demitrez and ernest (1989), bekle**

etal (2002)Abdalgader etal (2012), FAO (2014). Such variation between the studies depend on management and feeding and season of the year.

Chapter Six

Conclusion & Recommendations

Conclusion :-

- The present study concluded that the production systems, breeding practices, reproductive performance of the camels at semi-intensive system was better in comparison to the other management systems.
- It was also concluded supplementing camels with concentrates feed improved the production and reproduction efficiency in the camels.

Recommendation

1. Breeding management should be improved. Proper records should be kept of births, matting's and possibly of production. Where the local population is incapable of doing this, outside inspection and help should be given.

2. Breeding practices should be modernized and improved. The camel herders must be educated to recognize signs of "heat" in the female.

3 .Stall-feeding should be introduced, as far as possible. This will guarantee more efficient use of feed and water, improved chances of introducing selection techniques, better health control and easier observation and control.

4. A veterinary advisory programmed should be drawn up to decide how to control and prevent prevalent diseases. Deworming and spraying or dipping is essential .Regional laboratories for serological research should be set up.

5. Camel raising can be combined with sheep and goat rising. Actually, if camels are stall-fed, sheep and goat breeding will be much easier and will increase the profitability of the herds. The different habits and often different preferences in feed make the combined husbandry an attractive proposition. Also in this case disease and parasite control are of importance.

6. For future prospects, more research should be conducted to delineate management practices and requirements for the camels to improve the milk

yield and herd composition in order to make camels rearing economical (milk, meat and/or dual purpose).

7. Initiation of the semi-intensive system should be encouraged at the different states of Sudan.

8. Efficancy systems of marketing and cost analysis is needed to evaluated and compare the production costs in the two systems.

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Appendix

بسم الله الرحمن الرحيم

جامعة السودان للعلوم والتكنولوجيا

كلية الدراسات الزراعية

قسم الإنتاج الحيوانى

إستبيان مسح ميدانى عن:أثر النظام الرعوى على الكفاءة التناسلية فى الإبل

1- معلومات عامه:

- رقم القطيع :.....

الولايه:.....

1- نظام التربيه المتبع؟

أ- سرحيرحل ب-رحل ج- مرحل تقليدى

د- نصف مغلقه ه- مغلقه (نظام مكثف)

2- قياس الكفاءة التناسل

أ. عمر البلوغ فى الإناث؟

ب. أقل من 3سنوات( ) 2- من 3-4سنوات ( ) 3- أكثر من 4سنوات ( )

ت. عمر البلوغ فى الذكور؟

i. 1- أقل من 3سنوات( ) 2- من 3-4سنوات ( ) 3- أكثر من 4سنوات ( )

ث. عمر الذكر عند أول موسم تناسل؟.....

i. 1- أقل من 4سنوات( ) 2- من4-5سنوات ( ) 3- أكثر من 5سنوات ( )

ج. عمر الأنثى عند أول تلقيحه (تلقيح الناقه البكر) ؟.....

i. 1-أقل من 3سنوات ( ) 2- من 3-4 سنوات( ) 3- من 4-5سنوات( ) 4- أكثر من 5سنوات ( )

ح. عمر الأنثي عند أول ولاده؟.....

i. 1-أقل من 4سنوات( ) 2- بين 4-5سنوات ( ) 3-بين 5-6سنوات( ) 3- أكثر من 6سنوات ( )

خ. *كم تبلغ عدد التلقيحات اللازمه للإخصاب؟*

د. *واحده( ) 2- إثنان ( ) 3- ثلاث( ) 3- أكثر من ثلاث( )*

ذ. كم تبلغ طول الفتره بين ولادتين؟

i. 1-أقل من15شهر ( ) 2- بين 15-19شهر( )

ii. 3- بين 20-24شهر( ) 4- أكثر من 24شهر( )

ر. متى تكون أول تلقيحه بعد الولاده؟

ز. 1/ 3-5 شهور ( ) 2/ 6 -11 شهر ( ) 3/ سنه ( )

س. طول الفترة المفتوحه بالشهر؟

ش. 3-5شهور ( ) 2/ 6 -11 شهر ( ) 3/ سنه ( )

ص. كم تبلغ عدد الحلبات فى اليوم؟

ض. واحدة( ) 2- حلبتان ( ) 3- ثلاث حلبات( )

ط. متوسط كمية الحليب اليومي للناقه بالرطل؟

.....

ظ. طول موسم الحليب؟

a. 1-4-6شهور ( ) 2- 7-9 شهور( ) 3- 10-12شهر( ) 4- أكثر من12شهر( )

بسم الله الرحمن الرحيم

Sudan University of Science & Technology

College of Agricultural Studies

Department of Animal Production

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

1- General Information

(..... State .....Herd No

2- Information about Herd:

1- What are the types of breeding system adopted?

1-Nomadic ( ) 2- Semi-nomadic ( ) 3- Sedentary ( )
4-Semi-intensive ( ) 5- Intensive ( )

2- Herd composition:

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

10: Reproductive measurement:

1-What is puberty age of the she camel?

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

2-What is puberty age of the male?

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

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

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

4-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 ( )

5-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 ( )

6-No of estrus cycle during the season?

1-One ( ) 2- between 2-5( ) 3-between 5-8 ( ) 4-more than 8 ( )

7-No of Services per consumption?

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

8-Calving Interval?

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

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

9-First Service after calving.

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

10-Open period per Month.

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

( ) 5- Unknown Reason ( )

Figure(1): Camels in nomadic system:

Figure(2):Camels in semi intensive system: