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ADDIS ABABA UNIVERSITY

FACULTY OF VETERINARY MEDICINE

STUDIES ON REPRODUCTIVE PERFORMANCE AND MAJOR REPRODUCTIVE HEALTH PROBLEMS OF HOLSTEIN FRIESIAN COWS AT ALAGE DAIRY FARM

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AMENE FEKADU FANTAYE

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A thesis submitted to the Faculty of Veterinary Medicine, Addis Ababa University in the partial fulfillment of the requirements to the Degree of Master of Science in Tropical Veterinary Medicine

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DEDICATION

This Paper is dedicated to my parents Fekadu Fantaye and Belaynesh Ali for their prayer support and encouragement.

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LIST OF ABBREVIATIONS

AFC	Age at First Calving
AFS	Age at First Service
AI	Artificial Insemination
ATVET	Agricultural Technical Vocational and Educational Training
BCS	Body Condition Score
BHV-1	Bovine Herpes Virus 1
CI	Calving Interval
DEFRA	Department for Environment Food and Rural Affairs
DO	Days Open
FAO	Food and Agricultural Organization
Gn-Rh	Gonadothropin Releasing Hormone
IBRV	Infectious Bovine Rhinotracheitis Virus
LH	Luteinizing Hormone
MRHP	Major Reproductive Health Problems
NSC	Number of Services per Conception
Pg F2α	Prostaglandin F2α
SCC	Somatic Cell Count
SAS	Statistical Analysis System

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ABSTRACT

In the present study the reproductive performance of Holstein Friesian cows in Alage Dairy Farm was assessed and the major reproductive health problems identified. The farm belongs to Alage Agricultural Technical Vocational and Educational Training College, which is located in the southern region of the country in the rift valley area. The main objectives of the study were to estimate the different reproductive parameters, to identify the major reproductive health problems and to assess the relationship of possible risk factors. Cross-sectional studies on reproductive parameters and abnormalities were undertaken for a period of 9 months. A total of 1099 records for calving interval, days open and number of services per conception and 699 records for age at first service and calving and 1278 records for major reproductive health problems were analyzed retrospectively. For the follow up study, 130 periparturient and post partum cows were included. Records of cows and heifers were used to calculate the least square means of reproductive traits like age at first service (AFS), age at first calving (AFC), calving interval (CI), days open (DO), number of services per conception (NSC) cow attributes and factors such as season and year were also analyzed. Clinical examination of each cow was conducted to determine the proportions of reproductive disorders. The overall means of AFS, AFC, CI, DO and NSC was 991.4 $\pm$ 24.3, 1265 $\pm$ 24.3, 561.3 $\pm$ 18.9, 285.8 $\pm$18.9 days and 1.69 $\pm$ 0.1 respectively. Season of birth had no significant effect on the AFS and AFC whereas year of birth ($p<0.001$) had a significant effect on AFS and AFC. Days Open and CI were significantly affected by parity ($p<0.001$) and season ($p = 0.04$) of calving. Of the factors tested, parity ($p<0.001$) and year of conception ($p<0.001$) significantly influenced the NSC. The analysis of variance showed that season had no significant effect on NSC. The estrus detection rate using heat watch system was 52%.

Generally from a total of 1278 assessed recorded data 31.5% (n = 403) were found with the major reproductive health problems. Uterine infection and retained fetal membranes were found to be the major reproductive health problems. Uterine infection accounted for the highest occurrence of 28.5% followed by retained fetal membranes (26.6%). Anestrus, repeat breeders, abortion, dystocia, cystic ovaries, vulvo vaginitis and vaginal and uterine prolapses accounted for 10.2%, 9.8%, 7.4%, 5.7%, 3.7%, 2.9%, 2.5%, and 2.2% respectively.

In the cross-sectional study, a total of 130 cows were examined and the major reproductive health problems were identified. Uterine infections accounted for the highest prevalence rate of 10.1% followed by retained fetal membranes (4.7%), cystic ovaries (3.9%) and dystocia (3.1%). The prevalence rates obtained for vaginal prolapse and repeat breeder were 1.6%.

The influence of BCS at calving on the prevalence of major reproductive health problems was found to be highly significant for uterine infection ($p = 0.000$), for retained fetal membranes ($p = 0.008$) and for cystic ovaries ($p = 0.004$). However parity has a significant impact on the prevalence rate of uterine infection ($p = 0.006$) and cystic ovaries ($p = 0.02$).

In conclusion the overall means in days for AFS, AFC, DO and CI investigated in this study are higher than that can be expected from a well managed herd. The statistically significant effect of season was observed in calving to conception interval (DO) and calving interval. Year had a highly significant effect on almost the traits studied. The slightly lower estrus detection rate obtained in the present study is an indication poor reproductive performance of cows. Uterine infections, retained fetal membranes are major reproductive health problems in Alage Dairy Farm.

Key words: Reproductive performance, major reproductive health problems, AFS, AFC, CI, DO, NSC, Holstein Friesian, Alage, uterine infections, retained fetal membranes, anestrus, repeat breeder, abortion, dystocia, cystic ovaries and vaginal and uterine prolapses.

1. INTRODUCTION

The Holestein cow is originated in Europe. The major historical development of this breed occurred in what is now the Netherlands and more specifically in the two northern provinces of North Holland and Friesland. The original stocks were the black animals and white animals of the Batavians and Friesians migrant European tribes who settled in the Rhine Delta region about 2,000 years ago. For many years, Holsteins were bred and strictly culled to obtain animals, which would make best use of grass, the area's most abundant resource. The intermingling of these animals evolved into an efficient, high-producing black and white dairy cow.

Not only do the indigenous breeds in developing countries generally produce relatively little milk, but the quality and quantity of feed, direct and indirect climatic factors and husbandry practices are additional important constraints on production (Ageeb and Hillers, 1991). In general, in the extensive areas of the world where the improvement of managerial and nutritional conditions is not at present feasible, the development of milk production can only be attempted either by selecting the best available local breeds, which are adapted to the environment but which have a low yield per lactation, bad milking deposition and a short lactation period or by the introduction of improved genotypes, i.e. stock of high producing origin to cross with the indigenous types (Alberro, 1983).

Introduction of high grade cows is considered a rapid and suitable option for meeting the increased demand for milk and milk products in the tropics compared to dairying base on indigenous cattle alone (Tegegne and Gebrewold, 1997; DeLeeuw *et al*., 1999). As a result, Channal Island breeds and Friesian were introduced into the country before the second world war (Abaye *et al*., 1991). The increase in milk yield obtained due to the introduction of improved dairy breeds was satisfactory.

Generally efficient reproduction is very important economically, because a cow like other mammals must first reproduce to produce (at least until artificial induction of lactation becomes practical). To do so, cows should calve at regular intervals and therefore must be bred and become pregnant with in a given period after calving. Accomplishment of this goal is achieved through excellent reproductive management (Farin and Slenning, 2001).

A variety of factors have been reported to affect the reproductive performance of dairy cows (Reimers, *et al.*, 1985). Management factors such as accuracy of heat detection, timing of insemination, use of proper insemination techniques, quality of semen, proper semen handling and skills in pregnancy diagnosis have been reported to affect the reproductive performance of dairy cows (Shiferaw *et al,* 2003; Silvia, 1998). As a whole the level of reproductive performance of dairy cows is well below the published optima, longer calving interval, delay of age at first calving, increase in number of services per conception and average days open, degrade modern dairies (Silvia, 1998).

Efficiency of reproduction is further modified by deficiencies of minerals (Bath *et al.*, 1985; Morrow, 1986; Gerloff, 2001) vitamins (Vandeplassche, 1982) and under feeding and over feeding (Vandeplassche, 1982). Additionally negative energy balance especially in the first 9 days postpartum affects the level of progestrone during luteal phase (Villa-Godey *et al.*, 1988). The amount and character of the protein in the cows ration at the time of insemination influences the reproductive performance of dairy cows.

The extent of thermal stresses is reported to cause early embryonic mortality (Putney *et al.*, 1988), depressed pregnancy rates (Dunlop and Vincet, 1971), decreased quality and viability of embryos (Monty and Racowsky, 1987), and decreased efficiency of artificial insemination (Xu *et al.*, 1998). High environmental temperature may also have an adverse effect upon survival of ova and sperms (Thatcher *et al.*, 1978).

Reproductive performance of a dairy herd is also affected by its overall health. Good sanitation and vaccination programs can prevent many infections or diseases that lower reproductive performance. The effects of disorders on reproductive performance, culling, and profit are more severe in older cows. Cows that are assisted at calving or are treated for retained placenta are at increased risk to suffer additional disorders (uterine infections and cystic ovaries). Therefore, the key to preventing losses due to reproductive disorders must be found in the prevention of such disorders, not in their treatment.

Maintaining a high level of reproductive efficiency is required if dairy herd profitability is to be maximized. Reproductive performance of a dairy herd is a function of certain management policies and how well these management policies are implemented in the day-to-day management of the herd. Included in these management factors are good breeding techniques, a balanced feeding program, accurate records, hygiene, and veterinary service to minimize reproductive inefficiency and diseases.

A close cooperative approach between the producer, nutritionist and the veterinarian is necessary for the program to be effective. Considerable profits can be realized from an effective program by increased milk production, better herd health, more calf sales, lower replacement costs and lower breeding expenses. Therefore, the decline in reproductive performance should urge every one in the profession and industry to be aware of the problem and must look into a new light on the entire system surrounding dairy cow reproduction, including the management.

Inspite of many studies in reproductive performance of dairy cows, information on the main important reproductive parameters of Holstein Friesian cows and factors affecting them in rift valley areas of the country is not available. In view of this the main objectives of the study were:

- to estimate the different reproductive traits of Holstein Friesian cows;
- to identify major reproductive health problems in the farm;
- to assess prevalence rates and associated risk factors and
- to give recommendations for improved reproductive performance of dairy cows in the area and similar environmental conditions.

2. LITRATURE REVIEW

2 .1. Parameters of Reproductive Performance

The productivity of cattle depends largely on their reproductive performance (Arthur *et al.*, 1989; Mukasa-Mugerwa 1989). Among the reproductive traits, age at first service (AFS), number of services per conception (NSC), days open (DO) and calving interval (CI) are the bases for a profitable dairy farming (Enyew *et al.*, 1999).

2.1.1. Age at First Calving (AFC)

Age at first calving marks the beginning of cow's reproductive life and is closely related to the generation interval (Mukasa Mugerwa, 1989). It is the fertility measure commonly used expressed in months or days. It signals the beginning of heifers reproduction influences both the reproductive and productive life of the female directly through its effect on her life time, calf crop and milk production and indirectly upon its influence on the cost invested for her upbringing and the magnitude of genetic progress.

There are several possible causes of variation in age at first calving of cattle. Generally as a fertility trait age at first calving is largely influenced by environmental component (Ageeb and Hayes, 2000). Lack of sufficient energy is one of the most common forms of nutritional infertility. Under feeding delays puberty and stops reproduction functions (Vandeplassche, 1982). In addition, it reduces conception rates and milk production and increases pregnancy loss. Tropical forages are generally poor in quality (low protein and solubility) and high lignin content with subsequent low digestibility. Thus long age at first calving measure of temperate and tropical cattle breeds and their crosses kept in the tropics are largely attributed to poor quality and inadequate feed Vaccaro (1973).

Jochle (1972) studied the effect of season on the reproductive performance of Brahman heifers that first conceived at between 15 and 37 months old in the Mexican Gulf coast. Of 111 heifers that first conceived at 15 to 24 months old, significantly more ($P<0.001$)

did so during the dry season than during the wet season. However, among heifers that first conceived at more than 24 months old, most conceived during the rainy season and overall there was no significant difference between the percentage of heifers conceiving first during the rainy or dry season. According to the study of Chagunda *et al*. (2004) on Holstien Friesian cows in Malawi age at first calving, which is a proxy for age at first service and sexual maturity was significantly affected by cow effect, herd, year of birth and sire group. Under better management in Ethiopia, however the pure Holstein Friesian heifers calved at the age of 41.1 months (Negash, 1994).

