بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

Effect of Feeding Systems on Reproductive performance and Milk yield and Composition in Dairy Buffalo- in Iraq

تاثير نظام التغذية على الاداء التناسلي والانتاجي في جاموس اللبن في العراق

By

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الآية

قَالَ تَعَالَىٰ:

﴿ وَإِنَّ لَكُمْ فِي ٱلْأَنْعَٰمِ لَعِبْرَةً ۖ نُّسْقِيكُم مِّمَّا فِي بُطُونِهِۦ مِنۢ بَيْنِ فَرْثٍ وَدَمٍ لَّبَنًا خَالِصًا سَآئِغًا لِّلشَّٰرِبِينَ ﴿٦٦﴾ ﴾

صدق الله العظيم

سورة النحل ,الآية(66)

Dedication

To the one who God sent mercy to the worlds, the teacher of humanity Abu al-Qasim Mohammad and the pure goodness of the righteous and his companions, the glorious ones

To my first teacher and to enlighten me the way and guide.... My father, may God have mercy on him

"The paradise lies under her feet, the tallest of God's ages, and she is dressed in my dear mother's well-being

"I came to love, give and sacrifice ... a friend of pathway and my wife

To the wind of my heart and the hollow of my eyes... My children .. Abdala and Rgaia

To the most powerful and strength……My brothers and sisters

Alaa

Acknowledgments

In the name of Allah the Merciful

Praise be to Allah, Blessed and Exalted be He, who made a path for me in science, and gave me patience to overcome the difficulties of his ways, and prayers and peace be upon the best creation of Allah Muhammad, peace be upon him, his good family and his productive companions. I have the honor to stand with respect and honor. I extend my thanks and gratitude to my distinguished professor, Professor Abdul Aziz Makkawi, for his efforts in supervising this thesis and for his valuable scientific guidance and his support to me always..I also extend my thanks to Dr. Ejlal Siddiq for the great effort she have exerted in helping me to accomplish this message. May God help her to achieve success throughout her life? And praise to the presidency of the Department of Animal Production and teachers evacuation, including in particular the father and educator Dr. Ahmed Khalil respected.And thanks and appreciation to the Dean of the Faculty of Agriculture, Dr. Abu Bakr respected, and I do not forget their preferred Dr. Ali Abdullah Al Saadoun, head of the Animal Production Department at the Faculty of Agriculture, Al-Muthanna University, which was the great credit for following up my work during the experiment and Professor Brother and friend Abdul Hassan Hamdan for all his From supervision, guidance and assistance throughout the research period. As well as brother and friend Dr.Hadi Awad for his great help in conducting chemical analysis. Ask Allah Almighty to reward him with the best reward and increase his bounty, his knowledge and his blessings. I also extend my thanks and appreciation to Prof. Dr. Faisal Mahbes Al Tahir, Dean of the Faculty of Agriculture, Al-Muthanna University for supporting me throughout the study period. Dr. Hassan Odeh Al-Ghanmi, President of the University of Al-Muthanna for his continuous support, My sincere gratitude to my brother, friend and fellow expatriate Ahmed Abdel Rahman Al Ja'ali, my friend and my colleague Mohammed Ismail for his humanitarian position in bearing the burden of alienation, and all the postgraduate staff in the Animal Production Department and thanks to my dear friend Mido Allah Gad. To help him in his scientific and practical life .And thank God for the valuable opportunity gave us not to appreciate the acquaintance of those good faces with pure hearts and my brothers and sisters graduate students for their efforts and support in the completion of the research. God is behind the intent.

... Alaa

Table of Contents

List of Tables

Title Page No.

List of Figures

Title Page No.

Abstract

This study was conducted to investigate the effect of the feeding system on some, reproductive performance and milk components of the Iraqi buffalo (river buffalo and swamps) the swamps buffalo present in the swamps area (DhiQar and Maysan) and the rivers buffalo present in Babel, Najaf and Samawah areas. The reproductive physiology and the milk production and components are as follows

The results of the reproductive performance showed that there were no significant differences between the two types in gestation length but on the other side there were significant differences between the two types in age at puberty in females and males, age of females at first calving, calving interval and the reproductive life of males and females, all in favor of swamps.

For milk the results of this study revealed that there were no significance differences between the two types of buffalo in milk lactation period and ash content. on the other hand It was observed there were significant differences in daily milk yield, protein, lactose and solid not fat all in favor of rivers but fat content was in favor of swamps.

As summing–up the reproductive performance of swamps buffalo better than rivers buffalo which could be attributed to the nutrition system but for milk production the rivers buffalo is better than swamp buffalo, this might be due to nutrition and management program.

المستخلص

أجريت هذه الدراسة لمعرفة تأثيرنظام التغذية على بعض الخصائص الفسيولوجية والتناسلية ومكونات اللبن للجاموس العراقي (الانهار والاهوار) وتمثل منطقة الاهوار محافظات(ذيقارومیسان) بينما تمثل مناطق الأنهارمحافظات بابل, النجف والسماوة منطقة اجراء البحث. وكانت النتائج المتحصل عليها لكل من الخصائص الفسيولوجية والتناسلية وانتاج ومكونات اللبن كالاتي:

اظهرت النتائج انه لاتوجد فروقات معنوبة بين النوعين من حيث طول فترة الحمل ومن جانب آخر كانت هنالك فروقات معنوية بين النوعين من حيث العمر عند البلوغ للإناث والذكور، عمر الاناث عند الولادة الاولي ، الفترة بين الولادتين و طول العمر الإنتاجى للذكور والإناث وكانت جميعها لصالح جاموس الأهوار.

اما بالنسبة للبن كشفت نتائج هذه الدراسة أنه لاتوجد فروقات معنوية بين النوعين في طول موسم الحليب و نسبة الرماد ولكن من جانب آخر فقد كانت هنالك فروقات معنوية في كل من إنتاج اللبن اليومى ، البروتين , اللاكتوز والجوامد الصلبة اللادهنية جميعها لصالح جاموس الأنهار لكن الدهن كان لصالح جاموس الأهوار.

وكملخص: كانت الافضلية في الأداء التناسلي لجاموس الاهوار مقارنة بجاموس الانهار وهذا قد يعزى لأثر التغذية والعوامل الادارية بين النوعين. اما بالنسبة لانتاح اللبن فقد كانت الافضلية لجاموس الانهار مقارنة بجاموس الاهوار وقد يعزى ذلك الى نظام التغذية والادارة.

CHAPTER ONE
INTRODUCTION

The buffalo (Bubalus bubalis) is an important contributor to milk, meat, fuel and leather production in many developing countries the domestic buffalo is an indispensable livestock resource to millions of smallholder farmers in developing countries, particularly in Asia.

Global buffalo population is estimated to be 177 million (FAO STAT, 2006). Out of which nearly 170 million are in Asia (more than 95%) and the remaining are found in Africa (3.92 million) and South America (1.3 million). Australia and Mediterranean countries also have significant buffalo population (FAO STAT, 2006).

Most buffalo owners nourish their animals on wheat bran and cotton seeds, and in most cases on only small amounts of green roughages (Juma, 1997; Baghdasar *et al*., 2010). Poor nutrition is one of the main factors for low milk productions, long calving intervals and delay in the onset of puberty, all of which contribute to low reproductive performance and productive losses leading to reduced income (Abdulkareem, 2008).

So that the comparison between buffalo is better to rely on the average milk yield additional measures to determine the efficiency of animal production (Bhannasiri, T. 1980). Although, more than 12% of the world milk production comes from buffalo, India alone produces 60% of the world's buffalo milk and their production was 100 million tons and buffalo milk contributes to more than 50% of the total milk produced in India, Prasad *et al* (2014)., and Cockrill(1977), stated that the buffalo of the most neglected animals in the world. In Iraq, the participation rate of buffalo milk is about 8% of the total milk produced in the country.

Although the buffalo can adapt to harsh environments and live on poor quality forage, reproductive efficiency is often compromised by such conditions,

resulting in late sexual maturity, long postpartum anoestrus, poor expression of oestrus , poor conception rates and long calving intervals. The age at puberty is influenced by genotype, nutrition, management and climate, and under favorable conditions occurs at 15-18 months in river buffalo and 21-24 months in swamp buffalo. The ovaries are smaller than in cattle and contain fewer primordial follicles. Buffalo are capable of breeding throughout the year, but in many countries a seasonal pattern of ovarian activity occurs. This is attributed in tropical regions to changes in rainfall resulting in feed availability or to temperature stress resulting in elevated prolactin secretion, and in temperate regions to changes in photoperiod and melatonin secretion.

Buffaloes could be categorized into Asian and Mediterranean buffaloes. Asian buffalo have two subspecies known as the Riverine and Swamp types.(Di Berardino *et al* 1981)

The main objectives of study to compare two feeding systems and their effects on the productive and reproductive performance of the two types of Iraq buffalo raised under two system of management

1-River system

2-Swamp system

parameter to be studied of reproductive performance are (Age at puberty in males and females, gestation length, Age of females at first birth, calving interval, Reproductive life of female and male, milk production and composition .

CHAPTER TWO

LITERATURE REVIEW

2.1 World buffalo population and distribution

Water buffalo is classified into the genus *Bubalus,* species *bubalis.* River,(Water buffalo) and swamp are the two sub species of buffalo with different morphology (body weight, shape & frame), genetics (50 and 48 chromosomes, respectively) as well as purpose of rearing. Buffalo is disturbed worldwide due to its inherent ability to produce high fat milk and better conversion of poor quality feed resources. In some regions of the world buffalo is native whereas, in other parts it was imported due to its distinct qualities. Buffalo is present in every continent and region of world varying in ecology, climate, topography and socio-economic conditions. According to FAO (2008), the world buffalo population is about 177.25 million heads: out of this Asiais contributing 95% of the total world buffalo population with 172 million heads; 4 million are in Africa (mainly in Egypt) contributing 2.3%; South America with 4.1 million heads and contributing 2.4%; in Australia 0.040 million contributing 0.02% 92Buffalo Bulletin 2013 Vol.32 (Special Issue 1): 91-110and Europe with 0.500 million heads contributing 0.3% to the world buffalo population (Chantalakhana and Falvey, 1999).

In Iraq, according to data provided by Borghese (2004), there were 98 000 total river khuzestani or Iraqi buffaloes , 40 000 adult females with an average of 1320 kg milk yield during a 270 day lactation period. Presently, it is impossible to estimate the real population in Iraq because of bad security. According to data provided by Magid (1996), the number of buffaloes in Iraq decreased by 30 % from 141,450 in 1986 to 98,700 in 1993. Iraqi water buffalo are found in most Iraqi provinces near the banks of the rivers and marshes , particularly in Basra (14 %), Missan (12 %), Thi-Qar (11 %),

Muthanna (5 %) and Qadissiya (3.5 %) provinces in the south, Baghdad (16 %), Anbar (1 %), Wassit (5 %), Babylon (6 %), Karbala (4 %), Najaf (5 %) and Salaheddin (1.9 %) provinces in Middle, Nineveh (10 %), Karkuk (3.4 %) and Kurdistan (Arbil , Dohuk and Sulaimaniya) (2 %) provinces in the north of Iraq (Juma, 1997). All of the buffalo numbers in Baghdad are in Al – Thahab Al – Abiath and Fudhaleya villages comprising about 20 000 buffaloes owned by about 1500 holders. Fifteen thousand buffaloes are in Thi-Qar province owned by 1000 owners distributed in 5 main locations (Nasserya, Al – Fuhood, Al – Tarr, Al – Jebayish and Soup Al – Shuikh). In Muthanna province, about 5250 buffaloes are found within 4 main districts (Samawah, Al – Khither, Rumaitha and Al – Salman). Most of the buffalo owners in Basra province who own about 18700 buffaloes founded in large herds in Medaina, Qurna and in Al –Dair districts in small herds. Twenty-nine villages in 4 districts (Dewanyia, Effak, Al – Hamza and Al – Shameyia) contain the greatest number of buffaloes in Qadissiya province (Veterinary Hospitals, 2007,. Magid (1996),

In Iraq, the dominant one was that buffaloes had been domesticated since third millennium B.C in Mesopotamia during Sumerian Era. Buffalo is considered one of the animals that has wide spread in the marshes area in the south of Iraq. It is considered as the main source for living the people of marshes. It was considered as a source of insurance for care taker and his family to face the request in that area, as the families in the villages can survive thank to the animals living with them Borghese (2004).

The buffalos can utilize poorer quality roughages, adapt to harsher environments and are more resistant to several bovine tropical diseases. Despite these merits, buffalo have relatively poor reproductive efficiency irrespective of their location throughout the world. Buffalo exhibit many of the known reproductive disorders including delayed onset of puberty, poor oestrus expression, longer postpartum ovarian quiescence, and most

importantly lowered conception rates particularly when bred artificially (Gordon, 1996). However, higher fertility could be achieved through better feeding and management (Perera *et al*., 1987; Usmani *et al*., 1990; Qureshi *et al*., 2007). It appears that because buffalo are located mostly in developing countries with meager resources, there is limited quality research in the area of basic physiology, health, management, nutrition and applied reproduction.

2.2 Description

Buffaloes color is black or slate grey with white spots in the forehead, legs and tail. They are reddish or dark hue at the extremities. There is usually a pronounced beard below the jaws. Albinoids, piebald are common especially in marshes and in the southern part of the country. In Basra, Albinoids are more popular than other breeds; they are believed to be deaf and more sensitive to cold and wet weather (Magid, 1996 and Juma, 1997). Horns are moderate in length and occasionally long, flat at the bottom, acutely curved to the back. They are of open sickle – shaped in marsh buffaloes, while in Basra, horns sloping halfway along the neck and curved upwards in the last quarter are very common. Tails are long reaching well below the hocks. The udder is not big or fleshy, with good attachment and provided with good sized, well-placed teats. The udder skin is very fine (Juma, 1997 and Moioli and Borghese, 2005).

2.3 Characteristics and behavior

2.3.1 Genetics

Although the river buffalo is the main dairy animal in some countries, it is a primitive animal compared to the developed dairy breeds among cattle like the Holstein-Friesian and Jersey.

Many generations of selective breeding have produced cattle with almost predictable productive and reproductive traits. This has not been the case

among the buffalo breeds as most of these animals are reared by landless and marginal farmers, with the animals reproducing naturally (Chantalakhana and Falvey, 1999). However there is no reason why buffalo breeds could not be developed in the same way as cattle.

Buffalo have a number of anatomical and physiological similarities with the other species in the Bovidae family. Cattle have 60 diploid chromosomes, river buffalo have 50 and swamp buffalo have 48. While the two types of buffalo can be mated to produce a fertile offspring which has 49 diploid chromosomes, buffalo cannot be successfully mated with any other species in this family (Mahadevan, 1992).

2.3.2 Heat tolerance

Buffalo are less tolerant of extremes of heat and cold than various breeds of cattle. The body temperature of a buffalo is lower than that of a cow in spite of the fact that its black skin absorbs much heat and its skin has only one-sixth the density of sweat glands that a cow skin has. This explains why buffalo like to wallow in water when the temperature and humidity are high (BSTID, 1981). Regulation of body temperature in this way influences feed intake, reproduction and milk production.

2.3.3Dairy temperament

A comparative study of temperament was done among Murrah buffalo, crossbred cows and Red Sindhi (Indian breed) cows. The results of this study showed that these buffalo had a higher percentage of docile animals (Nayak and Mishra, 1984). Almost 50% of this group of Murrah buffalo were docile. About 7% of the group were aggressive. The rest were classed as restless or nervous animals. However in another study by Roy and Nagpaul (1984), Murrah buffalo were compared with Karan Swiss and Karan Fries dairy cows (two Indian breeds of crossbred cows). It was found that the buffalo had higher temperament score (more aggressive temperament) than the dairy

cows. The temperament scores for all three groups decreased with increasing parity between the third and fifth lactation (Roy and Nagpaul, 1984)

2.4Dairy buffaloes

Swamp type buffalo is mainly kept for draught purpose and meat with relatively less milk production of around 600 kg per year whereas river buffalo is kept as a dairy animal with higher milk production up to 2,000 kg per lactation. It is also used for meat production due to its larger body Size.

have been used for milk production in India, Pakistan, some other South Asian countries, the Middle East and Italy; while dairy characteristics are being induced in the local population of Indo-Chinese Region and South America through crossbreeding with Pakistani Nili Ravi and Indian Murrah buffaloes. The milk yield increased from 700 to 2,000 kg/year in China through crossbreeding (Yang *et al*., 2007).

2.5Feeding and husbandry

Buffaloes rear outdoors all through the year. They are housed in thatched, mud – roofed sheds, in mud – walled paddocks or paddocks made of local plants (reeds, brushes and palm leaves) with a wall on one side, and three open sides. They are hand fed at the time of milking, morning and evening. Products as lactose cane waste, reeds also feed them such from marshy land and home baked waste. Those that swim in ponds and rivers also fed aquatic plants. Milking done by hand in 99 % of cases. Male buffaloes are very hazardous, strong and difficult to handle and always aggressive to humans. In few cases, for tilling operations, they castrated (Juma, 1997).

Buffalo are, like cattle, ruminants. This means that they utilize micro-organisms in the rumen to digest the feed. Feed eaten by ruminants is of vegetable origin. The ruminant is an expertinconverting cellulose and other fibrous materials into high quality milk and meat. Their digestive capacity is

greater than the non-ruminant. Ruminants “chew the cud”, that is they regurgitate partly digested food to the mouth to chew it again, thus helping to breakdown this plant material.**(**Bhannasiri,. 1980**.)**

Feed enters the rumen when swallowed by the animal. Buffalo have slower rumen movement than cattle, which leads to a slower rate of ingest a outflow. The pH of the rumen content is similar to that of cattle, and it is affected in the same manner. Normal pH is between six and seven, depending on feed and time of feeding (Borghese *et al* 1997)

Feed components can be divided into protein, energy (carbohydrates), fat, minerals and water. The breakdown and utilization of the different feed components are reviewed below.

2.5.1Feeding system

Buffalo are grazers (Pathak, 1992) and they graze a wider range of plants than cattle do (BSTID, 1981). They utilize low-grade roughage more efficiently than cattle do. Buffalo have slower ruminal movements, Ja smaller rate of outflow from the rumen and higher bacteria population in rumen fluid. This leads to a longer exposure of the feed and consequently a more complete digestion. (BSTID, 1981).

The buffaloes in Iraq bred in the marshes. They feed on papyrus, reeds, common ash and other plants (like shahaf and cholan, low quality roughages where grow naturally in the marshland area). When the floodwater is high, their owners have to go out and collect these plants in order to feed the buffaloes on platforms. Rice hulls also given when available. Buffalo in towns rarely graze on natural pasture; they fed mostly straw, wheat bran, agricultural by – products and occasionally on green roughages (Magid, 1996 and Borghese and Mazzi, 2005).

Buffaloes rose outdoors all through the year. They housed in thatched, mud – roofed sheds, in mud – walled paddocks or paddocks made of local plants (reeds, brushes and palm leaves) with a wall on one side, and three open sides. They are hand fed at the time of milking, morning and evening. Products as lactose cane waste, reeds also feed them such from marshy land and home baked waste. Those that swim in ponds and rivers also fed aquatic plants. Milking done by hand in 99 % of cases. Male buffaloes are very hazardous, strong and difficult to handle and always aggressive to humans. In few cases, for tilling operations, they castrated (Juma, 1997).

2.5.2Feedstuff

The main diet for buffalo is roughage such as grass, legumes and straw. The roughage can be fed either fresh as pasture or in a cut-and-carry system, or conserved as hay or silage. Roughage is often complemented with grains, concentrate and agro-industrial by-products such as oilseed cakes, lactose cane tops etc. Roughage should form the base of the feed ration and contribute to meeting at least the total maintenance requirements. Grains and concentrate should be fed only to meet additional requirements such as growth, pregnancy and milk production. Too much non-fibrous feed will alter the rumen environment. In the long run this could lead to serious problems in feed digestion causing loss of appetite, weight loss and a drop in milk yield. This is especially important for animals under stress, for instance from high growth rate or high milk yield. The roughage should be of good quality – of both nutritional quality and hygienic quality. This cannot be emphasized enough(Borghese*et al* 1994b)

The most common roughage is grass (of various species). However Lucerne, berseem and clover are herbaceous legumes which have an advantage over grass as they are nitrogen fixing. This means that the plants will (with the help of bacteria) fix air-nitrogen and thus they are less dependent on the nitrogen content of the soil. These plants contain more protein than grass under the

same circumstances. Lucerne (or alfalfa) has several advantages. It contains elevated amounts of calcium, vitamin E and caroteen which are of major importance for milk production. There are also tree legumes which can be used as high quality feed, e.g. Leucaenaleucocephala, Gliricida spp., Sesbania and others. However as many of the tree legumes contain anti-nutritional compounds which may depress digestibility as well as decrease feed intake, they should not be fed as the sole source of roughage. A maximum ratio of 50% tree legumes in the total diet can be considered a safe level. Since buffalo are strict grazers, the trees should be pruned and the branches or leaves given to the buffalo. Pruning with regular intervals of six to ten weeks increases re-growth of the leaves.

Straw provides lower quality roughage. Straw from rice, barley, wheat, sorghum etc. is widely used in feeding ruminants, but its protein and energy content is low. Rice or paddy straw has a high silica content in the cell walls which makes it difficult to digest.(Basra *et al* 2003)

In the beginning of the growth season, the protein and energy content of grass is high and the lignin content low. Thus, the grass is of high quality. With maturity the protein and lactose content and the cell walls become lignified. The growth pattern is the same for legumes although it is a little slower. It is therefore important to harvest roughage in the optimal period and to conserve it for use in dry seasons.

Of the long-stemmed Phragmites and Typha species are papyrus species (Jane *et al* 2014)

2.5.3 Typha and Phragmi

As for reeds called (cattails) called papyrus name pond grass, emergent macrophytes Jane *et al* (2014). Common reed is common They are between 3 and 4 biennial plants. (Wenerick*et al*(1989) He pointed out that reeds and papyrus are made of bifurcated plants Any plant that is rooted in the water is anchored plants respectively and their leaves are long and protruding from the

vertical plants While most of the body of the plant is located outside the water, and pointed out that both types can grow in water with high organic deposits or lack of focus.

Reeds and papyrus are widely spread throughout the world except the southern and northern poles Nguyen, *et al* (1976).

Both species are large in Iraq in wet habitats, some of which are very long, others are medium in length and two are from Alwan *et al* (2006). These two species are widely distributed in Iraq in the marshes and swamps The southern regions and on the banks of the Shatt al-Arab and spread to include the center and north of Iraq as its plants grow in shallow waterIn clay soils in forests in mountainous areas, and in semi-saline wetland fields and environments Which contains the most important economic crops in Poaceae to the Phangmites family belongs to the genus reeds Which include Typhaceae Ventmi to the Typha family of the world such as wheat, rice, barley, etc. (Clevering *et al*(2001).

.The largest types of herbs with large - sized leaves, brown color, single - sex flowers and composite ears (Grace *et al* (1981).

For a long time, reed and papyrus have been the main contributors to scientists' research and interestingly because they areThey are plants that can purify water by taking nutrients and dissolved pollutants into the water in which they liveAnd provide clean, clean, polluting environments for many other species. Clevering *et al* (2001). There are many studies that show the role of cane As a treatment for water pollution when exposed to different environmental conditions, as these research indicates the area of interest of scientific research in(Clevering*et al* (2001).

2.6Effect of nutrition on milk production and composition

Poor nutrition leads to lack of digestion, sugar, increased fat, protein and mineral salts in milk, and good nutrition reflects these symptoms. As a general rule, any nutrition that leads to increased milk production generally

reduces fat content in milk.

When reducing feed intake to 30% and less dry matter, the fat content is reduced to 2% and less. 1.5% body weight should be given to prevent the reduction of fat. At least 15-17% of the raw fiber is required for food and the provision of sodium bicarbonate, potassium, magnesium carbonate or magnesium oxide leads to an increase in milk fat, and feeds containing fodder feed less than 1/8 inch or soft green spring feed lead to reduce fat in milk reducing the protein content of fodder leads to a lack of production, but the increase in the abnormal protein does not lead to increased milk, but leads to a slight increase in the proportion of milk protein. Lactose If Food shortages lead to a low milk lactose deficiency (Thawinprawat *et al* 1985)

2.7 The Effect of Nutrition on Reproductive Performance

was significantly higher (83.5%) when kept on higher plan of nutrition as compared to 66.6% for those maintained on low plan of nutrition, (Poy and Panda, 1971). Balanced feeding, improved management and minimum disease prevalence can be helpful in reducing the age of first calving (Heinrichs*et al*. 2005). Bhatti*et al*. (2007) stated that in their system, forage should be the main feed supplemented with concentrate and suggested other performance modifiers to gain faster growth rate for early puberty on cost effective basis. Buffaloes are suitable for breeding at about 24 months of age. In the majority of dairy buffaloes calving occurs at 4-6 years of age. This is due to an inadequate supply of feed and nutrients during the growing phase (Ingawale and Dhoble, 2004). The available feed ingredients for livestock in tropical and subtropical countries including Pakistan are low in crude protein (CP) and lipids whereas high in crude fiber (Ludri and Razdan, 1980), which adversely affects the onset of puberty independent of growth rate. Nanda *et al*. (2003) reported that most buffalo cease ovarian cyclicity during hot summers probably due to the combined effects of nutrition, environment and

management. Nutritional manipulations may influence the period of sexual maturation (Schoppee, *et al*. 1996)

2.8 Reproduction and breeding

Buffalo are said to be seasonal breeders. However, this is not entirely true as buffalo are polyestral animals and may breed all year round. The buffalo's reputation as a difficult breeder is because of its inherent susceptibility to environmental stress, which causes anoestrus and sub-oestrus. These conditions are responsible for prolonged inter-calving periods, resulting in great economic losses for the buffalo dairy industry. Susceptibility to heat stress also affects feed intake and in turn the nutritional balance, and this also inhibits reproductive efficiency.(Porwal*et al* 1981)

The reproductive efficiency of a species is determined by many different processes, which result from interaction among genetic and environmental factors. The processes involved, individually or together, include age of puberty or maturity, pattern of oestrus cycle and oestrus behavior, length of breeding, ovulation rate, lactation anoestrus period, post-partum anoestrus, inter-calving period and reproductive life span. A combination of these traits is used to measure breeding efficiency or breeding performance in farm animals (Agrawal, 2003).