Swensson *et al*. (1981) observed that irrespective of origin of cattle age at first calving under a given tropical environment was essentially similar ranged from 3-4 years. The extensive review of Vaccaro (1973) on reproductive performance of exotic dairy cattle breeds and their crosses showed age at first calving from 25- 30 months were obtained.

Oliveira (1974) observed that Nellore cows in Brazil that calved first in the dry season were younger than those that calved first in the rainy season. Miranda *et al*. (1982) found that age at first calving in Brazilian Nellore heifers was significantly affected by year and month of birth: calves born from January to May tended to be younger at first calving than those born between June and December. Sabino *et al* (1981) also found a year-of-birth effect among Haryana, Gir and another unspecified zebu type cattle in Venezuela, as did Sharma (1983) in Nagauri cattle in India. However, Sabino *et al*. (1981) found that neither month of birth nor breed significantly affected age at first calving

Taurine dairy cattle breeds can be bred satisfactory under one year of age, for instance in Israel it was possible to breed Friesian heifers at the age of 8 months with out any appreciable detrimental effects on the subsequent performance, but in other studies early breeds has been found to notably affect the sub sequent performance (Amir *et al*., 1975). According to Kiwuwa *et al*. (1983) the problem of age at first calving lies in whether the economic gain obtained by early breeding will offset the cost of high level of feeding and management under local condition.

The most important difference age at first calving among and with in breeds is suggested to be managerial (Mukasa Mugerwa, 1989). Yet genetic differences in age at puberty and AFC also exit. According to the review of Mukasa- Mugerwa (1989) bos taurus breeds calve for the first time 6-12 months earlier than contemporary indicus breeds. Vaccaro (1973) has found differences in AFC of exotic breeds kept in the tropics and she has attributed the difference to originate largely from managerial differences.

2.1.2. Calving Interval (CI)

Calving interval is the period of time between two successive calvings (Arthur, 2001). It is the sum of gestation period and the calving to conception or (days open) period The optimum calving interval for holstein dairy cows is often stated to be 12 months, but most stockmen are happy with an average interval of 13 months, which in certain circumstances may indeed have advantages over the 12 months interval (Vandeplassche, 1982).

Calving interval has a very low heritability. Chagunda *et al.* (2004) reported a heritability of 1% for first calving interval in holstein dairy cattle and Hailemariam and Kassamersha (1994) reported a heritability value of 3.7% for Boran cattle in Ethiopia. Nutritional conditions that vary seasonally and yearly have major effects on calving interval (Oliviera ,1974; Oyedipe *et al.*, 1982; Hailemariam and Kassamersha, 1994).

Short calving interval is great advantage to commercial breeds, because long interval means long dry periods and great loss of feed and carrying of unproductive females (Farin and Slenning, 2001). Attaining short calving interval enables to exploit the early peak yields of each lactation. Temperate dairy cattle breeds kept in the warm climate often show longer Calving interval than the ideal period of one year.

An older review of Vaccaro (1973) has showed CI predominantly longer than 14 months it appears therefore that some fairly low age at first calving has been obtained. As a quantitative trait calving interval can be influenced by both the environment and genetic makeup of the animal, with the former having the predominant effect on its variation (Mukasa Mugerwa, 1989).

2.1.3. Days Open (DO)

Days open are number of days since calving the cow is not pregnant. Average days open is commonly seen as the "bottom line" measure of the efficiency of dairy herd reproductive program. It represents the average interval from Calving to conception (Farin and Slenning, 2001). The average days open in Holestein dairy cows lengths 85 days, if a calving interval of 12 months is to be achieved (Peters, 1984). The review of Vaccaro (1973) on reproductive efficiency of temperate dairy breeds kept in the tropics showed days open ranging from 85 to 355. Values higher than the ideal were predominant. Further studies of days open are done at different times for instance Arora and Sharma (1982) in India found 139.8 and 135.3 days in contemporary to Holestein Friesian and Jersey cows respectively. Also in Ethiopia Negussie *et al.* (1988) have found that days open measure of 120.8 + 10.8 days in Friesian zebu cross breeds. Goshu *et al.* (2005) worked on data material of contemporary Fogera cattle breeds at Andassa ranch has reported least square means of days open to be 305 $\pm$ 10.0 days. Negash (1994) reported the average days open 183.6 $\pm$ 5.5 days for Holstein Friesian cows at Holetta.

2.1.4. Number of Services per Conception (NSC)

Number of services per conception is a very important economic factor both in natural breeding and AI. For any AI center number of services per conception exceeding 2.0 means a disaster (Vandeplassche, 1982). It is usually higher under uncontrolled natural breeding and low where hand-mating or AI is used (Mukasa Mugerwa, 1989). The over all mean number of services per conception in central high lands of Ethiopia under different production systems ranges form 1.66 to 1.79 both in natural services and AI (Shiferaw *et al.*, 2003). Heritability of the number of services per conception is low and most of variation is attributable to environmental factors. Heritability values of 2% were reported for NSC by Cassel (1992) in Holestein Friesian cattle.

Hailemariam and Mekonnen (1996) indicated that breed and season of conception influence NSC. Sharma and Bhatnager (1975) found a significant effect of parity on NSC in Sahiwal, Red Sindi and Tharparar cattle. Chagunda *et al*. (2004) reported that first calf heifers had a significantly lower NSC than cows in second and third lactation. Moreover, NSC is lower for animals for wet areas than those from drier areas in Ethiopia. Management factors such as accuracy of detection of heat, timing of insemination, use of proper insemination techniques, quality of semen, proper semen handling and skills in pregnancy diagnosis have been reported to decrease the NSC (Shiferaw *et al*., 2003).

2.1.5. Calving Rate

The calving rate is the percentage of cows served, which calve at term and have optimal chances of producing a living calf. The figure is lower than the final conception rate because an average of 3 percent of abortions has to be allowed for (Vandeplasshe, 1982). Calving rate can be affected by environmental, genetic disease and management factors. These influence the reproductive process at ovulation, fertilization or implantation or during gestation and parturition (Mukasa Mugerwa, 1989).

Fertility rates can also be estimated prior to calving as the percentage non- return rate. This is the number of cows bred that do not come back in heat and are thus assumed to have conceived. This value may be derived at 60, 90, 120, 145 or 200 days after mating (McDowell *et al*, 1976). Where artificial insemination is employed, fertility rates can be expressed as the number of calves born per 100 inseminations (Macfarlane and Goodchild, 1973). Progesterone assay now makes it possible to determine conception rates as early as 21 days after breeding. It is also ideal for estimating the magnitude of early embryonic losses.

2.1.6. Conception Rate to First Service

The conception rate is the percentage of females actually pregnant after first breeding. It is a result of combining estrus detection on accuracy and breeding technique. The conception rate in Ethiopian central high lands of crossbred dairy cows ranged from

41.9% to 44.7% (Shiferaw *et al.*, 2003). The commonly recommended goal conception rate for holstein cows is 60% (Farin and Slenning , 2001).

Conception rate to first provides a useful estimate of the conception rate for a herd. However it is a measurement that combines the effect of semen quality, fertility of the cow, timining of insemination semen handling and insemination techniques as well as factors such as high environmental temperature and stress (Nebel, 2005).

Table 1. Some Estimates of Age at First Calving of Holstein Friesian and Friesian Crosses.

Breed	Location	Estimate (Months)	Source
Holstein Friesian	Ethiopia	41.1	(Negash, 1994)
Holstein Friesian	Sudan	25.2	(Ageeb and Hayes, 2000)
Holstein Friesian	Malawi	32.5	(Chagunda *et al.*, 2004)
50% Holstein Friesian 50% Zebu	Ethiopia	32.9	(Shiferaw *et al.*, 2003)
50% Holstein Friesian 50% Boran	Ethiopia	32.9	(Goshu and Hedge, 2003)
50% Holstein Friesian 50% Fogera	Ethiopia	36.0	(Goshu *et al.*, 2005)

Table 2. Some Estimates of Calving Interval of Holstein Friesian and Friesian Crosses.

Breed	Location	Estimate (Days)	Source
Holstein Friesian	Ethiopia	477.6	(Negash, 1994)
Holstein Friesian	Malawi	416	(Chagunda *et al.*, 2004)
Holstein Friesian	Kenya	429	(Pollot, 2004)
50% Holstein Friesian 50% Zebu	Ethiopia	551.8	(Shiferaw *et al.*, 2003)
50% Holstein Friesian 50% Boran	Ethiopia	417.7	(Goshu and Hedge, 2003)
50% Friesian 50%Barca	Ethiopia	400	(Tadesse and Dessie, 2003)
50% Friesian N'Dama	Gambia	400	(Diack *et al.*, 2004)

2.2. Factors Affecting Reproductive Performance of Dairy Cows.

2.2.1. Estrus Detection

Detection of estrus can be one of the most boring dairy herd management chores and human motivation is the key to success. The positive impact that efficient detection of estrus improves reproductive performance and can be a motivating factor to dairy farm managers. Therefore routine measurement and monitoring of efficiency of estrus detection should be a positive motivation force (George *et al.*, 1994).

There are many reasons for poor estrus detection. Lack of knowledge on the most reliable signs of estrus such as standing to be mounted and mounting of other cows results poor reproductive performance in many dairies (Arthur *et al.*, 1989). The ability of the management to detect estrus efficiently and accurately in cows and heifers profoundly influences reproductive performance and profitability of dairy herds. Routine estimates of efficiency and accuracy are important to monitor reproduction and to evaluate management problems in breeding herds (Farin and Slenning, 2001).

Accurate detection of estrus is the key to efficient reproduction and to high milk production by capitalizing the superior sires available through artificial insemination or hand mating (Foote, 1974). In accuracies of estrus detection result in insemination of cows that are not in estrus thus lowering the herd conception rate (Xu, *et al.*, 1998).

Low estrus detection rates have stimulated an increase interest among producers about effective programs for synchronization of estrus and ovulation in cows (Farin and Slenning, 2001). Heat detection efficiency is usually less than 50 percent in most herds and heat detection accuracy varies widely because up to 5 percent of all cows presented for AI have been reported as not in estrus based on high milk progesterone level (Reimers *et al.*, 1985). Therefore the efficient and accurate detection of estrus and timing of AI remain current challenges in dairy production (Reimers *et al.*, 1985). In synchronization of estrus and controlled ovulation schemes, clear guidelines also must be established to optimize insemination time with respect to ovulation (Dalton *et al.*, 2001).

2.2.2. Time of Insemination

Numerous studies have investigated the optimal time of AI relative to the stage of estrus (Dransfield *et al.*, 1998; Roberts, 1986;Tegegne *et al.*,1981). Maximum conception rates in dairy cattle were realized after AI during midestrus until a few hours after the end of behavioral estrus (Dalton *et al.*, 2001). This work led to the development of the a.m-p.m guideline and assumed on intensive visual estrus detection regimen. Foote, (1978) reported similar non-return rates for once daily AI and AI following the a.m-p.m guideline under farm conditions where less intense estrus detection was practiced.

There is a direct relationship between insemination time and fertilization status, sperm accessibility to the ovum as measured by accessory sperm number per embryo or embryo quality (Dransfield *et al.*, 1998). Each of these factors is important in establishing pregnancy. The degree to which insemination time affects these factors may lead to techniques that will enhance reproductive success in dairy cattle. Taken together with the realization that estrus detection is the primary problem limiting reproduction in dairy cattle (Dalton *et al.*, 2001).

2.2.3. Inseminators Efficiency

AI technician have been reported to have an important effect on herd fertility (Faulkner and Pineda 1980). Poor technique in storage or in thawing straws of semen as well as failure to deposit the semen in the uterine body can reduce fertility (Farin and Slenning, 2001). Semen handling and insemination techniques are two important elements in successful AI programme for cattle (Momont *et al.*, 1988). Insemination technicians are trained to deposit semen at the junction of the uterine body and the internal cervical os, i.e., the AI target (Momont *et al.*, 1988).

The tendency for some inseminators to deposit semen at a site other than this target has been as a cause of low pregnancy rates (Seguin, 1980). The tendency may be the result of inadequate training target in the cow (Pallares *et al.*, 1986). Inseminators who frequently miss the target had lower non return rates has led some to conclude that deposition of semen in one uterine horn leads to a lower pregnancy rate if the ovulatory follicle is on the ovary contralateral to the site of deposition (Pallares *et al.*, 1986). Momont *et al.* (1988) found insemination ipsilateral to the ovarian follicle. The AI target that pregnancy rates are improved after unilateral cornual should give emphasis on insuring that all inseminations give good result in intrauterine deposition of semen.

Artificial insemination organization must have some rapid means of assessing the fertility of semen and the performance of inseminating technicians (Faulkner and Pineda, 1980). This is accomplished through an analysis of the insemination receipts, which the technicians are required to complete each time a cow is bred (Faulkner and Pineda, 1980).

Fertility is judged by computing the percentage of all females inseminated for the first time in a reproductive cycles that are not presented for a repeat service within a given time interval. The time interval must frequently use in 60 to 90 days, and the estimate of conception rate is the 60 to 90 days (Faulkner and Pineda, 1980).

2.2.4. Quality of Semen

To maximize conception rate, high quality semen must be placed in the cow's reproductive tract. A variety of morphological abnormalities of sperm can occur in bull and may be associated with infertility (Faulkner and Pineda, 1980). These include detached sperm heads, acrosomal defects, coiled tails, immature sperm each containing a proximal droplet at the junction between head and mid piece of sperm (Peters and Ball, 1995). Fertilization failure is one of the contributors to reproductive failure. Use of semen of poor quality and semen with low fertility bulls decrease fertilization rates (Farin and Slenning, 2001).

2.2.5. Proper Semen Handling

Spermatozoa are sensitive to the effects of a variety of environmental factors (Peters and Ball, 1995), which could modify seminal characteristics resulting in lower conception rates. Harmful chemicals, water, exposure to air and sunlight or other radiations, agitation of sperm, cold shock causes death of spermatozoa (Faulkner and Pineda, 1980). Thawing multiple straws at one time and loading multiple AI guns before AI breeding several cows in a row decreases conception rates of the second and subsequent cows compared with that of the first cow inseminated (Lee *et al.*, 1997; Plourd, 1999). Therefore errors in semen handling can have a profounded effect on conception rates and frequently might be overlooked as a cause of reduced fertility (Archabald, 1993).

Improper handling in the field is probably the largest single factor contributing to occasionally disappointing results with the use of frozen semen, especially technicians, in their enthusiasm to achieve the best results, to develop innovations which neglect or alter the principles taught during their training. Periodic retraining and continuing education are as essential to the practice of artificial insemination as they are to the practice of veterinary medicine (Faulkner and Pineda, 1980).

2.2.6. Thermal Stress

The early bovine embryo is extremely sensitive to harmful effects of maternal hyperthermia. Dunlop and Vincent (1971) reported that elevated ambient temperature (32^0c) for 72 hrs immediately following breeding severely depressed pregnancy rates of beef heifers from 48 to 0%. Furthermore exposure of dairy cows to summer heat stress conditions or dairy heifers to hyperthermia (42^0c) during the first 7 days of pregnancy resulted in decreased quality and viability of embryos (Montey and Racowsky, 1987). Heat stress between days 8 and 17 of pregnancy may also alter the uterine environment as well as growth and secretary stress antagonizes the inhibitory effects of the embryo on the uterine secretion of PGF2α (Montey and Racowsky, 1987).

Embryonic mortality increases in a number of species following exposure of the dam to elevated ambient temperatures especially in tropical areas .The effects of thermal stress on the early embryo are not apparent until the later stage of its development. Fertilized eggs of sheep and cattle when exposed to high temperature either in vitro or in vivo are damaged but continue to develop only to die during critical stages of implantation. Reduced fertility at summer heat stressed dairy cows may result from decreased viability and developmental capacity of 6 day old to 8 old embryos and may account for the well documented seasonal reduction in the efficiency of artificial insemination during summer (Putney *et al* 1988).

Environmental modifications such as various shade structures, air conditioning and evaporating and cooling of cows have been used to improve fertility of cattle during heat stress. Therefore reproductive management strategies should be combined with environmental modifications to maximize conception rates (Putney *et al*., 1988).

Heat stress alters concentrations of circulating reproductive hormones by increasing circulation concentration of corticosteroids. The effect of heat stress on concentration of luteinizing hormone in plasma is variable with reports of unchanged increased or decreased concentrations. Heat stress also alters the pattern of follicle selection and has an adverse effect on the quality of follicles and their steroidogenic capacity (Derensis *et al*., 2002).

2.2.7. Nutritional Deficiencies and Excesses

The mechanisms by which more severe nutrient deficits may affect reproductive performance are unclear and require further definition (Ljokel *et al*., 1995). Follicular development begins during early lactation and the metabolic conditions associated with net energy balance may affect ovarian follicular development and reduce oocyte quality and lower concentrations of plasma progesterone possibly reflecting reduced luteal viability impaired synthesis progesterone or altered clearance of progesterone by the liver (Westwood *et al*., 2000).

There is convincing evidence that the fertility of cows is significantly affected by their energy and heath status 2 to 3 months before the estrous cycle of breeding. Cows in significant negative energy balance sustain damage to developing population of follicles that are recruited for ovulation 2 to3 months later. Negative energy balance in the first 9 days postpartum reduces progesterone levels of cows during the luteal phase or their second and third postpartum estrous cycles (Villa-Godey *et al*., 1988). In large herds managed with mechanical aids, it has happened that dry cows have been overfed by being given the same low fiber and high energy ration (eg. maize, silage and concentrate) as was supplied to lactating cows, excessive deposition of fat then occurs, leading eventually to a generalized obesity "the fat cow syndrome" (Vandeplassche, 1982). Additionally under feeding leads to a marked delay in attaining of sexual maturity, and to ovarian inactivity, due to a shortage of gonadotropin releaser (Gn-Rh) and pituitary gonadotropins (Vandeplassche, 1982)

Another nutritional aspect that appears to influence reproductive function is the amount and character of the protein in the cows ration at the time of insemination. Cows fed high levels rumen degradable protein have been shown to reduce reproduction efficiency (Ferguson and Chalupa, 1989). Similarly, heavy feeding during the dry and peripartum periods alter follicular development decrease reproductive performance (Vandeplassche, 1982).

The fat-soluble vitamin A is recognized as necessary additives in dairy cow diets (Gerloff, 2001). Unless the ration is adequately supplemented, a shortage of vitamin A can occur after along dry season and may depress female fertility by increasing the prevalence of embryonic mortality. A shortage of β-carotene plays an important role in infertility of dairy cattle during the stall feeding period especially if the basic forage consists of maize silage which is very poor in β-carotene. The deficiency of β-carotene leads to deficient development of the corpusluteum and lowered blood vessels. Such cows may show disturbed ovarian function, silent heat, lowered conception rate, increased embryonic mortality and early abortion (Vandeplassche, 1982).

Minerals have been shown to be the nutrients frequently implicated in fertility in cattle. The large number of interrelationships that exists in the absorption and utilization of mineral makes it difficult to delineate relationship between a specific mineral and fertility (Morrow, 1986). Phosphorous deficiency has been the most common mineral deficiency affecting reproduction in dairy cattle (Bath *et al.*, 1985). A severe deficiency of phosphorous can delay the onset of puberty and postpartum estrus because of in active ovaries, where as a moderate deficiency may be associated with repeat breeding (Etagen, 1978). Calcium, iodine copper, manganese, cobalt, zinc and selenium have also known to have an effect on the reproductive performance when they are deficient (Gerloff, 2001; Morrow, 1986).

2.2.8. Large Herd Size

In dairy farms large herd size has been reported to result insufficient space for each group of animals in the herd, which may cause overcrowding; this increases the risk of the spread of infectious diseases and of problems with nutritional management. Failure to provide separate feeds and feeding systems so that groups of cows can be fed according to their needs may lead to under nutrition as well as to subsequent health problems (Heinrichs and Radostits, 2001). Moreover over crowding can limit the detection, identification and handling of cows in heat, this causes sub optimum reproductive performance (Peters and Ball, 1995).

An increase in herd size might cause an increase in mortality (Heinrichs and Radostits, 2001). A marked increase in population density commonly causes an increase in the incidence of infectious disease. Outbreaks of infectious disease in calves under 4 weeks of age occur more commonly in large herds of over 100 cows than in smaller herds and can cause major economic losses because of death, the costs of treatment and sub optimum calf performance (Heinrichs and Radostits, 2001).

2.2.9. Culling Policy

Reproductive problem is the primary reason given for why cows are culled in modern dairies (Table 3) accounting for 29 percent of all primary culling reasons, and approximately 10 percent each for all secondary and tertiary culling reasons (Bascum and Young, 1998). They also found that reproduction become a more important culling factor as a herd production rose. It should be noted that all of these cows culled for reproductive reasons were truly infertile. Once a cow experiences one type of difficultly assuming she is at a higher risk of the same problem in the next lactation. It is likely that dairies are willing to " put up "with poor reproductive performance if milk production is high, this makes the control of reproductive disorders much complicated (Farin and Slenning, 2001).

Culling policy also has an important effect on reproductive efficiency (Peters and Ball, 1995). For example, if all cows that do not exactly match reproductive targets are immediately culled then the apparent reproductive efficiency of the herd at any one time is considerably enhanced. This action maybe looked as good but the average age of the herd and the average herd's milk production will be decreased with increased costs for replacement heifers. Alternatively if the culling policy is directed solely at improving cow milk production there may be a tendency to keep old or infertile cows because of their genetic worth (Farin and Slenning, 2001).

Table 3. Reasons for Culling Dairy and Beef Herd in the UK.

Reason for culling	Approximate Percentage	
	Dairy	**Beef**
Planned		-
Milk Yield or quality	14	32
Culling policy per price	-	8
Age	8	-
Other(temperament, conformation)	13	-
	35	40
Unplanned		
Infertility	19	37
Mastitis	16	-
Others (feet problems injury, disease)	30	23
	65	60

Source: (Peters and Ball, 1995)

2.2.10. Body Condition

Butler and Smith (1989) showed that cows lose a significant amount of weight (more than 0.5 body score points 5 points scale) in early postpartum and have extended days to each ovulation and have significantly reduced conception rates for at least the first three services. Body condition score is a useful indicator of nutritional status of cows (Peter, 1984; Robinson, 1996; Kassa and Tegegne, 1998). Cows with low BCS would have poor nutritional status that could lead to longer postpartum anoestrus interval. The physiological mechanism behind such delay is suggested to involve the blockage of gonadotropin-releasing hormone at the level of hypothalamus. Further more the same argument can party be used to explain the poor reproductive performance of cows calving with BCS below the critical level (Robinson, 1996)

2.2.11. Skills in Pregnancy Diagnosis

Knowing whether or not an animal is pregnant is of considerable economic value, as well as being an important tool in reproductive management (Arthur, 2001). It assists to identify non-pregnant animals, which must be culled or served again with a minimum of delay (Betteridje and Laing, 1970).

A regular check up is necessary to confirm if the animal has settled to services or not, and to investigate the causative factors for sub fertility or infertility. A veterinarian should have good knowledge of the pathophysiology of reproduction and the experience of having examined a number of cows both pregnant and non-pregnant in various stages of gestation (Sang, 1982).

2.2.12. Housing and Environmental Factors

Providing an environment for animals that has a positive influence on the animal's health, welfare and productivity. Essentially all aspects of the animals surrounding and activities are taken into account including ventilation, stalls and beds, access to feed and water and walking surfaces. The veterinarian should be aware of the housing and environmental factors that affect health, production and reproductive performance of dairy cows. Ongoing regular monitoring should be performed to determine the effects of the environmental management programs (Bickert and Radostits, 2001).

Lameness in dairy cows is both a welfare problem and a source of economic loss to the dairy herd and the industry (Lague, 1998). Lameness may affect the producer in several ways: increased labour requirement, increased treatment costs, reduced milk production, reduced fertility, involuntary culling and decreased slaughter value. Lameness may also reduce the expression of estrus thus affecting reproductive performance, which increases the risk of early culling. Lameness can prolong the interval from calving to first service and the interval from first service to conception (Barkema *et al*., 1994). Dairy cows with the lameness scoring system may have an extended interval from calving to first service and to conception, spend more days in breeding herd require more services per pregnancy and be 8. 4 times more likely to be culled (Sprecher *et al*., 1997).