Reproductive efficiency in buffalo is reported to be alarmingly low, causing severe economic losses to milk producers (Ranjan and Pathak, 1992).

2.8.1 Natural mating

Except for a very small percentage of the world's buffalo, most are bred through natural mating. In most cases at the village level and in the home tracts of buffalo there is no information on the buffalo bull or on the dam's milk yield, and this information is seldom considered while breeding. This has been one of the major reasons for the diversity in both the productive and reproductive traits of buffalo. Even in Italy where buffalo production is more

advanced, 95% of buffalo are bred naturally. In Italy as well as in Egypt and India, one bull is maintained for 30 females. However as this method persists on the farms it is crucial to avoid the spread of venereal diseases which cause infertility and sterility in both sexes. In recent years these problems have shown an increasing pattern in buffalo herds in India (Ingawale and Dhoble, 2004).

Having a breeding bull with the dams all the time enhances the chances of fertile mating, this bull seldom misses a female in heat. However, to be able to calculate the time of calving it is advisable to keep some sort of record of expected heat. The observant farmer will soon learn how his buffalo behave when in heat and when to expect conception and calving. The females can be teased with a bull twice a day around expected oestrus. A breeding bull can be put into service from three years of age. In Italy, it is recommended that a breeding bull on a large farm should be exchanged after a maximum of five years. One bull, if managed correctly, can serve 20 to 25 females. On a smaller farm, the bull should be exchanged more often to avoid interbreeding. If the bull shows signs of loss of interest in the females or is otherwise ill, he should be taken out of service immediately. In order to perform best, bulls must be fed high quality feed and be protected from heat and cold stress in the same way as the rest of the herd. Bulls should not be used for service more than twice a week.(Ranjan and Pathak, 1992)

2.8.2Artificial insemination (AI)

Genetic improvement of dairy animals to improve productivity has been the centre of focus of many advanced dairy countries. Using genetically superior animals can improve the reproductive efficiency of dairy species. With the help of AI improved genes are transmitted to a large number of offspring, and the interval between generations is reduced.

Buffalo generally have more difficulty conceiving by artificial insemination than cattle do. Reports from the National Dairy Research Institute, Karnal, India, show that the conception rate for first insemination is around 40% and the conception rate for third insemination is around 77%. Even in Italy only about 2 500 buffalo are inseminated per year specifically for progeny testing. Although intensive research is going on at various universities and institutions around the world, breeding programmers for buffalo are not readily available for the common farmer. In the state of Gujarat in India, the National Dairy Development Board has a breed improvement program me called Dairy Herd Improvement Program me Actions (DIPA). The genetic gain of buffalo is being improved through selective mating of both sire and dam, to breed sires with the desired genetic traits. A progeny testing program me is being followed, producing 100 completed first lactation records of progeny per bull. Twenty bulls are put to test every year, with 2 000 doses of frozen semen from each bull being distributed to the selected villages, and 5 000 doses being stored until the test results are available (Agrawal, 2003).

2.8.3Reproductive efficiency in water buffaloes

In spite of the expansion in buffalo breeding, there was no significant improvement in milk and meat production due to slow genetic progress. The increase in the productivity obtained over the last years was mainly due to an improvement in management techniques rather than to genetic improvement. Reproductive efficiency is the primary factor affecting productivity and hampered in the buffalo females by delayed attainment of puberty, seasonality, long post – partum anestrous and subsequent calving interval, and poor estrus expression (Barile, 2005). Subsequently, considerable attention must focus on the most four important items affect the reproductive efficiency of water buffalo (puberty, seasonality, anestrous and estrous induction as well as pregnancy diagnosis).(Pererа*et al* 1981)

2.8.3.1Males Reproductive

Bulls reach sexual maturity at two to three years of age. Semen is produced all year round but it is highly affected by heat stress and low quality feed. The buffalo bull seems to be most fertile in spring, when the volume of ejaculate and sperm concentration is highest. Sperm vitality is also much higher in spring than at other times of the year. Corresponding values are lowest in summer time. Heat stress may have a negative effect on libido.(Porwal *et al* 1981)

2.8.3.2Females Reproductive

Wild or aggressive female buffalo reach sexual maturity at two to three years of age. Domesticated buffalo that are cared for and fed properly may reach puberty earlier. Puberty is highly affected by management factors. Size is more important than age, and a Murrah heifer should weigh around 325 kg at insemination or mating and 450 to 500 kg at her first calving. The age of puberty in buffalo is 36 to 42 months in India. It is comparatively late compared to other countries like Italy, where the age at first calving is between 28 to 32 months on average (Borghese and Mazzi, 2005).

2.8.3.2.1Puberty

When they reach about 60% of their adult body weight (250 to 400) kg, but the age at which they attain puberty can be highly variable, ranging from 18 to 46 months (Jainudeen and Hafez, 1993). The factors that influence this are genotype, nutrition, management and climate. It could be attained under optimized conditions at 15 to 18 months in river buffalo and 21 to 24 months in swamp buffalo (Borghese, 2005). The delay in puberty, consequently delays conception and results in low reproductive efficiency and lengthening of the non-productive life. A major cause of delayed puberty may be poor feeding and management under field conditions. Puberty in buffalo delayed

compared with cattle (Jainudeen and Hafez, 1993). It is difficult to establish the age at puberty because of difficulties in estrus detection in this species and most estimations appear to have been extrapolated from the age at first calving. According to Jainudeen and Hafez (1993), the river type exhibit first estrus earlier (15 to 18 months) than the swamp type (21 to 24 months). First conception occurs at an average body weight of 250 to 275 kg, which usually attained at 24 to 36 months of age (Barile, 2005).

Many factors influence age at puberty, such as breed, season, climate, nutrition and growth rate (Hafez and Hafez, 2000). Correspondingly, the ovarian cyclic activities affected by different farm conditions like feeding levels that improve growth and sexual maturity (Roy *et al.*, 1975 and Hafez and Hafez, 2000). Several experiments have been carried out in Italy aimed at advancing the age at first calving (Borghese *et al*., 1993c, 1994a, 1994b, 1996, 1997; Terzano*et al.*, 1996 and 1997). The pre-weaning and weaning systems are important in promoting growth and achieving puberty, therefore attention must be given to heifer management needs beginning from birth to ensure correct weight increase (Barile, 2005). The age at puberty affected by the dietary energy level. The heifers fed a high-energy diet (5.56 MFU /day) had a daily gain of 562 g*vs*.456 g of the heifers fed a low energy diet (4.42 MFU / day) and reached puberty 30 days earlier (Borghese *et al*., 1994b).

For the Indian buffalo, Madan (1988) reports a large variation in age at puberty ranging from 16 to 40 months depending on the breed, with an earlier age in the Surti and a later age in the Nagpuri. In contrast , Sule*et al*.(2001) reports in Surti buffalo an average first heat and first conception of 1365.06 ± 12.85 and 1418.6 ± 13.16 days (about 45.5 and 47.3 months) respectively. Gogoi*et al.*, (1985) studying the age at first calving of Murrah and Surtibuffaloes from some government farms , found that Murrah buffaloes had a higher age than Surti buffaloes (53.88 ± 0.48 *vs*. 51.51 ± 1.18 months).

In Pakistan , Naqvi and Shami (1999) studied the age at sexual maturity in the Nili – Ravi buffaloes and reports a mean age of 976.49 ± 9.2 days (about 32.5 months) ranging from 957.93 ± 10.68 to 1015.26 ± 17.39 days depending on the farms. Similarly, Ishaq (1972) found for the Nili – Ravi reached puberty at 30 – 32 months and 450 – 519 kg body weight.

2.8.3.2.2Oestrus cycle of a buffalo

In order to enhance reproductive efficiency of buffalo, a thorough understanding of the regulatory mechanisms involved in the oestrus cycle is required. The duration of the oestrous cycle in buffalo is similar to that in cattle, ranging from 17 to 26 days with a mean of around 21 days (Jainudeen and Hafez, 1993). However, there is a greater variability of the oestrous cycle length in buffalo compared to cattle, with a greater incidence of both abnormally short and long oestrous cycles. This may be attributed to various factors including adverse environmental conditions, nutrition and irregularities in secretion of ovarian steroid hormones (Kaur and Arora, 1982; Nanda *et al*., 2003).

In buffaloes, ovarian follicular dynamics during the oestrous cycle is similar to that in cattle. Studies from India (Taneja *et .al*., 1996), Brazil (Baruselli et *al*., 1997) and Pakistan (Warriach and Ahmad, 2007; Figure 1) have shown clearly that the majority of buffalo have two waves of follicular activity during their *oestrous* cycle. More investigations on the effect of follicle stimulating hormone and nutrition on number of follicular waves need to be studied in buffaloes.

The oestrus cycle varies between 21 and 29 days depending on breed. The total duration of oestrus is usually 24 hours but varies from 12 to 72 hours. The most reliable sign of oestrus is frequent urination. The signs of oestrus are much less pronounced in buffalo than in cattle.

Many buffalo show oestrus only at night time, and then it is difficult to detect. A lactating animal may have a slight decrease in milk yield when in heat, although it is seldom as pronounced as in cattle. The buffalo may be more restless and be difficult to milk (Bhikane and Kawitkar, 2000).

2.8.3.2.3 Gestation length

Buffaloes have a gestation period about one month longer than that of cattle (Hafez, 1992). According to Usmani*et al*. (1987), the gestation length in 92% of buffaloes ranged over a 30- day period more than in cattle. Fischer and Bodhipaksha (1992) reported that, the pregnancy period is varying from 305 to 320 days for the river buffalo and from 320 to 340 days for the swamp buffaloes. An average of 315 days for gestation length was quoted for Nili-Ravi buffaloes by Dutt*et al*. (1991). Gestation period was found to be significantly affected by sire of calf and the season of conception in a study by Chaudhry (1990) in Nili-Ravi buffaloes in pakistan. Twins are rare in buffaloes and their occurrence is less than 1 per 1000 births (Tulloch, 1992). Gestation period: 310-320 days for the swampe ,revire buffalo Iraq (Barile, 2005).

2.8.3.2.4 Calving interval

Regularity in conception and a short calving interval are most important to achieve a high lifetime milk production. Calving interval in buffalo is highly dependent on management, climate and nutrition. It is therefore shorter in some regions and longer in others . In order to shorten the calving interval the female should be serviced again as soon as possible after calving, after providing a sufficient period of rest. Weaning of calves at birth has been shown to decrease the service period in comparison to unwanted buffalo. A shorte rservice period will lead to a shorter calving interval – a calving interval of less than 410 days is recommended.(Heinrichs*et al*., 2005)

2.8.3.3 Reproductive life of buffalo male and female

The buffalo has an exceptionally long productive life. A normal healthy female buffalo could have as many as nine to ten lactations (Ganguli, 1981).

2.9Buffalo Milk production performance

Buffalo are the second largest source of milk supply in the world. In 2004, according to statistics from the United Nations' Food and Agriculture Organization (FAO) the world production of buffalo milk was 75.8 million tonnes (Mt). Trends in world milk production over the five years to 2004 indicate that the volume of buffalo milk is increasing steadily at about three percent per year While dairy cattle produce 84% of the total milk in the world it has to be noted that this volume is with an average fat and protein content of 4% and 3.5% respectively. The average fat content in buffalo milk is about 7 to 8% while protein content in buffalo milk ranges from 4.2 to 4.5%. So in terms of energy corrected milk, buffalo milk is making a greater food contribution than the actual volume of buffalo milk suggests.