2.2.13. High Milk Production

Milk production playing a minor role in reproductive performance, however, on an individual animal basis, higher production individuals with in a herd are often at risk of lowered reproductive performance. Furthermore cows selected for high milk production show different characteristics in follicular and endocrine functions that could lead to decreased reproductive efficiency (Nebel *et al.*, 1993).

There are likely several reasons for the loss in reproductive performance this can occur due to heat stress, increased production and herd size (Farin *et al.*, 1994). Milk production of cows has increased and reproductive performance of cows has declined during the past 20 years and evidenced by increasing days open and depressed conception rates. Problems related to breeding management (e.g. elective postponement of rebreeding and estrus detection rate) and the negative influences of high milk production and heat stress may be responsible for this decline in reproductive efficiency (Farin and Slenning, 2001).

2.2.14. Book and Record Keeping

Herd records provide the opportunity to monitor, diagnose and provide guidance in correcting breeding herd problems (Ruegg, 2001). In addition the record systems help to analyze individual animal events such as calving history, disease events, treatments, reproductions events and examinations and animal characteristics such as BCS and SCC (Ruegg, 2001).

The investigation of infertility problems and the maintenance of good quality require the keeping of accurate records of the reproductive history of each and every cow in the herd. The absence of accurate and accessible records makes the task of the veterinarian difficult, if not impossible (Arthur *et al.*, 1989)

Both heat detections and AI techniques can be evaluated by examining a series of reproductive indices if the records are complete and accurate (Williamson, 1987). The keeping of accurate records is vital in good herd reproductive management. Records are important since they enable the farmer to monitor reproductive performance of the herd and individual cows (Peters and Ball, 1995).

2.3 Major Reproductive Health Problems

Maintaining a healthy herd is a constant challenge to today's dairy producer. Each year an average of 20 to 25 percent of dairy cows are culled due to poor reproductive performance or other health problems.

Goals that are realistic and made possible by adopting a reproductive health program are:

1. Average calving interval between 12 to 13 months.
2. Breeding efficiency below 1.5 services per conception and less than 30 percent returns after 60 days.
3. Postpartum interval to first standing heat between 30 to 40 days.
4. Postpartum interval to first breeding no greater than 55 to 70 days.
5. Repeat breeders of 8 to 10 percent or less.
6. Abnormal anestrus after 60 days postpartum reduced to 2 to 15 percent.
7. Abortions of 1 to 2 percent or less.
8. Retained placentas of 5 to 10 percent or less.
9. Metritis of 5 to 10 percent or less.
10. Culling percentage for reproductive failure below 18 percent.
11. Cystic follicles of 5 to 15 percent or less (Rice *et al*., 1996)

2.3.1. Endometritis

Endometritis is an inflammation of endometrial lining, which significantly impairs reproductive performance of dairy cows. Several specific diseases are associated with metritis or endometritis. These include brucellosis, leptospirosis, campylobacteriosis and trichomoniasis (Trichomoniasis). More often, endometritis is the result of nonspecific infections (Olson, 1996).

For decades, endometritis in cows has been treated with the intrauterine infusion of a bewildering array of substances. This is now receiving closer scrutiny. Although infusion of antimicrobials may rid the uterus of bacteria, there is no evidence that it eliminates the endometrial inflammation or restores the affected cow to fertility (Steffan, 1984). Indeed, many preparations routinely administered into the bovine uterus are known to be detrimental to uterine tissue. Increased concern about milk and carcass residues, along with poor or uncertain results, should discourage intrauterine therapy as a routine approach to management of bovine endometritis (Sheldon, 1988). In the rare cases in which systemic signs of illness are seen, systemic administration of antimicrobials is indicated.

Cows are known to be more resistant to uterine infection during estrus, and as cows undergo more estrous cycles after parturition, the prevalence of endometritis is diminished. This has led to increased use of prostaglandin (PG) F2α or its analogs, at usual luteolytic doses, for the management of endometritis (Gilbert *et al.,* 1998). Another potential advantage of the use of PGF2α or its analogs is stimulation of uterine contraction and expulsion of uterine exudate (Bekana *et al.*, 1996).

2.3.2. Retained Fetal Membranes

Normal expulsion of fetal membranes occurs within 3-8 hr after delivery of the calf. Retention of fetal membranes usually is defined as failure to expel fetal membranes within 24 hr after parturition (Bekana *et al.*, 1996). The incidence is 5-15% in healthy dairy cows and lower in beef cows. The incidence is increased by abortion, dystocia, hypocalcaemia, twin birth, high environmental temperature, advancing age of the cow, premature birth or induction of parturition, placentitis, and nutritional disturbances (Manspeaker, 2005).

The precise pathogenesis of retained fetal membranes is poorly understood, but normal maturation and loosening of the placenta begin during late pregnancy and are marked by alterations in the collagen of the placentome. During parturition, changes in uterine pressure, diminution of blood flow, and physical flattening of the placentome during uterine contractions contribute to final loosening and expulsion of the fetal membranes.

Diagnosis is usually straight forward and degenerating, discolored, ultimately fetid membranes are seen hanging from the vulva >24 hrs after parturition. Occasionally, the membranes may be within the uterus and not readily apparent, in which case their presence may be detected by a foul-smelling discharge. In most cases, there are no signs of systemic illness (Kirkbride, 1991). When systemic signs are seen, they are related to toxemia. Uncomplicated retention of fetal membranes is unsightly and inconvenient for animal handlers and milkers but is generally innocuous to the cow (Manspeaker, 2005). However, such cows are at increased risk of developing metritis, ketosis, mastitis, and even abortion in a subsequent pregnancy. Cows that have once had retained fetal membranes are at increased risk of developing the condition at a subsequent parturition.

Manual removal of the retained fetal membranes is no longer recommended and is potentially harmful. Trimming of excess tissue that is objectionable to animal handlers and contributes to gross contamination of the genital tract is permissible (Bolinder *et al.*, 1988). Untreated cows expel the membranes in 2-11 days. Routine use of intrauterine antimicrobials has not been found to be beneficial and may be detrimental. Although oxytocin, estradiol, and prostaglandin F2α have all been advocated at various times, none hastens expulsion of retained membranes (Kumar *et al.*, 2001). When signs of systemic illness are present, systemic treatment with antimicrobials and nonsteroidal anti-inflammatory drugs is indicated. In herds in which incidence of retained fetal membranes is unacceptably high, predisposing causes should be sought and eliminated.

2.3.3. Abortion

Abortion results from premature initiation of parturition when normal relationships between fetus and dam fail. This results in the expulsion of a fetus that is incapable of independent life. Effective fetal control of the pregnant uterus is lost after the fetus dies. Abortion can occur any time during gestation (Yaeger and Holler, 1997). Most of the abortions occur during the first trimester of pregnancy, go unnoticed and the animal is treated clinically for infertility. Although many factors have been incriminated, the mechanism of abortion has never been explained. Whether abortion and normal parturition are mediated through the same pathways is unknown, but irrespective of the cause of abortion there is drop in progesterone level in the animal. The pathogenesis for abortion may be acute or chronic. In general, premonitory signs are usually lacking.

The greatest risk of fetal loss is during the first trimester of gestation and then progressively decreases as gestation advances with a slight increase in the risk toward the last month of gestation (Thurmond, *et al.*, 1990). All the abortions in the first trimester go unnoticed or undiagnosed and we always suspect fertility problems when cows are found open rather than embryo/fetal loss. The observed fetal loss is far less than the actual incidence. The cumulative incidence of fetal loss between 31 and 260 days of gestation is 10.8%. Of this only 20% of the fetal losses are detected by observation of an expelled fetus or fetal membranes and the proportion detected increases with increasing gestational age at time of fetal loss (Forar, *et al.*, 1996). It is also believed that the abortion rate increases after 5 pregnancies or after 4 calvings and furthermore the risk is higher for an animal that already had an abortion.

Both infectious and non-infectious agents may cause abortion. The infectious causes include bacterial, fungal, viral, and protozoan. Historically, it has been suggested that 50-65%, 20-25%, and 15-25% of infectious abortions were caused by bacterial, fungal, and viral causes respectively. The non-infectious causes include nutritional factors, chemicals, drugs, toxins, poisonous plants, and hormonal agents. Under modern systems of dairy management cows & buffaloes continue to experience a seemingly high risk of abortion, despite intensive efforts toward immunization against infective agents (Augustine, 2005).

It should be remembered that because of the endemic nature of abortion occurring in vaccinated cattle, factors other than the infectious agents might contribute to the risk of abortion. Thus, preventive strategies to contain abortion on farm become utmost important. Exogenous progesterone can become a handy tool in prevention of abortion especially during the first trimester of gestation.

The organism *Brucella abortus* causes brucellosis. Aborted fetus, uterine discharge, placenta, infected premises and milk are sources for the spread of infection, and abortion occurs from 6 to 9 months into gestation. It is possible to eradicate the condition through vaccination.

Leptospirosis is caused by *Leptospira pomona, hardjo, canicola, icterohemorrhagiae,* and *grippotyphosa*. Infected cows, wildlife, swine, water and feed contaminated with urine are some of the sources of infection. Abortion occurs in the last trimester of gestation (Alonso- Andicorbeey *et al.*, 2001).

Camphylobacter fetus causes Camphylobacteriosis. Infected bulls and cows spread the infection and abortion occurs from 6 to 8 months of gestation. Listeriosis is caused by *Listeria monocytogenes*, and the organism is excreted in feces, urine and milk. The organism grows in silage with high pH. Abortion occurs mostly in the later part of last trimester.

Haemophilus somnus is responsible for the *haemophilus somnus* complex. Infected cattle spread the infection possibly via the respiratory route. The organism is capable of causing abortion in all stages of gestation.

Ureaplasmosis is caused by *Ureaplasma diversum* and is spread via semen, vulvar discharges, and possibly by nasal secretions. Abortion can occur anytime but usually in the last trimester of gestation. Other bacteria like *Salmonella, Actinomyces, Escherichia coli, Streptococcus, Staphylococcus, Bacillus, Pseudomonas, Proteus, Pasteurella, Nocardia, and Chlamydia* species, can also cause abortion. These are secondary to either a septicemia in the dam or ascending infection through the vagina and cervix or due to persistent endometritis (Anderson *et al.*, 2001;Yaeger *et al.*, 1997; Dennis, 1980).

Fungal or mycotic infection of the placenta is one of the most common causes of sporadic bovine abortion. Anywhere from 20-35% of abortions have been attributed to fungal causes. Abortion occurs when fungal spores enter a pregnant cow's blood stream (possibly through breaks in the lining of the upper digestive tract), settle at the junction of the maternal and fetal *Aspergillus fumigatus* accounts for 60 to 80 percent of abortions that are caused by fungal organisms. The organism may cause abortion from 4 months to term. Any condition/stress that reduces the cow's resistance to infection increases the chances of mycotic abortion. Providing good health (via good management and nutrition) and not feeding moldy feeds can reduce the incidence. Placentas grow and attack the placental tissues.

Infectious Bovine Rhinotracheitis (IBRV) or Bovine Herpesvirus 1 (BHV-1) is a major cause of viral abortion. Although the development of effective vaccines appears to have reduced the incidence of IBRV induced abortions, it still remains the most frequently diagnosed viral cause of abortion. Abortions occur from 4 months to term. Bovine viral diarrhea causes abortion usually in the early part of gestation (up to 4 months) and is spread by infected cattle housed or pastured together (Augustine, 2005).

Trichomoniasis: caused by *Tritrichomonas fetus* and is spread by venereal transmission. The organism is responsible for early embryonic death, infertility, and rarely abortion. Neosporosis: *Neospora caninum* is a recently recognized protozoan parasite of animals. It is probably not a new disease, but rather a newly recognized one. Neosporosis is a major cause of abortion in cattle in many countries including Canada and USA (Dubey and Lindsay, 1996; Pare *et al.*, 1996). An important feature of the disease is that the parasite can be maintained in cattle as a chronic, apparently lifelong, infection, which can be passed on to the fetus during pregnancy. The greatest risk of fetal death is observed between 98 and 105days of gestations

Recent epidemiological studies have suggested that the dog may be involved in the transmission of *Neospora caninum*. It is possible that the dog is the definitive host (Anderson, 1991). Presence of dogs and presence of seropositive cattle in control herds in a detailed study, suggested the role of dogs in the spread of the condition.

Starvation may result in placental insufficiency and abortion, however, it rarely occurs in a modern dairy practice. Vitamin A deficiency has been suggested to result in thickening and degeneration of placenta and abortion in late gestation (Vandeplasshe, 1982). Iodine deficiency has also been suggested as a cause of abortion (Gerloff, 2001).

Chemicals, drugs, and toxins: High concentration of nitrates in plants/weeds can cause abortion from 3 to 9 months of gestation. Ergot can cause placental necrosis, fetal death and abortion. Warfarin and coumarin can also cause abortion. Mycotoxins from the fungal agents are suspected to cause abortion. Bacterial endotoxin is responsible for sporadic abortions. Among the hormonal agents, estrogen, glucocorticoids, and prostaglandin are important. They cause abortion depending on the dose and the stage of gestation they are used. Stress of any kind increases cortisol level in body & hence may cause abortion (Kirkbride, 1991).

2.3.4. Anestrus

Anestrus has been identified as one of the major problem affecting the efficiency of reproduction in the tropics and subtropics, where inadequate nutrition, high ambient temperature, high parasitic burdens and disease exacerbate the problem (Kumar, and Kumar, 1993). Low body weight and poor body condition, compounded with lactation stress, can further extend the postpartum anestrus period. The long anestrus period in the nursing cow might be due to an elevated level of prolactin, which appears to depress the secretion and release of GnRH (Vandeplassche, 1982). Conditions that simulate pregnancy, such as pyometra , severe metritis, foetal maceration or mummification, may cause anestrus. Pyometra, which often occurs when foetal membranes are retained or following postpartum metritis, is a frequent cause of anestrus (Martinez and Thibier, 1984). These conditions damage the endometrial lining of the uterus and reduce secretion of luteolytic prostaglandin. The cyclic activity of the ovary is thus interrupted in the luteal phase and the cow or heifer is anestrus until the condition is corrected. Without regular veterinary care and palpation, these conditions may remain undiagnosed and the cow may be believed to be pregnant.

3. MATERIALS AND METHODS

3.1. Study Area

The Alage Agricultural Technical Vocational and Educational Training (TVET) College is situated at 217 kms south-west of Addis Ababa in the vicinity of Abijata and Shala lakes. west of Bulbula town 32 kms away from Addis Ababa- Shashemene high way. Its absolute location is a longitude of about 38^0 30' east and a latitude of 7^0 30' north. It rests on 105 'gasha' or 4200 hectars of land with an altitude of 1600 meters above sea level. The area is characterized by mild subtropical weather with minimum and maximum temperature ranging from 11^0C to 29^0C. The area experiences bimodal rainfall distribution with annual average of 700-900 mm. The three defined seasons based on rainfall distribution are: short rainy season (March to April); long rainy season (June to September) and long dry season (October to January). The dominant soil types are black clay soil (vertisol) with sand-slit clay with a pH of 7.9. The area is suitable for livestock production. According livestock unit, there are about 600 cattle, 500 pigs, 400 sheep and goats, 7000 poultry in the college.

3.2. Study Population

The dairy farm of Alage ATVET College started its dairying activity in 1980. The foundation stock were 300 females and 4 males of Holstein- Friesian origin brought from Stella dairy farm, Holetta and individual farms around Addis- Ababa. For this study, the foundation stock and the subsequent generations, including the animals present to date were considered.

3.3. Herd Management

The Alage dairy farm holds two types of cattle, Holstein Friesian cattle whose genotype and blood level is well known and pure Borena cattle. Animals that were included in the experiment were exclusively stall-fed and were supplemented with concentrate feed during late pregnancy and during lactation and also with mineral licks. The concentrate was prepared at the farm by mixing maize wheat bran, nouge cake (*Guizotia abyssinica*), salt and limestone. The hay was produced from105 ha of land from various types of annual and perennial plants *Graminea* species, namely, *Paspalum conjugatum, Digitaria ciliaris, Cyperus asculantus* and also some *Hyperhenia* species. Alfalfa was the main green feed supplied to animals. Feeding of animals in the farm was mostly focused only on lactating cows than calves and heifers.

Lactating cows were hand milked twice daily. Water was available anytime. Newborn calves were taken away from their dams shortly after birth and bucket fed. There are well constructed separate calf pens, where calves were managed in individual pens.

Breeding was controlled mostly using artificial insemination and rarely natural mating by means of pure bred Holstein Friesian bulls. Detection of estrus was carried out twice a day, early in the morning and late in the afternoon, but some times missed heat signs were observed due to the inability of the AI technicians and the animal attendants to detect heat signs, lack of continuous supply of liquid nitrogen and semen. Regular checking for pregnancy and reproductive abnormalities is at monthly intervals. Pregnant cows were managed separately during the trimester; they calve in a well constructed calving pens.

Animals were routinely vaccinated against anthrax, pasteurellosis blackleg foot and mouth disease, lumpy skin disease and contagious bovine plueropneumonia. Moreover, interadermal tuberculin test and test for brucellosis was carried out once in a year. Regular dosing and spraying against internal and external parasites was practiced. Most of the time culling was done due to mastitis, old age, infertility and some diseases.

3.4. Study Animals

For analysis cows were divided into 3 groups. Cows in the first lactation grouped together because of their continuous need for supplement nutrients for growth, in addition to lactational need. Cows in their second and third lactation, having a low growth requirement, but not yet mature were further grouped together. Mature cows were formed in the third group.

3.5. Study Design

A cross sectional study was carried out on reproductive parameters and abnormalities, which was undertaken for a period of nine months (July 2005- April 2006). Estrus detection rate was measured by counting the number of estruses detected and the number of estruses missed for a period of four months (number of estruses detected/total number of estruses x 100) according to Xu *et al.* (1998). Additionally semen storage, handling procedures and thawing techniques were also evaluated. The recording system related to reproduction was evaluated. Retrospective data July 1985 - June 2005 and July 1996-June 2005, were also used to calculate some of the reproductive parameters (age at first service, age at first calving, calving interval, number of services per conceptions and calving to conception interval) and reproductive abnormalities respectively. Moreover periparturient and postpartum reproductive problems for the last calvings were studied. The definitions of reproductive traits, which were considered in the study, are shown in the Table 4.

Table 4. Reproductive Traits and Their Definitions

Trait	Definition
Age at First Service (AFS)	The number of days from birth to the date of animals at first service. In the study all cows including heifers served were included.
Age at First Calving (AFC)	The number of days from birth to the date of animals first calving. In the study all cows that calved at least once were included.
Calving Interval (CI)	The period between the last two consecutive calvings. Only cows that calved at least two times were included.
Calving to Conception or Days Open (DO)	The number of days between parturition and subsequent conception. The study of this trait was conducted only for cows that were found pregnant through rectal palpation.
Number of Services per Conception (NSC)	The number of services be it natural or artificial required for successful conception. The study for this trait was conducted only for cows that conceive and confirmed pregnant.

3.6. Data Collection

Reproductive and clinical records of dairy cows were used in the study. Additionally, the study was conducted on 130 existing dairy cows. Reproductive parameters such as age at first service, age at first calving, calving interval, number of services per conception, calving to conception, periparturient and postpartum reproductive problems observed, diagnosed and recorded during the last calvings.

3.7. Individual Cow Reproductive Information

The following information was gathered;

Identification number: Individual cow number, sire and dam identification number

Breed: Exotic

Birth date, date at first service and calving

Lactation number

Date of last calving, date of last service and number of services per conception.

Type of mating for the last service

Status: Lactating, dry or heifer

Pregnancy status: pregnant, not pregnant or uncertain

Stage of Pregnancy: first trimester, second trimester, third trimester

- Ease of last calving: unassisted (help of person or veterinarian, health assistant or technician)
- Reproductive history of last calving: normal gestation with calf born alive or healthy, stillbirth (after full gestation period born dead within 24 hours after calving, abortion, retained fetal membrane, prolapse, uterine infection, and milk fever
- Reasons for not being pregnant: not served because postpartum period (six weeks after calving; voluntary waiting period, anoestrus (heat not observed), conception failure periparturient or postpartum reproductive problems, absence of liquid nitrogen and semen. Moreover, the present health status: good (no signs

of diseases), medium (recovering) and poor (signs of acute and chronic disease) will be recorded.

Body condition scoring was conducted for each dairy cow and heifer at calving according to 1 to 5 scale (DEFRA, 2001).

3.8. Clinical Examination

Clinical examination of each cow, including vaginoscopy and rectal palpation were conducted. The vulva and perineal area were inspected for vaginal discharge and cows with discharge were examined using a vaginoscope. The reproductive tract observation was done clinically and as appropriate the vaginal parts were examined by the use of speculum. Cows were routinely examined (postpartum examination and pregnancy examination) per rectum at weekly and monthly intervals respectively. Cows that were not in estrus by the time of desired breeding (anestrus) or found not pregnant at the previous examination and cows with a history of an abnormality of the reproductive organs, including ovarian cysts, uterine infections, retained fetal membranes, observed abortion and dystocia were identified.

Periparturient and postpartum disorders were recorded and cows were classified as having an abnormal reproductive health status if any one of the following is recorded or diagnosed in the last calving: 1. dystocia, 2. stillbirth, 3. retained fetal membranes, 4. ovarian cysts (follicular and luteal), 5. prolonged anestrus, 6. uterine infections and 7. vaginal or uterine prolapses. The definitions of major reproductive health problems, which were considered in the study, are shown in the Table 5.

Table 5.The Definitions of Major Reproductive Health Problems.

MRHP	Definition
Uterine Infection	Reddish or brownish, cloudy or purulent vaginal discharge with or with out incomplete uterine involution, remaining 30 days after calving.
Retained Fetal Membranes	Failure to expel fetal membranes within 24 hr after parturition.
Dystocia	Abnormal or difficult birth in which the first or especially the second stages of parturition markedly for more than 6 hrs and the cow requires assistance.
Repeat Breeders	Cows or heifers that showed failure of conception after two AIs with normal length of estrous cycles.
Uterine Prolapse	The coming out of the uterus through the vulva after parturition and hanged out with inner surface outer most.
Vaginal Prolapse	The protrusion of the vagina and or the cervix through the vulva.
Ovarian Cyst	A fluid filled structure on the ovary greater than 2.5 cms in diameter with no Corpusluteum present on either ovary.
Abortion	Fetal death and expulsion between 42 and 260 days of gestation.
Anestrus	A state of complete sexual inactivity with no manifestation of estrus.

3.9. Statistical Analysis

All data were entered into a Microsoft Excel database. After deleting incomplete records a total of 1114 records for calving interval, calving to conception and number of services per conception and 720 records for age at first service and calving were analyzed by general linear models procedure of Statistical Analysis System (SAS, 2000). For analysis, the fixed effects considered were parity numbers (1,2,3,4,5,6,7), season and year of birth, calving and conception. For the analysis of major reproductive health problems, the collected data were analyzed by Stata Statistical Software (Stata, 2001). Association of risk factors was established by Fisher's exact test.

For analysis, the following general model were considered:

$Y_{ijk} = m+S_i+P_j+ R_k+ e_{ijk}$,

where;

Y_{ijl} is dependent variables under consideration

m is overall mean,

S_i is season effect,

P_j, is effect of parity,

R_k effect of the year of birth or calving and

e_{ijk} is a random error

In all the analysis, confidence level was held at 95% and unless and otherwise indicated, $p < 0.05$ was set for determination of significance of the finding.

4. RESULTS

4.1. Reproductive Performance

4.1.1. Age at First Service and Age at First Calving

The analysis of variance of age at first service (AFS) and age at first calving (AFC) are shown in Table 6.

Table 6. Analysis of Variance of Age at First Service and Age at First Calving for Holstein- Friesian Heifers at Alage Dairy Farm.

Factors	Age at First Service			Age at First Calving		
	df	Ms	p value	df	Ms	p value
Birth Year	20	1661712.78	p< 0.001	20	1654719.8	p< 0.001
Birth Season	2	150474.9	0.08	2	1345335.2	0.1034
Error	698	1531095.3		698	59105.2	

df = degree of freedom Ms = mean square

The analysis of variance showed that season of birth had no significant effect on the AFS and AFC but year of birth had a significant effect on AFS and AFC.