Average daily milk yield is highly variable, and it mainly depends on the feeding system and management practices, like the number of milking per day. Baghdasar and Juma (1999) noticed that the overall mean of 305 total milk yield (TMY) of buffaloes in the south – east of Iraq (Misan Animal Breeding Station) was 1220 kg, and this TMY was highly significantly affected by parity, lactation period and breeding efficiency. They also observed that lactation yield of milk increased steadily from 915 kg during the first lactation to 1329 kg in the fifth lactation and decreased thereafter. Whereas, Juma*et al.*, (1992) reported a highly significant effect of parity on milk yield of Iraqi buffaloes, added that maximum yield obtained from the fourth lactation. In other reports on buffaloes in southern Iraq, average lactation milk yield was higher than estimates obtained by Baghdasar and Juma (1999). It ranged between 1309 kg during 256 days (Ragab, 1976) and

1453 kg during 284 days (Al – Amin *et al.*, 1987). In other reports, the averages are 1342 kg (Juma*et al.*, 1992, 1994) and 1315 kg (Juma and Baghdasar, 1994). In Iraqi buffaloes of Badosh, north of Iraq, however, average 305 – daily milk reported as 2960.6 kg (Al – Jamass, 1997).

2.8.4Some of the difficulties observed with buffalo reproductive performance

1. The first post-partum heat varies greatly with season, breed and individual. It has been reported to appear within less than 60 days in some cases and over 230 in others.

   Average Post-partum oestrus in the Murrah breed of India has been reported to be 100 days.

   The first post-partum oestrus is not always fertile, especially if it comes very near part us.
2. At birth buffalo have fewer primordial cells in the ovary than cattle have.
3. Compared to cows, buffalo suffer from higher atresia of follicles – 20 000 versus 100 000 (Bhosrekar, 2005).
4. Buffalo have a high proportion of silent oestrus and short duration oestrus. This is one of the most important problems in buffalo reproductive efficiency.

   It is even more problematic during the hot and humid months when it is compounded by thermal stress.

   Short and silent oestrus is the main reason why heat is often undetected in buffalo.
5. A large number of buffalo suffer from post-partum anoestrus, a complete absence of oestrus cycle and no signs of heat. This is one of the most common causes of buffalo infertility.

Reasons for poor reproductive performance

1. Climate affects both production and reproduction in all farm animals. However as buffalo are very susceptible to extreme conditions of heat and cold they show a tendency towards better performance during the cool months.

In India 70 to 80% of buffalo conceive between July and February. In Italy the usual calving season is from September to December. In India it is reported that a lower number of services are needed during the July to February breeding season than in the March to June season (Agrawal, 2003).

Buffalo are sexually activated by decreased daylight.

2. As mentioned earlier buffalo have poor thermal tolerance on account of an under developed thermo regulatory system and are unable to get rid of excess body temperature. If their housing is not designed to take care of this special species-specific requirement for adequate shade and ventilation, it will affect production and reproduction (Ramesh *et al*., 2002).

3. Nutrition plays a major role in the reproductive performance of buffalo, aswith other farm animals. However there is a strong possibility that the consequences of poor nutrition are often interpreted as seasonality of breeding in buffalo. Under feeding, over feeding or unbalanced Feeding, as well as deficiencies in minerals, vitamins or trace elements will cause reduced fertility in buffalo just as in other farm animals. A poor body condition score at calving affects fertility, characterized by prolonged post-partum intervals, reduced conception rates, and more services per conception. A very low protein diet can cause cessation of oestrus (Agrawal, 2003).

2.9.1Limitations in buffalo milk production

The limited application of systematic programmers for breed improvement through selective breeding at the village level has been the main bottleneck in

the development of buffalo production. In general, a dairy cow is considered to be efficient if the age at first calving is about 24 to 30 months. The calving interval should be about 12 to 13 months, with a lactation length of about 300 days, a 60 to 90 day dry period, and milk production of between 6 000 to 7 000 kg per lactation. As an example, in Sweden the average milk produced per recorded dairy cow was 8 794 kg, with 4.1% fat and 3.4% protein or 8 939 kg ECM (energy corrected milk, Sjaunja*et al*., 1990). Age at first calving among the herds reported was around 29 months with calving intervals at about 13.2 months (Swedish Dairy Association, 2003

Table (1)Milk production of buffalo in different regions of the world and the length of the milk season

Types	Milk yield per kg	Lactation length	Counter /areas	Number of showed	Searcher
Buffalo in Iraqi	1309	Iraqi /Maysan	Iraqi methan	-----	)Ragab (1976
Buffalo in Iraqi	1434.22	Iraqi/Maysan	272.7	410	Juma& Al-Samaraie (1985)
Buffalo in Iraqi	1452.5	Iraqi	283.7	78	Al-Amin et al)1987(
Buffalo in Iraqi	680-1600	IraqiThe Marshlands	--	----	Saleh*et,.al*(1989)
Buffalo in Iraqi	2500	Iraqi /White Gold Village	--		
Buffalo in Iraqi	1337.88	Iraqi	305		Ismail (1990)

2.9.2Milk composition

Buffalo milk is high in total solids, fat, proteins and vitamins compared to cow's milk. Buffalo milk also contains less cholesterol and more tocopherol, which is a natural antioxidant.

The peroxidase activity is two to four times higher in buffalo milk than in cow's milk, which means that buffalo milk has better natural keeping qualities (Chantalakhana and Falvey,1999). Buffalo milk appears to be whiter than cow's milk because it lacks the yellow pigment carotene, a precursor of vitamin A. But buffalo milk contains even more vitamin A than cow's milk.

According to the definition of USDA (2011), water buffalo milk is the normal lacteal secretion practically free of colostrum, obtained by the complete milking of one or more healthy water buffalo. Water buffalo milk shall be produced according to the sanitary standards of this ordinance. Quite a number of studies focused on cow milk, even if the milk produced by other animals such as buffaloes are essential in human diet indifferent parts of the world. Buffalo milk is a totally natural product that can be consumed like any other milk. It is one of the richest products from a compositional point of view and characterized by higher fat, total solids, proteins, caseins, lactose and ash contents than cow, goat, camel and human milk. Monitoring changes in composition of buffalo milk over years is important as an overall index for the combined effects of environmental and genetic factors. Zicarelli (2004a) recorded an increase in fat content of Italian buffalo milk from 7.3 to 8.3% and its protein content from 4.4 to 4.8% respectively from 1967 to 2000. Differences in the composition of buffalo milk in different localities reflect differences in breeds, management, feeding and environmental conditions.

Proteins:

The protein content of buffalo milk is higher than in cow (Ragab *et al*., 1958; Ganguli, 1973, Ahmad *et al*., 2008).Of the total proteins of buffalo milk, ~80% are caseins and ~20% are whey proteins with traces of minor proteins (Sirry*et al*., 1984). Whey proteins and minor proteins are even higher in colostrum than mature buffalo milk.(Sahai, 1996)

Fat:

Buffalo milk is nearly twice as rich in fat as compared to cow milk and the most important fraction responsible for its high energetic and nutritive value. Varrichio *et al.* (2007) reported the fact that the fat content has an average value of 8.3% but can also reach up to 15% under normal conditions. Tonhati *et al.*, (2011) found the fat yield means 90.1±24·6 g.kg-1. Medhammar *et al.*,(2011)The rumen of a buffalo also has a higher production of volatile fatty acids than the rumen of cattle. This might be one of the factors contributing to the higher fat content in buffalo milk (Ganguli, 1981).

Lactose:

Lactose is a disaccharide made up of glucose and galactose bonded together in buffalo milk like other milks. Buffalo milk is richer source of lactose than cow, goat, sheep and camel milk so a good of source of energy for body activities particularly of brain and hormonal regulation. Before it can be used by the body, the bond must be broken by the enzyme lactase in the small intestine. People that have decreased activity of lactase in the small intestine may have problem of lactose digesting and this is referred to as lactose intolerance or malabsorption. Due to higher concentration, the chances of such problems are more by using buffalo milk but cases have not been noticed

as for cow milk, may be due different repartition of lactose in the buffalo milk.(Abd El-Salam*et al*., 1966)

Minerals:

Buffalo milk has been found to contain more minerals than cow milk. Contents of macro minerals and selected trace elements in dairy products have been published by Cashman (2002a, b). The chemical form in which a macro mineral and trace element is found in milk or in other foods and supplements is important, because it will influence the degree of intestinal absorption and utilization, transport, cellular assimilation, and conversion into biologically active forms, and thus bioavailability. Buffalo milk is characterized by high calcium content than in cow, goat and camel milk). Most of calcium is found in insoluble form mainly due to the high casein contents of buffalo milk which plays an important role in determining the properties of buffalo milk. Based on the available data the insoluble calcium represents 67.6-82.6% of the total calcium. It has been estimated that micellarcalcium in buffalo milk to be 1.12 mM.g-1 casein as compared to 0.84 mM.g-1 casein in cow milk (Ahmad et al., 2008). The ionizable calcium of buffalo milk represents 34.6% of the soluble calcium. Buffalo milk is also rich in phosphorous contents. The phosphorous is disturbed between colloidal inorganic phosphate (42.4% of total), soluble inorganic phosphate (30.0%of total) and esters phosphorous (9.2% of total) (Abd El-Salam and El-Shibiny, 1966). The soluble magnesium represents 50% of total magnesium and soluble citrate represents 85% of the total citrate while sodium, potassium and chloride are almost completely present as soluble salts. The presence of 15 elements presents as tracesin buffalo milk has been reported in the table 7. Wide variations are found in reported levels of traces elements in buffalo milk which reflect the difference variable on the composition of milk in addition to differences in the used methods of analysis. Zinc, iron, and copper content of buffalo milk have received special attention. Trace elements are distributed variably between different phases of buffalo milk. Boron is found in buffalo

milk as 44.8% soluble, 37.6% associated with fat and 17.6% associated to casein. It contains 18%, 72%, and 10% of zinc as soluble associated with casein and lipid phase, While, 36.5, 42.5 and 21% of iron are found in cream, rennet whey and rennet curd. The secretion of some trace elements seems to be affected by hormonal like oxytocin administration which increases copper and manganese contents and decreases magnesium, iron and zinc contents without altering the calcium concentration of buffalo milk (Sheehan et al., 2009).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area and time of study

The experiment included various sites from central and southern Iraq, and included five Iraqi states, which are: Babil, Najaf, Samawa representing rivers buffalo and theeqar and Missan representing swamps buffalo. The overall climate in the marshlands is more temperate than the central regions where the river buffalo is grown, where the levels of the river are 3 to 5 degrees higher than the rivers in the central region, and the humidity in the marshes increases due to the large water bodies ,as for rain it is fairly equal. The study was conducted in the period from 5/4/2017 to 5/10/2017.

3.2 Data Collection

3.2.1Questionnaire

Structural questionnaire was designed to study the effect of the different system in the different region and their effect of the type animal performance. The data of reproduction (gestation length and Age of puberty in females and Age of puberty in males and Age of females at first birth and calving interval and Reproductive life of female and Reproductive life of male and Milk lactation)were collected by questionnaire from buffalo breeders of the Swamps and river buffalo in the above states, were (60) breeders: (30) river buffalo and (30) Swamps buffalo breeders were selected for this study.

3.2.2 Milk Sample collection

On the laboratory analysis of samples taken from the above regions (60) samples of milk buffalo and (44) sample of Buffalo Swamps. The animals at different ages, starting from the first season to the tenth season

3.4Chemical analysis of milk samples

The analysis was carried out in the laboratories in Department of Animal Production, Faculty of Agriculture at Al-Muthanna University. The obtained

samples were taken to the laboratory and analyzed by the EKOMILK (made at 2010) Dutch-based, a modern device that measures the components of milk by ultrasound and measures four types of animal milk (cattle, buffalo, sheep and goats) This device has ten readings, according to sequence, fat and solids Non Fat, SNF, Density, Protein, Freeze point, Temperature, Lactose, Ash, Z, PH and water. The sample is prepared for analysis at 10 - 30 ° C. After arrival, the sample is homogenized prior to insertion into the device to ensure that the fat milk is not gathered in the tube surface. The device then pulls the sample automatically from the bottom of the machine with a special handle to insert the sample into The device to read, and then determines the type of animal which the milk sample was taken from by an electronic program for the type of animal in the machine and start reading the sample, which takes up to 60 seconds per sample. The readings of each sample on the screen of the device, which are from the top left and right towards the fat, solids, density, protein, freezing point, heat, lactose's, After each sample analysis device was washed distilled water for cleaning the device.

3.5 Nutrition System:

The feeding method varies among the River buffalo and swimming buffalo. Through questionnaire with the buffalo breeders in the above survey areas we observed the following:

1. Feeding Rivers buffalo are limited and according to the potentiality of the breeder, where the breeder fed buffalo on the concentrate , roughages and fodders and be often twice a day.. Morning and evening.. The difference between concentrated feeds between barley and wheat bran and roughages which are straw of wheat or barley or rice according to agricultural season and the green fodders consist mainly of the alfalfa or some of the farms byproduct as in table(1)

Table (2) **showing the chemical composition of the feed of Iraqi Buffalo (rivers)**

Feed Stuff	**Dry mater**	**Crude protein**	**Ether**	**Curd fiber**	**Ash**	**Carbohydrates Dissolved**
Alfalfa	26.63	4.62	0.89	6.76	2.84	11.52
Barley straw	94.00	1.86	1.50	33.50	9.86	47.28
Rice straw	91.03	3.36	1.18	32.08	8.28	46.16
Wheat straw	93.50	2.75	0.60	35.87	9.25	45.03
Barley	92.85	10.72	1.42	6.50	3.82	70.39
Wheat bran	90.42	15.86	4.05	10.63	4.99	54.89
Mean	81.40	39.17	9.64	20.89	6.5	45.87

2.Nutrition in the swamps buffalo is adlibitum and open where the animals are fruly fed throughout the day from morning to evening and on the available species in his environment and consists of Phragmites and Typha are mainly as in table(2)

Table (3) Showing the chemical composition of the feed of Iraqi Buffalo (swamps)

Feed stuff	**Dry Mater**	**Crude protein**	**Ether**	**Crude fiber**	**Ash**	**Carbohydrates dissolved**
Phragmites	34.1	5.15	0.57	8.97	4.83	29.59
Typha	34.5	4.14	0.74	11.7	4.20	13.69
Mean	34.3	4.64	0.65	10.33	4.51	21.64

3.6 Statistical analysis

For Statistical analysis using the Statistical Analysis System (SAS software, version 2012) According to SAS Institute in USA. The Questionnaire data and milk composition were analyzed by one way ANOVA test . according to (Firas Rashad Samuraimeans.2009) with significant difference ($p<0.05$) were compared by the least significant difference (LSD) test.

CHAPTER FOUR

RESULTS

The current research comes within the framework of rising interest and drawing the attention of the Iraqi government to the importance of developing and effective program to improve production in Iraq Buffalo breeding culture, as it is one of the pillars of the national economy for its active contribution in all productive activities despite the neglect which lasted for a long time,in one of this target programing Scientific research contributes to future studies in the field of nutrition and its impact on milk components and reproductive performance of the Iraqi buffaloes.

the data collected through questionnaires has disclosed results that revealed the effect of feeding system on some reproductive performance of River _Swamp buffalo

4.1 Reproductive Measurement

Table (4.1) Reproductive performance in rivers and swamps buffalo

Item	Rivers buffalo	Swamps buffalo	LSD	Sig
Age of puberty in males / year	3.52^{a}	3.15^{b}	0.1555	*
Age of puberty in females / year	3.53^{a}	3.01^{b}	0.1373	*
Gestation length in day	313.27^{a}	313.21^{a}	2.0445	NS
Age of females at first birth / year	4.42^{a}	3.56^{b}	0.2402	*
Calving interval in day	441.8^{a}	433.1^{b}	24.707	*
Reproductive life of female / year	17.65^{a}	18.43^{b}	0.7469	*
Reproductive life of male / year	8.93^{a}	11.60^{b}	1.3033	*

*=Significant different

NS=not Significant different

4.1.1 Puberty age of males

The data in table (4.1) fig(1)recordedthat there is significant difference ($p \leq 0.05$) between the two types of buffalo, The average of puberty age in males were 3.51 ± 0.05 and 3.15 ± 0.06 yearsin swampsand rivers buffalo respectively.

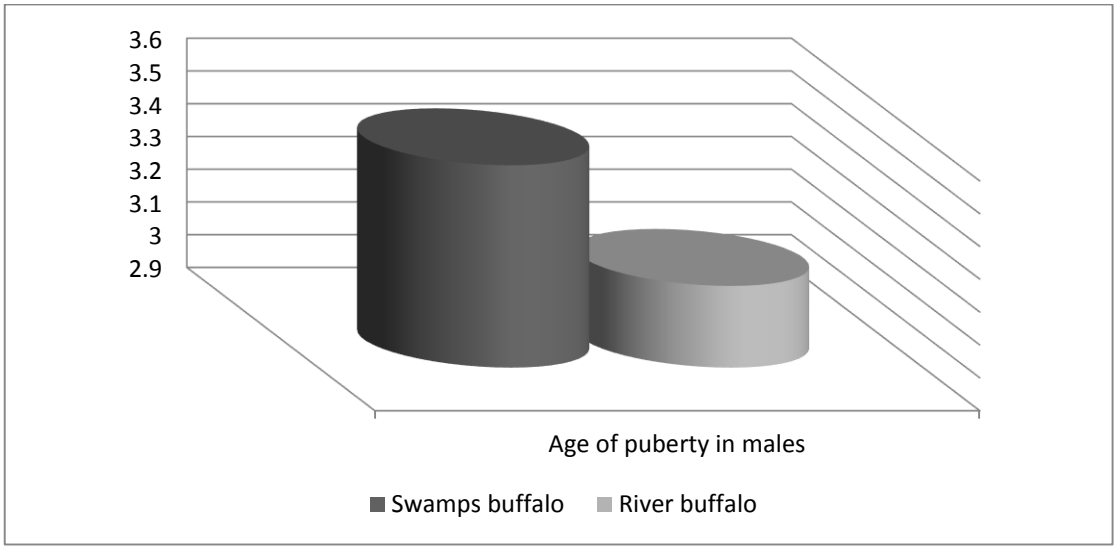

Fig (1) Age at puberty in males and the difference between the swamp and river buffalo

4.1.2 Puberty age of females

The data in the table(4.1) fig(2) showed a significant difference ($p \leq 0.05$) between the two types of buffalo.The average of age at puberty in females in yearwas 3.52 ± 0.05 and 3.01 ± 0.05 years in swamps and rivers buffalo respectively.

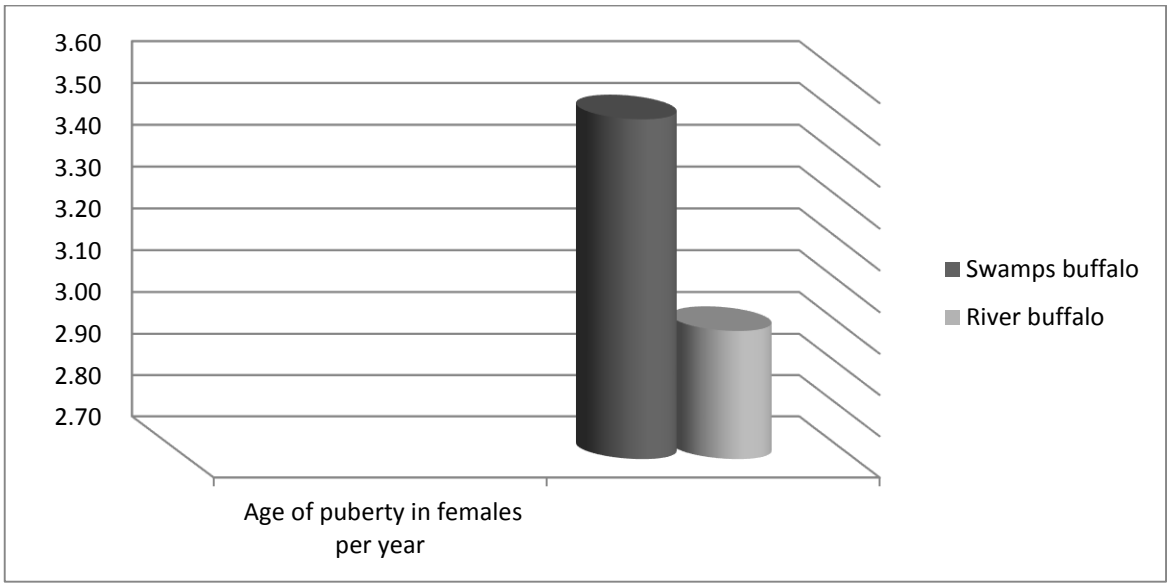

Fig (2) Age at puberty in females and the difference between the swamp and river buffalo

4.1.3 Gestation length

The data in table (4.1) fig(3)recorded no significant difference ($p \geq 0.05$) between the two types of buffalo .The average of gestation length 313.27 ± 0.85 and 313.21± 0.55 days in swamps and rivers buffalo respectively.

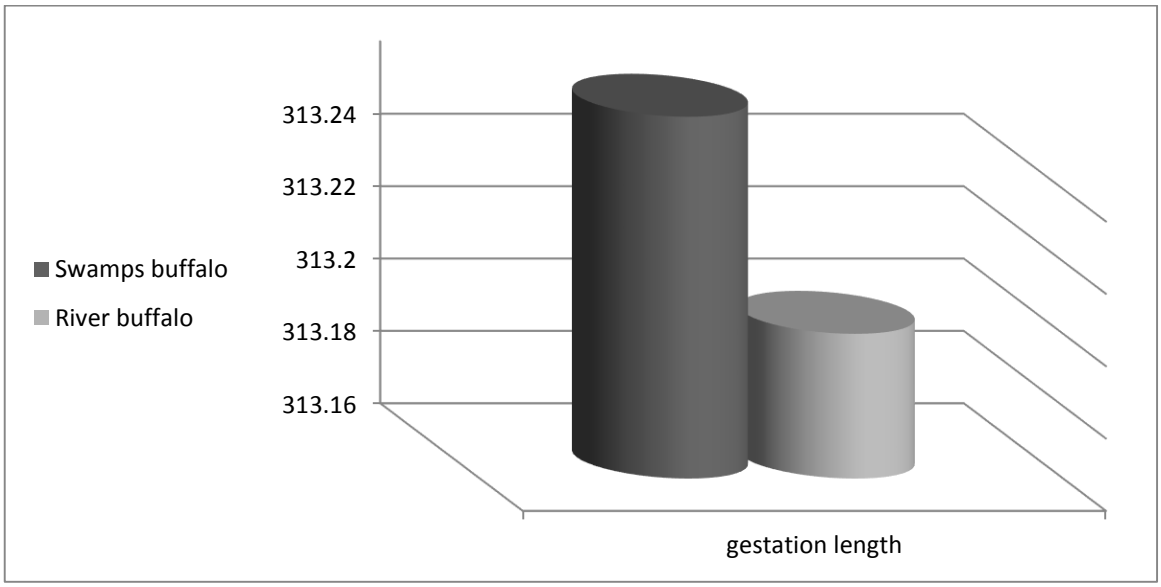

Fig (3) gestation length and the difference between the swamp and river buffalo

4.1.4 Age of females at first calving

The data in table (4.1) fig(4) indicated significant difference ($p \leq 0.05$) between the two types of buffalo ,The average age of females at first calving 4.42 ± 0.09 and 3.56 ± 0.07 years in swamps and rivers buffalo respectively

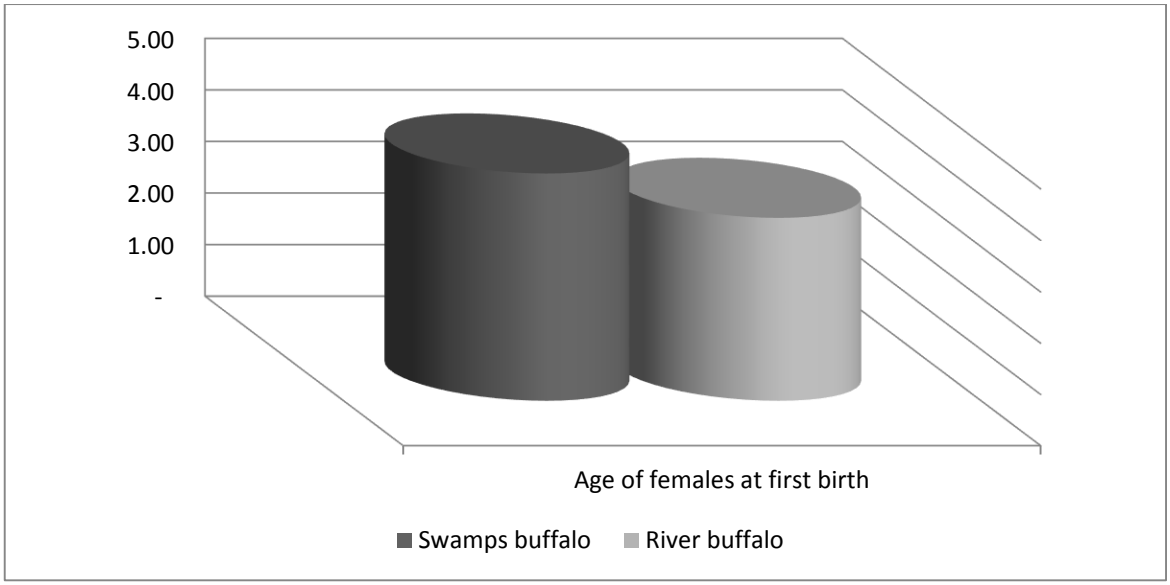

Fig (4) Age of females at first birth and the difference between the swamp and river buffalo