Table 7 indicates the least square means of age at first service (AFS) and age at first calving (AFC).

Table 7. Least Square Means ($\pm$ S.E.) of Age at First Service (AFS) and Age at First Calving (AFC) by Season and Year for Holstein- Friesian Heifers at Alage Dairy Farm.

Source	n	Age at First Service Mean $\pm$ S.E (Days)	Age at First Calving Mean $\pm$ S.E (Days)
Overall	721	991.4 ± 24.3	1265.4 ± 24.3
Season of Birth			
Short Rainy	180	1034.1 ± 25.7^{bc}	1305.7 ± 25.6^{bc}
Long Rainy	197	983.5 ± 22.9^{a}	1257.7 ± 22.9^{a}
Dry	344	973.6 ± 16.6^{a}	1248.0 ± 16.7^{a}
Year of Birth			
1985/86	6	1074.8 ± 20.4^{bc}	1352.7 ± 20.4^{bc}
1986/87	7	$828.3 \pm 74.6g^{c}$	1099.8 ± 73.5^{c}
1987/88	9	1114.1 ± 59.1^{bc}	1394.0 ± 58.2^{bc}
1988/89	26	1027.4 ± 51.2^{bc}	1303.9 ± 51.4^{bc}
1989/90	35	886.9 ± 22.1^{c}	1160.7 ± 22.3^{c}
1990/92	25	794.7 ± 50.1^{c}	1069.8 ± 50.1^{c}
1991/92	54	757.2 ± 21.9^{c}	1029.4 ± 21.9^{c}
1992/93	56	994.8 ± 42.1^{a}	1269.5 ± 42.1^{a}
1993/94	39	1054.0 ± 56.2^{bc}	1328.6 ± 56.3^{bc}
1994/95	18	1326.6 ± 82.3^{bc}	1600.4 ± 82.3^{bc}
1995/96	27	1405.7 ± 54.0^{bc}	1677.3 ± 54.0^{bc}
1996/97	8	1402.6 ± 26.1^{bc}	1677.4 ± 26.1^{bc}
1997/98	43	1364.8 ± 44.9^{bc}	1633.7 ± 44.7^{bc}
1998/99	40	1303.6 ± 44.5^{ab}	1577.6 ± 44.4^{ab}
1999/2000	52	1169.4 ± 34.3^{bc}	1446.3 ± 34.3^{bc}
2000/01	42	1006.0 ± 36.4^{abc}	1277.9 ± 35.7^{abc}
2001/02	40	974.7 ± 38.2^{a}	1243.8 ± 38.2^{a}
2002/03	42	774.8 ± 24.0^{ab}	1054.7 ± 24.0^{ab}
2003/04	65	770.9 ± 17.7^{ab}	1048.0 ± 18.0^{ab}
2004/05	65	758.2 ± 20.2^{ab}	1030.5 ± 20.2^{ab}
2005/06	22	878.1 ± 43.7^{c}	1148.9 ± 44.7^{c}

Within variable, means indicated by different superscript letters differ significantly ($p < 0.05$).

From Table 7 it can be seen that the overall means of AFS and AFC was 991.4 $\pm$ 24.3 and 1265 $\pm$ 24.3 days, respectively. The least square means for AFS and AFC were highest for short rainy season and for those born in the year 1995/96 but lower for those born in the year 1991/92 and dry season.

4.1.2. Calving to Conception and Calving intervals

The analysis of variance of calving to conception interval (DO) and Calving Interval (CI) is presented in Tables 8.

Table 8. Analysis of Variance of Calving to Conception Interval (DO) and Calving Interval for Holstein- Friesian Heifers at Alage Dairy Farm

Factors	Calving to Conception Interval (DO)			Calving Interval		
	df	Ms	p value	df	Ms	p value
Parity	6	194318.2	p<0.001	6	1437210.7	p<0.001
Calving Year	21	147323.1	p<0.001	21	1191804.8	p< 0.001
Calving Season	2	108945.6	0.04	2	1089297.1	0.04
Error	698	38714669.4		1074	36015.7	

df = degree of freedom Ms = mean square

It has become apparent that DO was significantly affected by parity ($p<0.001$) year ($p<0.001$) and season ($p = 0.04$) of calving (Table 8).

Table 9 indicates the least square means of calving to conception interval (DO) and calving interval

Table 9. Least Square Means (± S.E.) of Calving to Conception Interval and Calving Interval by Parity, Season and Year of Calving of Holstein- Friesian Heifers at Alage Dairy Farm.

Source	n	Calving to Conception interval Mean ± S.E (Days)	Calving Interval Mean ± S.E (Days)
Overall	1114	285.8 ± 18.9	561.3 ± 18.9
Parity			
1	452	307.6 ± 0.02[b]	582.5 ± 9.6[b]
2	288	278.4 ± 10.4 [b]	554.4 ± 10.4[b]
3	163	276.0 ± 15.9[b]	552.5 ± 15.9[b]
4	96	226.4 ± 15.0[b]	502.9 ± 15.0[b]
5	66	271.9 ± 26.4[b]	544.2 + 25.2[b]
6	33	390.4 ± 53.9[a]	666.4 ± 54.4[a]
7	16	212.1 ± 55.4[b]	494.9 ± 55.5[b]
Season of calving			
Short Rainy	277	307.4 ± 12.6[a]	582.7 ± 12.6[a]
Long Rainy	354	275.3 ± 9.5[b]	550.8 ± 9.3[b]
Dry	483	281.1 ± 9.3[ab]	556.5 ± 9.3
Year of calving			
1985/86	5	119.0 ±14.1[b]	392.0 ± 13.2[b]
1986/87	5	385.0 ± 22.8[a]	660.0 ± 22.8[a]
1987/88	6	214.5 ± 52.5[ab]	490.0 ± 54.0[ab]
1988/89	23	240.1 ± 32.5[ab]	511.3 ± 32.1[ab]
1989/90	53	209.2 ± 17.5[ab]	482.3 ± 17.6[ab]
1990/91	79	339.8 ± 30.3[ab]	614.7 ± 30.1[ab]
1991/92	89	316.9 ± 19.3[ab]	589.0 ± 18.6[ab]
1992/93	73	299.7 ± 19.9[ab]	574.0 ± 19.9[ab]
1993/94	77	304.4 ± 25.7[ab]	580.6 ± 22.5[ab]
1994/95	74	246.0 ± 22.7[ab]	522.3 ± 22.6[ab]
1995/96	74	227.5 ± 23.2[ab]	500.3 ± 23.3[ab]
1996/97	50	423.1 ± 44.1[a]	697.6 ± 41.2[a]
1997/98	37	383.4 ± 35.3[a]	659.9 ± 35.3[a]
1998/99	31	272.7 ± 39.9[ab]	549.7 ± 40.0[ab]
1999/2000	70	303.4 ± 22.6[ab]	579.7 ± 22.6[ab]
2000/01	74	266.3 ± 22.3[ab]	544.8 ± 22.2[ab]
2001/02	102	285.4 ± 14.4[ab]	561.6 ± 14.3[ab]
2002/03	74	259.0 ± 16.9[ab]	536.0 ± 16.9[ab]
2003/04	73	261.0 ± 17.5[ab]	558.1 ± 17.5[ab]
2004/05	37	237.0 ± 18.6[ab]	513.0 ± 18.7[ab]
2005/06	15	133.0 ± 19.6[a]	406.8 ± 21.4[a]

Within variable, means indicated by different superscript letters differ significantly ($p < 0.05$)

The estimated least square means in Table 9 revealed that the length (DO) consistently decreased from the 1st through the 4th parity classes, but then raised to reach an average maximum of 390.4 $\pm$ 53.9 days at the 6th parity class. The shortest (DO), 212.1 $\pm$ 55.4 was observed for the seventh parity class. Year of calving also had a highly significant effect on (DO). Except the year 1985/86 and 2005/06 almost all years had (DO) of more than 200 days. The highest value for (DO), 423.1 $\pm$ 41.1 days was observed for the year 1996/97.

Calving interval was significantly affected by parity ($p<0.001$) and season ($p = 0.04$) of calving (Tables 8). The overall mean calving interval for Holstein Frisian breed was 561.3 $\pm$ 18.9 days. The estimated least square means in Table 9 revealed that the length of calving interval decreased as the age of the cow increased up to the forth parity. Beyond the fourth parity; the trend was not uniform. The longest calving interval of 666.4 $\pm$ 54.4 was noticed for sixth parity and the shortest 494.9 $\pm$ 55.6 for the seventh parity. Year of calving also had a highly significant effect ($p<0.001$) on CI. Except the years 1985/86, 1987/88, 1989/90 and 2005/06 all years had an interval of more than 500 days.

4.1.3. Number of Services per Conception

The analysis of variance of number of services per conception (NSC) is given in Table 10.

Table 10. Analysis of Variance of Number of Services per Conception by Parity, Season and Year of Calving of Holstein- Friesian Cows at Alage Dairy Farm.

Source	df	Ms	p value
Year of Conception	20	37.49102649	p<0.001
Season of Conception	2	3.08966205	0.109
Parity	7	41.99087	p<0.001
Error	10788	0.3136744	

df = degree of freedom Ms = mean square

Table 11 indicates the least square means of number of services per conception (NSC).

Table 11. Least Squares Means (± S.E.) of NSC by Parity, Season and Year of Holstein-Friesian Cows at Alage Dairy Farm.

Source	n	Mean ± S.E
Overall	1114	1.69 ± 0.1
Parity		
1	452	1.63 ± 0.024[a]
2	288	1.51 ± 0.05[a]
3	163	1.81 ± 0.06[a]
4	96	2.38 ± 0.09[ab]
5	66	2.22 ± 0.09[ab]
6	33	2.07 ± 0.07[ab]
7	16	2.0 ± 0[ab]
Season of conception		
Short rainy	274	1.22 ± 0.029[a]
Long rainy	351	1.34 ± 0.031[b]
Dry	479	1.27 ± 0.027[ab]
Year of conception		
1985/86	5	1.22 ± 0.02[a]
1986/87	5	2.0 ± 0.06[ab]
1987/88	6	1.75± 0.16[ab]
1988/89	23	1.96 ± 0.16[ab]
1989/90	53	1.84 ± 0.12[ab]
1990/91	79	1.95 ± 0.11[ab]
1991/92	89	1.93 ± 0.12[ab]
1992/93	73	1.77 ± 0.11[a]
1993/94	77	1.81 ± 0.12[a]
1994/95	74	1.79 ± 0.11[a]
1995/96	74	2.07 ± 0.11[ab]
1996/97	50	1.84 ± 0.16[ab]
1997/98	37	1.26 ± 0.08[a]
1998/99	31	1.54 ± 0.08[a]
1999/2000	70	1.48 ± 0.08[a]
2000/01	74	1.30 ± 0.08[a]
2001/02	102	1.47 ± 0.08[ab]
2002/03	74	1.73 ± 0.09[a]
2003/04	73	1.79 ± 0.08[a]
2004/05	37	1.64 ± 0.10[a]
2005/06	15	1.45 ± 0.16[a]

Within variable, means indicated by different superscript letters differ significantly ($p < 0.05$)

The overall mean number of services per conception was 1.69 ± 0.1. Of the factors tested, parity and year of conception significantly influenced NSC. The analysis of variance showed that season had no significant effect, however, the least square means showed that cows inseminated during the rainy season (June-September) had a slightly higher NSC than those cows that were inseminated during the other seasons, dry and short rainy seasons.

A highly significant variability in the number of services per conception was observed for the cows bred during the different years. Cows required higher number of services per conception during the years 1986/87 and 1995/96.

The estrus detection rate in Alage Dairy Farm was calculated by counting the total number of estruses detected and missed. The result demonstrated that the estrus detection rate using heat watch system was 52%. Semen storage conditions, handling procedures and thawing techniques were very poor.

4.2. Major Reproductive Health Problems

Summary of the retrospective data on the occurrence of major reproductive health problems recorded in the farm during the 9 years period is presented in Table12.

Table 12 Occurrence of Major Reproductive Health Problems (MRHP) Diagnosed in Years Between 1996/97 and 2004/05 Among Holstein Friesian Cows at Alage dairy Farm.

Year	Total No of Cows	No of Affected Cows	Major Reproductive Health Problems No of Observed Cases (%)									
			Dystocia	Retained Fetal Membranes	Uterine Infections	Abortion	Vulvo-Vaginits	Vaginal Prolapse	Uterine Prolapse	Repeat Breeder	Cystic Ovaries	Anestrus
1996/97	160	52	2(3.8)	16(30.1)	15(28.8)	3(5.8)	3(5.8)	2(3.8)	1(1.9)	4(7.6)	2(3.8)	4(7.6)
1997/98	145	46	3(6.5)	17(37.0)	8(17.4)	4(8.7)	2(4.3)	2(4.3)	2(4.3)	5(11.0)	2(4.3)	1(2.2)
1998/99	148	50	4(7.8)	15(29.4)	16(31.4)	2(3.9)	2(3.9)	1(1.9)	2(3.9)	1(1.9)	2(3.9)	5(10.0)
1999/2000	135	43	2(5.9)	7(21.0)	15(44.1)	3(8.8)	2(5.9)	2(2.59)	2(5.9)	4(11.8)	2(5.9)	4(11.8)
2000/01	145	40	3(7.5)	9(22.5)	15(37.5)	4(10.0)	_	_	1(2.5)	4(10.0)	_	4(10.0)
2001/02	150	73	3(4.2)	17(23.3)	14(19.2)	2(2.7)	3(4.1)	1(1.4)	_	12(16.4)	5(6.8)	16(22.0)
2002/03	132	35	2(5.7)	10(28.6)	12(34.3)	4(11.4)	_	_	_	_	_	7(20.0)
2003/04	125	40	2(5.0)	9(22.5)	13(32.5)	6(15.0)	_	2(5.9)	1(2.5)	7(17.5)	_	_
2004/05	138	24	2(8.3)	7(29.2)	7(29.2)	2(8.3)	_	_	_	2(8.3)	2(8.3)	2(8.3)
Total	1278	403(31.5)	23(5.7)	107(26.6)	115(28.5)	30(7.4)	12(2.9)	10(2.5)	9(2.2)	39(9.8)	15(3.7)	43(10.2)

Uterine infection and retained fetal membranes were found to be the major reproductive health problems. Generally from a total of 1278 assessed recorded data 31.5% (n = 403) were found with the major reproductive health problems. Uterine infection accounted for the highest occurrence of 28.5% followed by retained fetal membranes that accounted for 26.6%. Anestrus, repeat breeder, abortion, dystocia, cystic ovaries, vulvovaginitis and vaginal and uterine prolapses accounted for 10.2%, 9.8%, 7.4%, 5.7%, 3.7%, 2.9%, 2.5%, and 2.2% respectively.

Table13. The Association of Prevalence Rate of Major Reproductive Health Problems with Body Condition Score and Parity Year (2005/06) Among Holstein Friesian Cows in Alage Dairy Farm.

MRHP	Variable		Total No of Cows	Percent Affected	Overall Prev. Rate	95% CI	Fisher's Exact
Uterine Infection	BCS	2	16	50	10.1	(5.4 - 16)	0.000
		3	57	8.8			
		4	37	2.7			
		5	18	_			
	Parity	primi	64	1.56			0.006
		pluri	65	18.5			
Retained Fetal Membranes	BCS	2	17	12.5	4.7	(0.9 - 8.3)	0.008
		3	57	7.01			
		4	37	_			
		5	18	_			
	Parity	primi	64	3.1			0.24
		pluri	65	6.1			
Dystocia	BCS	2	48	1.6	3.1	(0.5 - 7)	0.08
		3	7	4.1			
		4	7	_			
		5	4	16.6			
	Parity	primi	64	1.6			0.3
		pluri	65	4.6			
Cystic Ovaries	BCS	2	16	_	3.9	(0.5 - 7)	0.004
		3	57	_			
		4	37	2.7			
		5	18	22.2			
	Parity	primi	64	4.68			0.02
		pluri	62	3.22			
Vagina Prolapse	BCS	2	16	_	1.6	(0.6 - 3.7)	0.74
		3	57	3.6			
		4	37	_			
		5	18	_			
	Parity	primi	65	_			
		pluri	64	_			
Repeat Breeder	BCS	2	48	2.08	1.6	(0.6 - 3.7)	0.09
		3	7	_			
		4	6	_			
		5	4	16.6			
	Parity	primi	64	_			
		pluri	65	3.07			0.106

In a cross- sectional study a total of 130 cows were examined for the major reproductive health problems. Uterine Infection accounted for the highest prevalence rate of 10.1% followed by retained fetal membranes, cystic ovaries and dystocia that accounted for 4.7% 3.9% and 3.1% respectively. Similarly prevalence rates were obtained for vaginal prolapse and repeat breeder that accounted for 1.6%.

The influence of BCS at calving on the prevalence of major reproductive health problems was found to be highly significant for uterine infection ($p = 0.000$), for retained fetal membranes ($p = 0.008$) and for cystic ovaries ($p = 0.004$). However parity has a significant impact on the prevalence rate of uterine infection ($p = 0.006$) and cystic ovaries ($p = 0.02$).

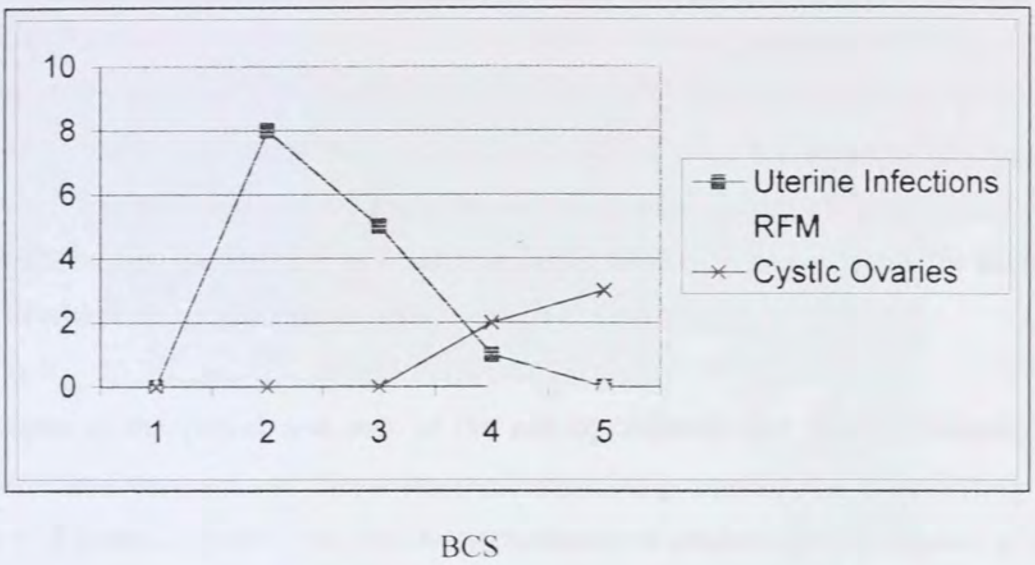

Figure 1. Effect of Body Condition Scoring on Major Reproductive Health Problems.

5. DISCUSSION

In the present study the reproductive performance of Holstein Friesian cows in Alage Dairy Farm was assessed and major reproductive problems were identified. The overall means for AFS and AFC reported in this study was higher than the previous reports for Holstein Friesian cattle and their Friesian crosses (Negash, 1994; Ageeb and Hayes 2000; Shiferaw *et al*., 2003; Bogale and Mesfin, 2004). However, the present finding was lower than the reports on 50% Fogera and 50% Friesian crosses in Andassa cattle breeding and improvement ranch (Goshu *et al*., 2005). The variability of AFS and AFC could be associated with feed availability that in turn affect the prepubertal growth rate because a high percentage of underfed heifers do not normally reach puberty at the right time (Rajan *et al* 1981). In agreement to previous reports (Giday, 2001; Chagunda *et al*., 2003), in the current study season of birth did not show any association with AFS but year of birth had a significant effect on AFS and AFC. Higher variations in AFS and AFC in different years might be associated with lack of close follow up of heat signs of heifers during week ends and holidays, absence continuous supply of liquid nitrogen and semen. Moreover, the absence of a veterinarian in different years affected the health of the herd which intern could have extended the AFS and AFC.

Days open is the period and part of the calving interval that can be shortened by improved herd management. The overall estimate of days open in the present study was 285.8 ± 18.6 days, which is far from being 'optimum' to attain a calving interval of 365-385 days (Peters, 1984). This estimate is higher than 185.0 days reported by Shiferaw (2003) and 120.8 ± 10.8 days for 1/2 Friesian 1/2 Zebu heifers reported by Negussie *et al*. (1998). Days Open was significantly affected by parity ($p<0.001$) and season ($p = 0.04$) of calving (Tables 8). The estimated least square means revealed that the length of days open decreased as the age of the cow increased up to the forth parity. The causes of age related difference may be lactation antagonism in young growing animals in their early parities and the ability of medium aged cows to rapidly gain body weight and condition after calving. Apparently, beyond the fourth parity the trend was not so uniform. The longest DO of 390.4 ± 53.9 days was noticed for sixth parity and the shortest 212.9 ± 55.4 days for the seventh parity. Year of calving also had a highly significant effect on DO. Except in the year 1985/86, all years had DO of more than 200 days. The highest value for (DO) 423.1 $\pm$ 41.1 was observed for the year 1996/97. In general, the mean higher DO reported in this study may indicate missed heat signs, service irregularities and/or poor record keeping system in the farm. In the present study, calving season had a significant effect on DO (Table8). Similarly, previous studies (Giday, 2001) showed an association between calving season and DO and noted this significant effect to be due to seasonal variations in ambient temperature and feed availability, which have recognizable influence on the reproductive physiology of the cows.

The duration of DO is influenced by nutrition (Vandeplassche, 1982), season (Purwantra *et al*., 2001), milk yield (Coleman *et al*., 1985), parity (Melaku, 1994), and suckling at any time, the effects of one or more of these factors may be confounded. In the present study, although the herd management and feeding at Alage Dairy Farm, which was exclusively stall- feeding with supplementation of concentrates and mineral licks, the finding of prolonged days open may have been the product of one or the combination of the above indicated influencing factors.

It is well known that the maintenance of a lower calving interval is desirable for profitable dairying. As the calving interval increases, the number of calves born and the number of bred heifers available for herd replacement per year is reduced. The overall means regarding calving interval for Holstein Friesian breed obtained in the present study was 561.3 $\pm$ 18.9 days which is higher than most of the values reported by different researchers for pure bred Holstein Friesian and Friesian crosses (Negash, 1994; Ageeb and Hayes 2000; Shiferaw *et al*., 2003; Chagunda *et al*., 2004) but lower than the reports of Mekasha *et al*. (2000) who reported 576.7 $\pm$ 21.6 days in urban and peri-urban production systems in Addis Ababa Milk Shed. The estimated least square means revealed that the length of calving interval decreased as the age of the cow increased up to the forth parity. Beyond the fourth parity however the trend was not uniform. The causes of these age related difference might be the effect of lactational stress in young growing cows in their early practices and the ability of middle aged cows to gain body weight condition quickly after calving. The longest calving interval of 666.4 $\pm$ 54.4 days was noticed for sixth parity and the shortest 494.9 $\pm$ 55.5 for the seventh parity. The relatively short calving interval in the last parity might be due to cows becoming more efficient in their performance. A similar tendency was observed by other researchers in cross bred cows in Cheffa state farm, Ethiopia (Goshu *et al.*, 2005). Calving interval was significantly affected by year and season of calving. The seasonal effect of calving interval obtained in this study is in agreement with reports in Kenya by Pollot (2004) in different farming systems. The increase in calving interval in different years may be due to management factors such as poor record and book keeping, poor heat detection, late insemination of cows, lack of proper culling practice of older and infertile cows and generally the decline in management level encountered in the farm.