4.1.5 Calving interval

The data in table(4.1)fig(5)reflectedalso significant difference ($p \leq 0.05$) between the two types of buffalo the average of calving interval 441.80 ± 9.09 and 433.1±8.31 years in swamps and rivers buffalo Respectively

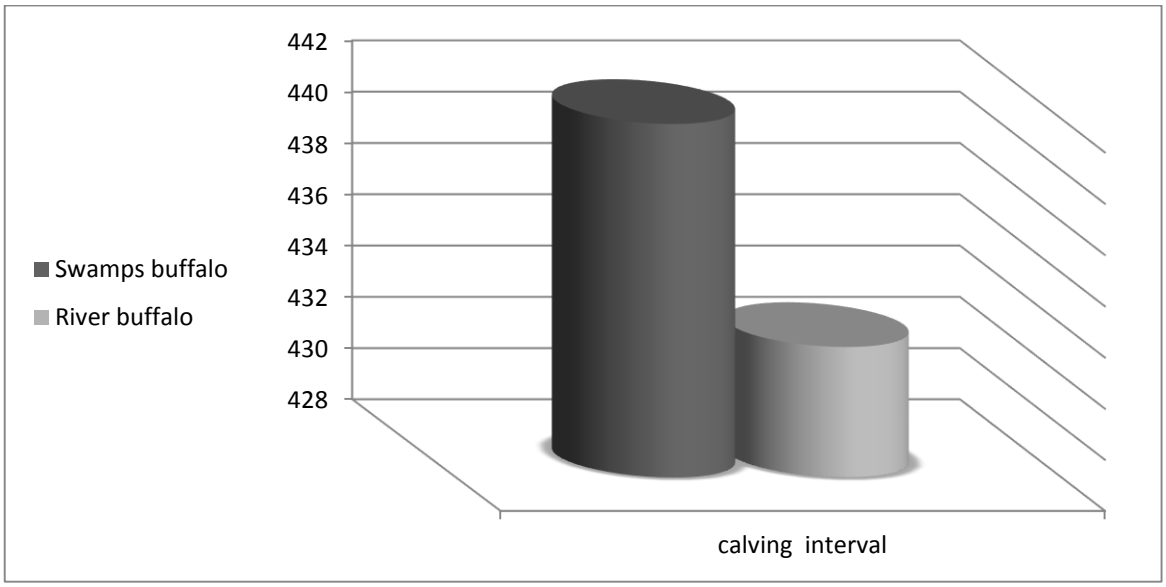

Fig (5) calving interval int he swamp and river buffalo

4.1.6- Reproductive life of female

The data in table(4.1) fig(6)indicated significant difference ($p \leq 0.05$) between the two types of buffalo the average of reproductive life of female 16.70 ± 0.29 and 15.43±0.20 years in swamps and rivers buffalo Respectively

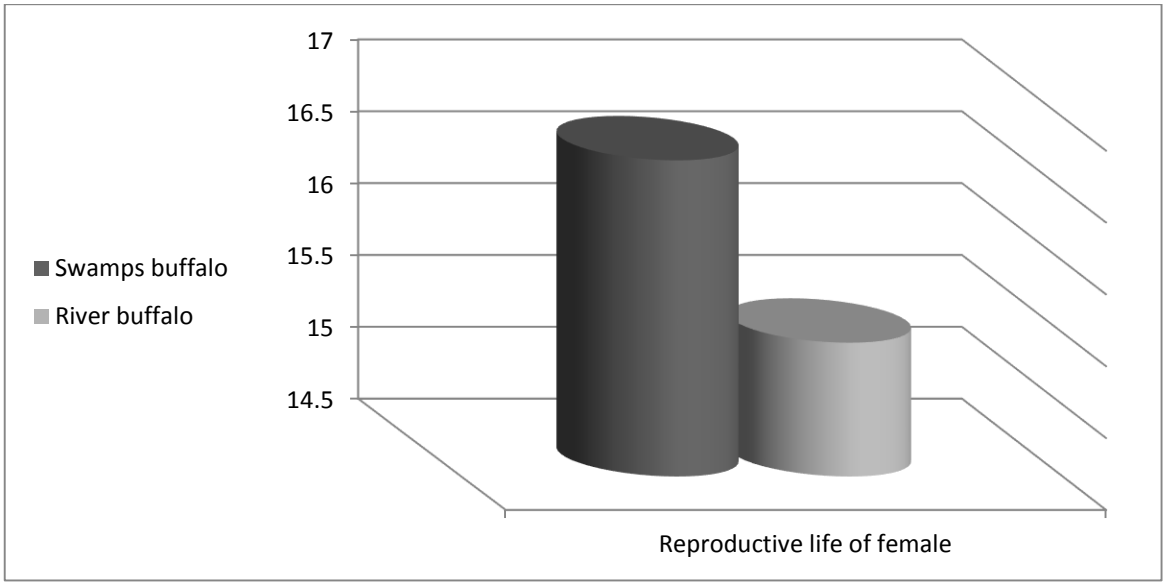

Fig (6) Reproductive life of female and the difference between the swamp and river buffalo

4.1.7 Reproductive life of male

The data in table(4.8) fig(7)recorded significant different ($p \leq 0.05$) between the two types of buffalo ,The average of reproductive life of male 11.60 ± 0.60 and 8.93±0.22 years in swamps and rivers buffalo respectively

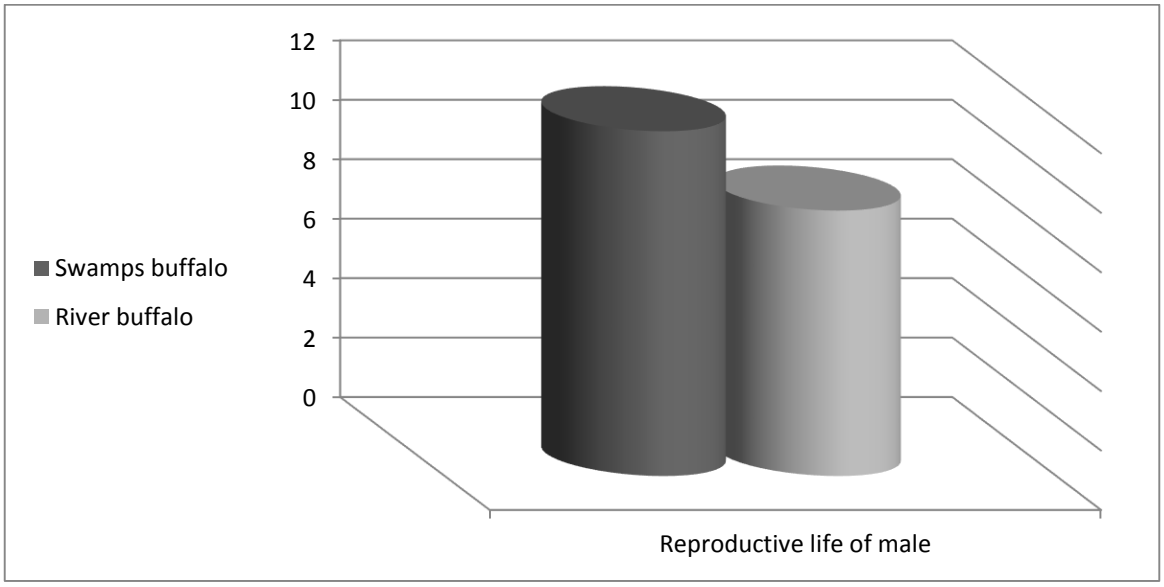

Fig (7) Reproductive life of male and the difference between the swamp and river buffalo

4.2 Milk production and composition

Table (4.2) Milk production and composition of rivers and swamps buffalo

Item		Rivers buffalo	Swamps buffalo	LSD	Sig
Milk lactation period/ day		281.72a	281.72a	28.026	NS
Daily Milk yield/ liter		9.21	5.67	0.456	*
Milk composition	**Fat %**	5.55[b]	10.44[a]	0.813	*
	Protein%	3.46[a]	2.85[b]	0.28	*
	Lactose%	4.94[a]	3.86b	0.304	*
	Solid not Fat%	9.1[a]	7.25b	0.497	*
	Ash %	2.61[a]	2.51[a]	0.0779	NS

*=Significant difference

NS=not Significant difference

4.2.1 Milk lactation period

The data in table (4.2)fig(8) there were no significant difference ($p<0.05$) between the two types of buffalo the average of Milk lactation period 281.6 ± 10.3 and 281.7 ± 9.43 day in swamps and rivers buffalo Swamps and Respectively.

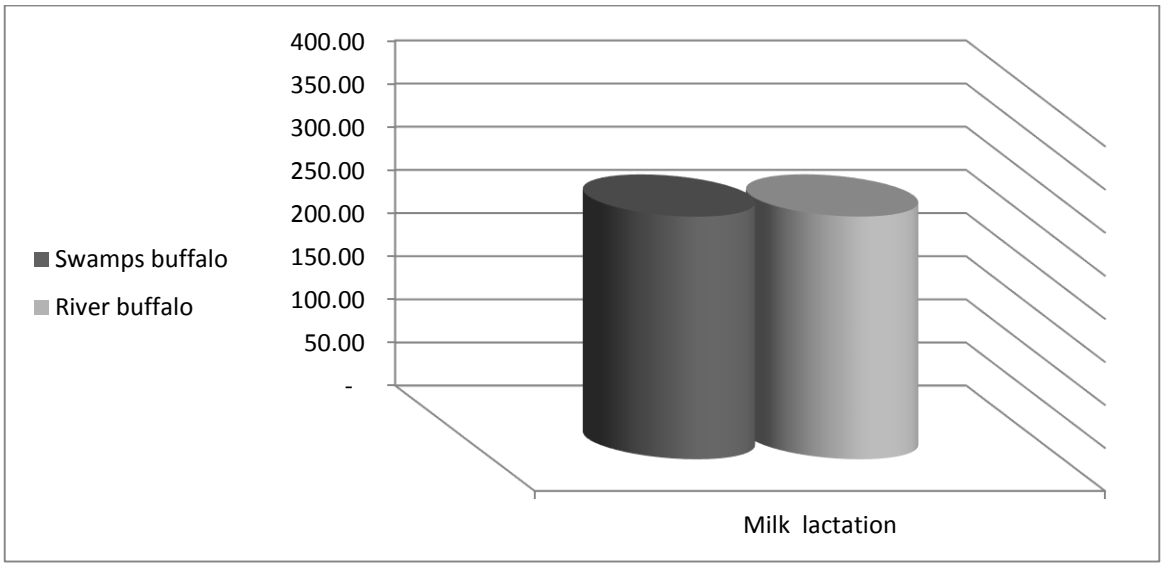

Fig (8) Milk lactation and the difference between the swamp and river buffalo

4.2.2 Daily Milk Yield/ Liter:

The data in table (4.2)fig(9) there are significant difference ($p<0.05$) between the two types of buffalo the average of daily milk yield/ liter 9.21 ± 0.15 and 5.67± 0.16 day in swamps and rivers buffalo Swamps and Respectively.

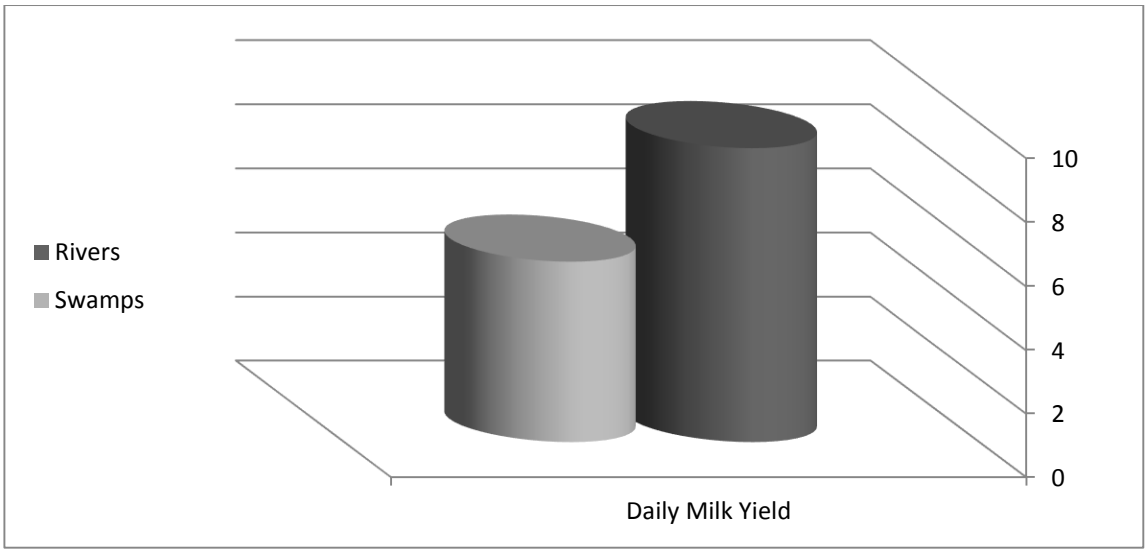

Fig (9) daily milk yield/ liter and the difference between the swamp and river buffalo

4.2.3Fat

The result obtained in table (4.2) fig(10) showed significant differences ($p \leq 0.05$)between the two types of buffalo ,The average Fat in milk was 5.55 ± 0.16 and 10.44 ± 0.43 respectively for both rivers and swamp buffalo.

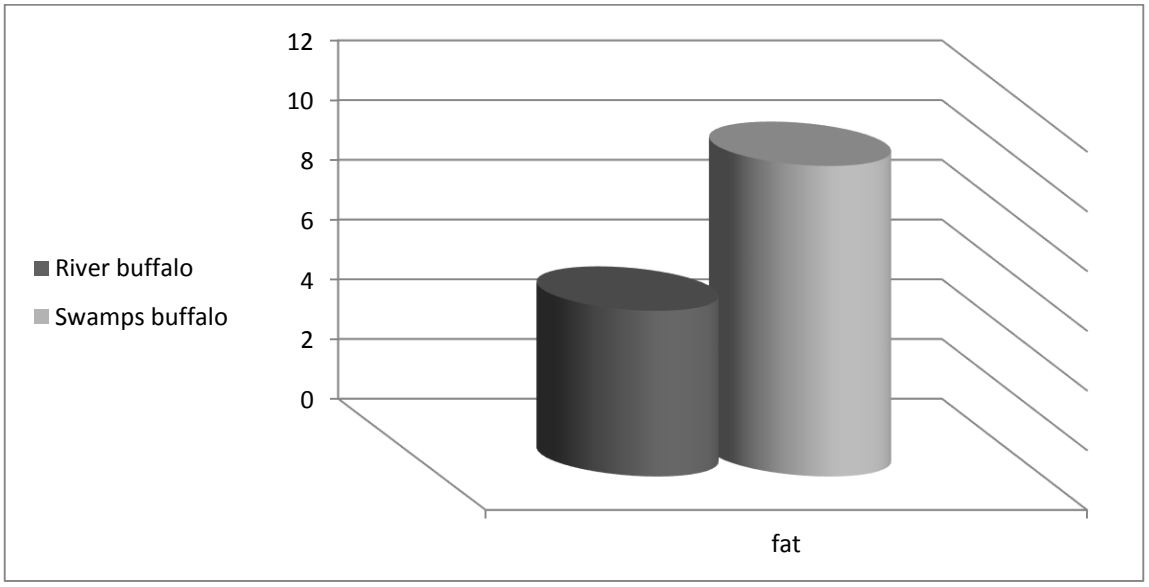

Fig (10) Fat and the difference between the river buffaland swamp buffalo

4.2.4 Protein

The result obtained in table (4.2)fig(11) showed significant differences ($p \leq 0.05$)between the two types of buffalo ,The average protein in milk was 3.46 ± 0.28 and 2.85 ± 0.08 respectively for both rivers and swamp buffalo.

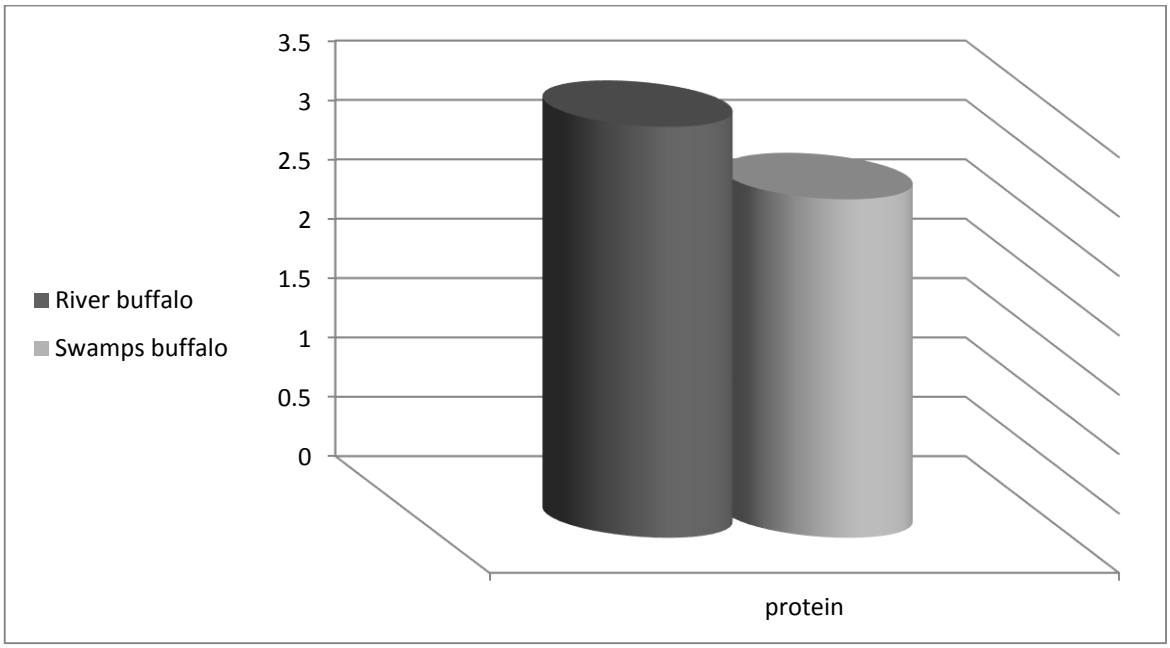

Fig (11) Protein and the difference between the river and swamp buffalo

4.2.5 Lactose

The result obtained in table (4.2)fig(12) showed significant differences between the two types of buffalo ($p \leq 0.05$) ,The average Lactose in milk was 4.95 ± 0.081 and 3.86 ± 0.14 respectively for both rivers and swampbuffalo.

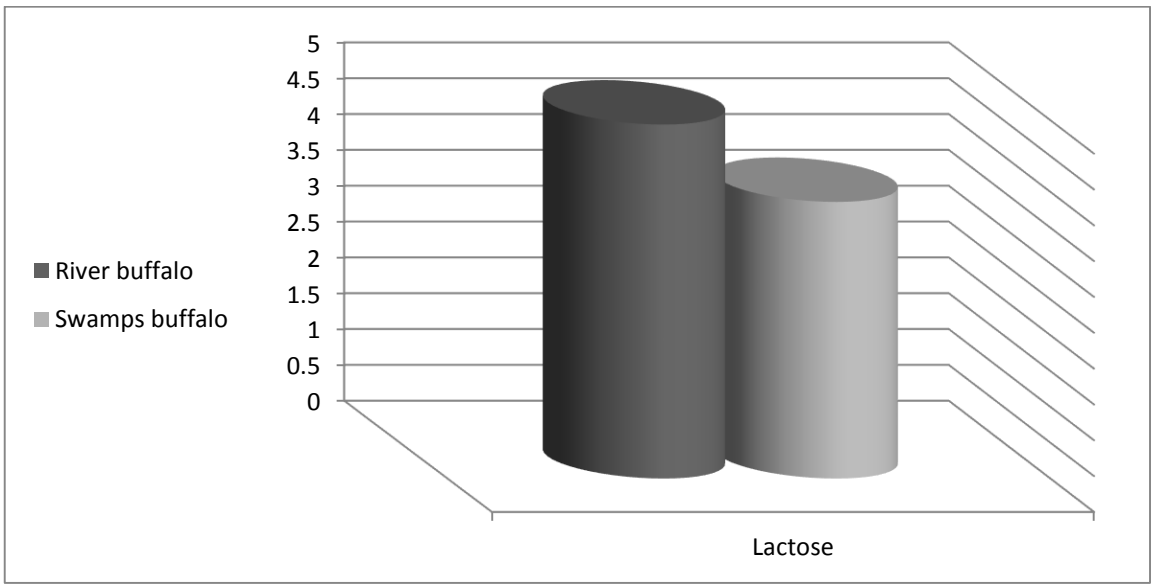

Fig (12) Lactose and the difference between the river and swamp buffalo

4.2.6 Solid not Fat

The result obtained in table (4.2)fig(13)showed significant difference($p \leq 0.05$) between the two types of buffalo, The average Solid not Fatin milk was 9.1 ± 0.14 and 7.25 ± 0.23.respectively for both rivers and swampbuffalo

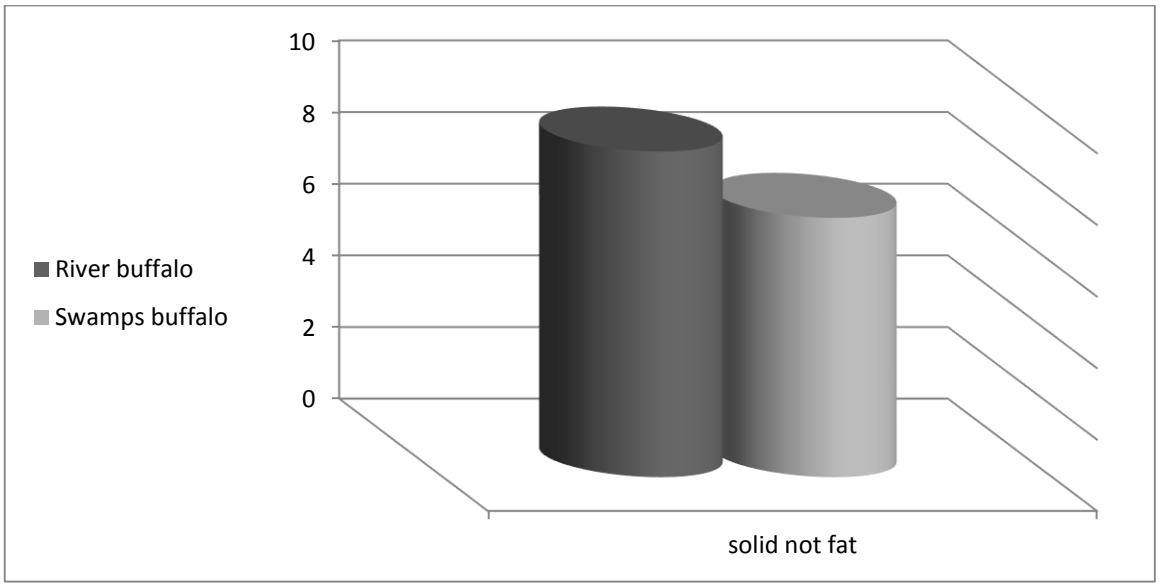

Fig (13) SNF and the difference between the river and swamp buffalo respectively.

4.2.7 Ash

The result obtained in table (4.13)fig(14) showed no significant differences ($p \geq 0.05$)between the two types of buffalo, The average protein in milk was2.61 ± 0.03 and 2.51 ± 0.03 respectively for both rivers and swamp buffalo.

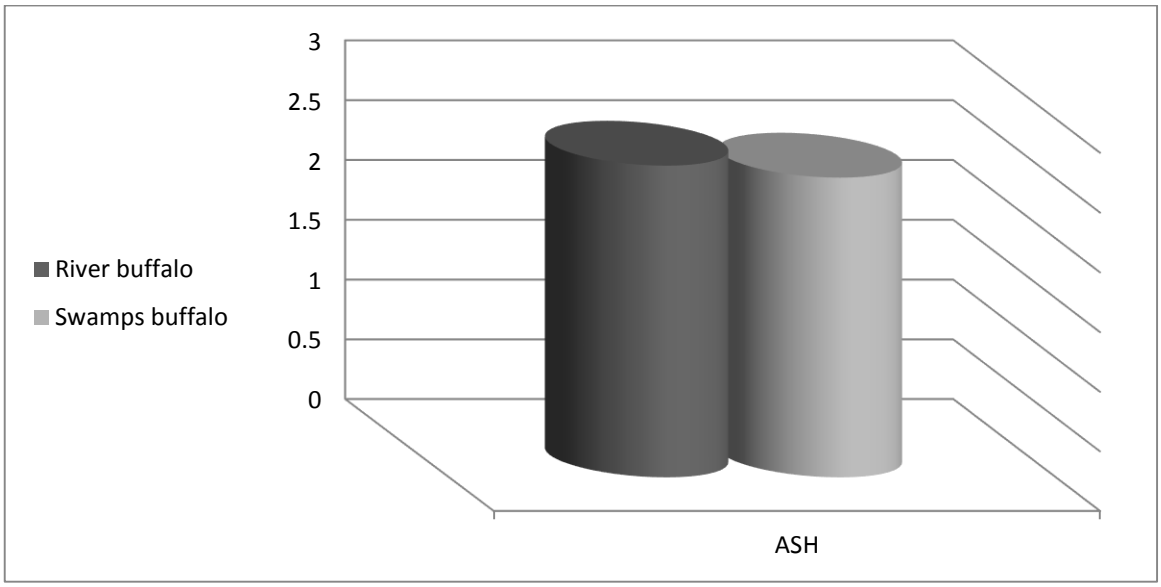

Fig (14) Ash and the difference between the river and swamp buffalo

CHAPTER FIVE

DISCUSSION

This study has been conducted to investigate effect of feeding systems on some characteristic and reproductive performance and milk composition in dairy buffalo in Iraq.

5.1 Reproductive performance

The average age of puberty in males showed significant different ($p \leq 0.05$) between the two types of buffalo (River _Swamp),The River buffalo recorded first estrus earlier in males and female, but the Swamp buffalo late puberty age in males and female than River buffalo, this result were in agreement with (Jainudeen and Hafez1993)the river type exhibit first estrus earlier (15 to 18 months) than the swamp type (21 to 24 months). First conception occurs at an average body weight of 250 to 275 kg, which usually attained at 24 to 36 months of age (Barile, 2005). For the Indian buffalo, Madan (1988) reports a large variation in age at puberty ranging from 16 to 40 months depending on the breed. Many factors influence age at puberty, such as breed, season, climate, nutrition and growth rate (Hafez and Hafez, 2000). Correspondingly, the ovarian cyclic activities affected by different farm conditions like feeding levels that improve growth and sexual maturity (Roy *et al.*,1975 and Hafez and Hafez, 2000) might attribute of such variation.

As **Gestation length**, the result, showed no significant different ($p \geq 0.05$) between the two types of buffalo (River _Swamp) This result was similar to Barile, (2005) who recorded gestation period: 310-320 days for the swampe, revire Iraq buffalo.

For the age of females at first Calving the result obtained showed there was significant different ($p \leq 0.05$) between the two types of buffalo (River _Swamp) in Age of females at first birth, The River buffalo recorded lower

age at first birth compared to Swamp buffalo ,This result was in agreement with (Clevering, O. A.; Brix, H. and Lukavská, J. (2001) This different depending on puberty age, sinceand the River buffalo recovered improveddiet with (barley straw wheat straw , ,wheat bran, and rice straw) this containing highly level of energy and protein compared to Swamp buffalo diets which depend to (phagmittes and typha) this forage is lowest in energy and protein . Balanced feeding, improved management and minimum disease prevalence can be helpful in reducing the age of first calving (Heinrichs*et al*., 2005).

The results explain there are significant difference ($p \leq 0.05$) between the two types of buffalo(River -Swamp) in **calving interval**, the River buffalo recorded lower calving interval than Swamp buffalo, such result is in agreement with(Hogbeng and lind,2003).Calving interval in buffalo is highly dependent on management, climate and nutrition. It is therefore shorter in some regions and longer in others In order to shorten the calving interval the female should be serviced again as soon as possible after calving, after providing a sufficient period of rest,Weaning of calves at birth has been shown to decrease the service period in comparison to unweaned buffalo. A shorter service period will lead to a shorter calving interval − a calving interval of less than 410 days is recommended. This differencemight be due to poor nutrient of Swamp buffalo and good nutrient of River buffalo, calving interval in buffalo is highly dependent on management, climate and nutrition.

For Reproductive life of male and female the results showed significant different ($p \leq 0.05$) between the two types of buffalo (River _Swamp) in reproductive life of male and female, The River buffalo recorded lower reproductive life than Swamp buffalo, Reproductive efficiency is determined by many different processes, which result from interaction among genetic and environmental factors. The processes involved singly or in concert, include age of puberty/maturity, pattern of estrous cycle and estrous behaviour, length of breeding, ovulation rate/littersize, lactational an oestrous period, post-

partum anoestrus inter calving period, and reproductive life span. These traits combined measure breeding efficiency/performance (Agrawal, 2003) .

5.2 Milk lactation period

The result showed there are no significant different ($p \geq 0.05$) between the two types of buffalo (River _Swamp) in milk lactation period, the result was similar with (Ragab, 1976) and 1453 kg during 284 days (Al – Amin *et al.*, 1987). and also disagree with Baghdasar and Juma (1999) who noticed that the overall mean of 305 total milk yield (TMY) of buffaloes in the south – east of Iraq (Misan Animal Breeding Station) was 1220 kg, and this TMY was highly significantly affected by parity, lactation period and breeding efficiency. They also observed that lactation yield of milk increased steadily from 915 kg during the first lactation to 1329 kg in the fifth lactation and decreased thereafter.

5.3 Milk composition

Buffalo milk is high in total solids, fat, proteins and vitamins compared to cow's milk. Buffalo milk also contains less cholesterol and more tocopherol, which is a natural antioxidant, the peroxidase activity is two to four times higher in buffalo milk than in cow's milk, which means that buffalo milk has better natural keeping qualities (Chantalakhana and Falvey,1999).

For Fat content the results showed that there were significant differences ($p \leq 0.05$) between the two types of buffalo (River and Swamp) in fat content, The Swamps buffalo recorded highly level of fat content in milk composition compared to river buffalo this result was in agreement with Varrichio *et al.*,(2007) who reported the fact that the fat content has an average value of 8.3% but can also reach up to 15% under normal conditions. Differences in the composition of buffalo milk fat in different localities reflect differences in breeds, management, feeding and environmental conditions, river buffalo had

high production milk but Swamps buffalo the had low milk production, so the negative correlation between amount of milk and fat might be a good justification for such difference.

The result obtained showed were significant differences ($p \leq 0.05$) between the two types of buffalo (River _Swamp) in **protein content**, the result was similar the river buffalo was highly protein content compared to Swamps buffalo was lower protein content, this differences in protein content due to nutritional sysem from two types of buffalo,the river buffalo diet with (barley straw wheat straw,wheat bran, and rice straw) those forage contened high level of protein, but the Swamps buffalo diet with(phagmittes and typha) the level of protein in this dietary is less, similar result were obtain by Sharma *et al.*,(1980),who reported The average protein content of milk from buffaloes was 3.86. and disagreement with (Thomas, 2008) who reported Protein content in buffalo milk ranges from 4.2 to 4.5%, the protein content lower than Khan *et al* (2007) (3.77 %) and lower than Ariota *et al*.,(2007) (4.71%),The difference in feeding range might be accuses for that differences.

For lactose the result obtained that there were significant differences ($p \leq 0.05$) between the two types of buffalo (River _Swamp) in lactose , the river buffalo recorded high lactose than Swamps buffalo was lower , such differences might be due to differences type of dietary from river and swamps buffalo. river buffalo diets contain more lactose than swamps buffalo diets, this results in agreement with Khan et *al*.,(2007) how reported the lactose in buffalo milk was (4.76 %), and lower than both Spanghero *et al*., (1996) (5.15 %), To consider the lactation state of the buffaloes the chemical composition of the milk changes during lactation period as well as through season. The fat, protein, DM and calcium content increase while lactose decreases (Fox *et al*., 1998).

For Solid not Fat Results showed that there were significant differences ($p \leq 0.05$) between the two types of buffalo (River _Swamp) in solid not fat, the Swamps buffalo recorded less level of solid not fat in milk composition compared

to river buffalo, This was due to the Swamps buffalo low production of milk compared to river buffalo was high production milk, and may refer to nutritional effect.SNF content of buffalo milk in this experiment was nearly similar with the result of Sharma *et al.*,(1980),this result was lower than (Roy and Chandra, 1978) who reported the solid-not-fat its was 10.2%.

For Ash content The result record that there were no significant differences ($p \geq 0.05$) between the two types of buffalo (River _Swamp) in ash content. This result disagrees with Sharma *et al.*,(1980), who found 7.2% ash.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

Conclusion:

There were differences between the two types of buffalo (River _Swamp) in reproductive performance and milk productive.

- ✓ Reproductive performance of Swamps buffalo is higher than Rivers buffalo.
- ✓ River buffalo produce more milk than swamp buffalo although they had the same lactation length.
- ✓ In milk composition the Swamps buffalo recorded high level fat content
- ✓ River buffalo recorded high level for milk composition (protein, lactose and solid not fat) than swamps.
- ✓ The ash content showed no significant difference between both buffalo types.

Recommendations:

- Concerns about buffalo since it represents the animal of the twenty-first century because it is resistant to disease and milk production and has the capacity to fattening above all other farm animals and the construction of a long-term genetic program for the improvement and development of buffalo in Iraq by the federal government and managed by top academic and related to the issue of artificial insemination for the purpose of forming a new generation Suitable for the prevailing environmental conditions and high production characteristics and work on the establishment of a herd of buffalo genetically distinct nucleus is the basis for the development of buffalo at the level of Iraq and in all the provinces where buffalo is used for artificial insemination The basis for the development of buffalo and

the use of dry breeding method as an alternative to education in the marshes and improve nutrition and the development of a program of food for animals according to production and weight and resort to night grazing and the optimal use of reeds and papyrus by adding some treatments to improve palatability and nutritional value.

- The interest of animal habitats from the technical and administrative point of view and the need for educators with low populations to benefit from the educational values of the genetically modified herds of sheep, as well as the use of modern and advanced methods in the field of biotechnologies and the genetic map of the Iraqi buffalo to rely on the daily milk for periodic examinations in the female genetic assessment if genetic variation is diagnosed Among individuals, as well as the establishment of swimming pools, rivers and private marshes for swimming buffalo.
- Opening milk collection centers and receiving milk from owner at a subsidized price and considering the issue of treating buffalo breeders similarly with vegetable and grain crops through distribution of land by the Ministry of Agriculture to buffalo breeders so that all breeders can cultivate enough animal feeds and provide financial loans for those wishing to construct sheds and to increase local income by encouraging applied research aimed at increasing the productivity of buffalo milk and meat to avoid import risks.
- Since The reproductive efficiency in the Swamps buffalo is better than the reproductive efficiency of the river buffalo except for the amount of milk produced and its composition. Therefore, we recommend improving the feed system, especially concentrated swamps buffalo, to increase the quantity of milk produced.

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Appendices

Interviews with owners

Rivers buffalo area




Swamps buffalo area

Analysis of Milk Composition

بسم الله الرحمن الرحيم

Questionnaire:

Herd No.....

Herd Information

Who is taking care of the herd?

1-the owner ( ) 2- hired person ( ) 3 - Other ( )

What is the purpose of breeding Buffalos:

1- Inherited job ( ) 2- Trading & profit ( ) 3-Livinghood ( )4 -Social prestige and hoppy( )

2- What are the types of breeding system adopted? .....

3- Nutrition

What are the main sources of nutrition?

1-Pasture ( ) 2- Pasture & fodders ( ) 3-Fodders ( )

4-Fodders & concentrate ( ) 5- Pasture & fodders& concentrate ( )

Time number of feeding the herd per day?

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

Reproductive measurement:

1- How many female in the herd?.....

2- How many adult male in your herd?

……...

3- Number of male to female (No of female that the rutting male can mate)?.....……

4- *When the breeding seasons start?*

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

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

5- *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 ( )

6- What is puberty age of female?

……

7- What is puberty age of male?

……

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

……

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

……

10- Age of female at first calf?

……

11- How long the duration of estrus period per day?

……

12- No of estrus cycle during the season?

……

13- No of Services per consumption?

……

14- Gestation period

……..……

15- First Service after calving- Open period per Month or Day……

16- Calving Interval?

……..……

17- What is reproductive age of female?

……

18- What is the number of calves born by female in her reproductive life?……

19- When do you cull the female? Age by year……

20- What is the reproductive age of male (When do you cull it)?

……

Production

1- Number of milking per day?

1-Once ( ) 2- Two time ( ) 3-Three Time ( )

2- What is average quantity of milk production per day?

.....

3- How long is the lactation period?.....