In the present study the findings of differences in calving interval due to seasons may be the fact that cows calving in the dry season could take advantage of improved nutritional conditions during the subsequent rainy season, enabling the animals to meet their total requirements for maintenance, growth and lactation (Ermed, 2004).

The overall mean NSC reported in this study (Table 11) agrees with an earlier study conducted on Fogera cattle and their Friesian crosses (Goshu, *et al.*, 2005), but it was lower than the reports of Mekasha *et al.* (2000); Negussie *et al.* (1998) who reported NSC 2.6 $\pm$ 0.5, and 2.0 $\pm$ 0.1 in Holstein Friesian cows in intra- urban production systems and Friesian zebu crosses in Asella livestock farm respectively and slightly higher than a 1.5 $\pm$ 0.03 services reported by Chagunda *et al.* (2005) in Malawi. The result obtained in the present study is consistent with the results reported by Goshu *et al.* (2005).

Of the independent variables tested by analysis of variance, parity and year of insemination also had a significant effect on the number of services per conception. The result in the present study showed that cows require more services per conception than heifers. The significant effect of parity of the dam on the NSC (Table 10) was consistent with previous reports (Chagunda *et al.*, 2000) and could be produced by mild infections gaining access to the reproductive tract and the increased probability of developing reproductive abnormalities after repeated calvings.

In agreement with previous reports (Giday 2001; Bogale and Mesfin, 2004) season had significant influence on the NSC (Table 10). Least square analysis indicated that cows inseminated during the rainy season (June-September) had higher NSC (1.34 $\pm$ 0.03) than those cows that were inseminated during the other seasons, dry season and short rainy season. This is probably due to the inability of the AI technicians and the animal attendants to detect heat signs as the result of confinement of the cows in the house through out the rainy season. A slight improvement observed during the short rainy season may be due to the moderate climatic condition observed during these period.

The statistically significant effect of year on the number of services required per conception is in line with the reports of Negussie *et al.* (1998) and Chgunda *et al.* (2005). The annual variability in this trait might be due to lack of experience of the AI technicians during the years 1984/85 and 1985/86, lack of frozen semen during some periods at the farm and application of different management practices followed over the years. Slight improvements in the number of services per conception observed in the study year, because some repeat breeders and infertile cows have been culled from the farm. In the present study factors like delayed resumption of ovarian activity after calving, longer intervals to first estrus and a brief duration of estrus along with its silent symptoms might have contributed to difficulty in heat detection and timely insemination of cows resulting in a prolonged period of days open.

One factor that can result in poorly timed insemination and low conception rate is inaccurate estrus detection (Stevenson, 2001). Failure to detect cows in estrus or misdiagnosis of estrus can result in significant economic losses (Senger, 1994). Estrus detection rate was measured by counting the number of estruses detected and the number of estruses missed for a period of four months. The result demonstrated that the estrus detection rate using heat watch system was 52%. Even though detection of estrus was carried out twice a day, early in the morning and late in the afternoon, some times missed heat signs were observed due to negligency and lack of continuous supply of liquid nitrogen and semen.

Not following recommended procedures for retrieving, thawing, and protecting straws until safely inside the cow's reproductive tract results in damaged sperm membranes, cold and heat shocked sperm or impaired sperm motility (Foote and Parks, 1993). Poor semen storage, handling and thawing techniques are most likely important factors resulted in poor reproductive efficiency in Alage Dairy Farm.

The keeping of accurate records is vital in good herd reproductive management. The absence of accurate and accessible records makes the investigation of infertility problems the difficult (Arthur *et al*., 1989). Lack of good record and book keeping is responsible for the decline in management level encountered in the farm.

Generally, from a total of 1278 assessed recorded data, 31.5% (n = 403) were found with the major reproductive health problems. Uterine Infection accounted for the highest occurrence of 28.5% followed by retained fetal membranes anestrus, repeat breeders abortion, dystocia, cystic ovaries, vulvo vaginitis and vaginal and uterine prolapses that accounted for 26.6%, 10.2%, 9.6%, 7.4%, 5.7%, 3.7%, 2.9%, 2.5%, and 2.2% respectively. A similar findings on high occurrence of major reproductive health problems, consisting mainly of uterine infection and retained fetal membranes was also reported, although the work was with the zebu and their Friesian crosses under small scale dairy farms in Ada'a District (Kassa and Lemma, 2005).

In the present study the prevalence rate of uterine infection which were found to be the major reproductive health problems in the cross- sectional study is almost similar to the 11.3% previously reported by Kassahun (2003) in Awassa, but higher than the 2.8% reported by Yimer (2005) in small holder dairy farms around Wolliso. This is probably due to poor farm hygiene, which predisposes the animal to the contamination of the reproductive tract during delivery, as well as the poor feeding practice that predispose the animal to uterine infections resulting decreased reproductive efficiency. The prevalence rate of retained fetal membranes in the present study accounted high prevalence rate next to uterine infections but was lower than many findings in different dairy farms in Ethiopia, on the other hand the prevalence rate of repeat breeders found in this study (1.6%) was by far lower than that of Kassahun (2003) and Mekonnen (2001) who reported 13% and 21.8% respectively. The 3.1% prevalence rate of dystocia in the present study is a slightly lower than the reports of Oumarmohammod (2003), who reported 4.4%; however the finding was higher than 2.2%-2.4% prevalence rate reported by Zewdu (1992).

The finding of the present study showed a significant association between the body condition scoring of the cows at calving and the occurrence of the major reproductive health problems among Holstein Friesian cows. The finding of higher prevalence rate of major reproductive health problems focused on moderate conditioned cows might be due to the fact that such cows with moderate body conditions are likely have compromised immune system and they have higher possibility of contamination with increased infection rates. On the other hand cows in good body condition have been reported to have better ability to meet the energy requirements for normal parturition, lactation and involution of the uterus than cows in poor body conditions (Peters, 1984; Robinson, 1996).

The significant effect of parity on the prevalence rate of major reproductive health problems found in the present study is similar to previous findings of Mekonen (2001); worku (2004) who reported significant higher prevalence rate in pluripara cows than in primipara heifers. This may be due to repeated exposure of the pluripara genitalia to environmental risk and older and weaker cows taking longer time to recover from pregnancy and lactational stress and could be also one of the reasons contributing to these variations.

6. CONCLUSIONS AND RECOMMENDATIONS

The overall means in days for AFS and AFC investigated in this study were higher than most of the previous reports for Holstein Friesian cattle and their Friesian crosses. Significantly different values obtained in different years shows low standard management practiced in the farm.

The overall means calving to conception and calving intervals obtained in the present study are higher than that can be expected from a well managed herd. The increase in calving interval in different years is most likely related to management factors such as poor record and book keeping, poor heat detection and the decline in management level encountered in different years. Relatively good value for NSC is obtained in this study.

The statistically significant effect of season was observed in calving to conception interval (DO) and calving interval. Cows calving in the short rainy season had higher values for calving interval and days open than cows calved during other seasons. Cows inseminated during the rainy season (June-September) had higher NSC than those cows that were inseminated during the other seasons, dry and short rainy seasons.

Year had a highly significant effect on almost the traits studied. The annual variability of the traits indicated application of different management practices followed over the years.

The slightly lower estrus detection rate obtained in the present study is an indication of poor reproductive performance of cows.

Uterine infection and retained fetal membranes are major reproductive health problems in Alage Dairy Farm. The finding of the present study showed that there is a significant association between the body condition scoring of the cows at calving and the occurrence of the major reproductive health problems.

Therefore based on the above conclusions, the following recommendations have been forwarded:

1. A greater educational effort to make the animal attendants be aware of the importance of improving the efficiency of heat detection especially in the post service period; possibly also introducing incentive arrangements.

2. Developing an appropriate recording system for data related to reproduction for proper monitoring and evaluation so that to improve productivity.

3. Decreasing age at first calving and intercalving period through improved heat detection and feeding management.

4. Better nutritional management of calves, heifers and cows during the precalving and post calving periods.

5. Improving the handling and quality of semen and monitoring the performance of the AI technicians.

6. The use of bulls for natural mating in the absence of semen and liquid nitrogen.

7. Decreasing the blood level of dairy cows to the minimum of 3/4 Holstein Friesian inheritance.

8. An attempt should be made to improve management systems such as housing, feeding and health management systems in order to minimize conditions that can predispose to reproductive disorders.

9. Further investigation on the interaction of different factors like climate, stress and nutrition with reproductive performance of dairy cows at Alage Dairy Farm and the possibility of isolating the infectious causes of uterine infections are recommended.

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8. ANNEXES

Annex 1. Breeding Record

Breeding Record

ID No ___Cow's ID No _________

ID No	Date Calved	BREEDING REST			BREEDING RECORD				DATE		
		Inheat but not bred			service Date	Bull/A NO.	Service Date	Bull/A No	Dry Off	Due Calf	Date Calved
		1	2	3							

Annex 2. Body Condition Score

Description of Scores		
Score	Condition	Detailed Description
1	Poor	Tail head- deep cavity with no fatty tissue under skin; skin fairly supple but coat condition often rough. Loin- spine prominent and horizontal processes sharp.
2	Moderate	Tail head- Shallow cavity but pin bones prominent; some fat under skin; skin supple. Loin- End of horizontal process can only be identified individually with ends rounded.
3	Good	Tail head- fat cover over whole area and skin smoooth but pelvis can be felt. Loin- End of horizontal process can only be felt with pressure; only slight depression in loin.
4	Fat	Tail Head- completely filled and folds and patches of fat evident. Loin- cannot feel processes and will have completely rounded appearance
5	Grossly Fat	Tail head- buried in fatty tissue, pelvis impalpable even with firm pressure.

Annex 3. Data Collecting Sheet

No	Tag No	Date of Birth	Date of First Service	Date of Repeat Service	Date of First Calving	Date of Second Service	Date of Repeat service	Date of Second Calving	Date of Third Service	Date of Repeat Service	Date of Third Calving

9. CURRICULUM VITAE

A. Biographical Data:

Name	Amene Fekadu
Date of birth	December 18, 1966
Place of birth	Addis Ababa
Marital status	Bachelor
Nationality	Ethiopian
Profession	Veterinarian
Occupation	Senior Instructor

B. Educational background

1972-1978	Elementary School W/o Kelemework School Addis Ababa
1979-1980	Junior Secondary School Patriots School Addis Ababa
1981-1984	Yekatit 12 senior secondary school Achievement: Ethiopian school leaving Certificate Examination
1985- 1986	University Under Graduate study Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia. Achievement: Diploma in Animal Health
1989- 1996	University Under Graduate Study Moscow State Academy of Veterinary Medicine and Biotechnology Named after C.I. Skrjabin Achievement: Doctor of Veterinary Medicine, D.V.M Degree

20004/05-2005/06	Post Graduate Study Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia Achievement: MSc in Tropical Veterinary Medicine

C. Work Experience

1987- 1988	Technical Assistant at the Faculty of Veterinary Medicine, Debre Zeit, Ethiopia
1997-2000	Head animal health section of Alage ATVET College
2000-2004	Senior instructor in animal health In Alage ATVET College

D. Research output/ Technical paper

a. Effectiveness of new Antihelminthic Drug in the Treatment of Avian Ascaridiosis and Hetrakidosis in the Condition of poultry farm.
b. Management Factors Affecting The Reproductive Performance of Dairy Cows
c. Studies on Reproductive Performance and Major Reproductive Health Problems of Holstein Friesian Dairy Cows at Alage Dairy Farm.

E. Membership

Member of Ethiopian Veterinary Association

F. Language

Amharic	Mother Tongue
Russian	Writing and Speaking
English	Writing and Speaking

G. Computer skill

MS Dose
Microsoft Word
Microsoft Excel
Microsoft power point

10. SIGNED DECLERATION SHEET

"This Thesis is my original work, has not been presented for any degree in any other university and that all sources of material used for thesis have been duly acknowledged".

Name: Amene Feradu

Signature: ________________

Date of submission: ________________

This Thesis has been submitted for examination with our approval as university advisors.

Professor Tesfu Kassa (DVM, FRVCS, M.V.Sc) ________________________

Dr. Kelay Belihu (DVM, PhD) ________________________

Studys On Reproductive Performance & Major Reproductive Health Problems Of Holstein Friesian Cows At Alage Dairy Farm

~~Adene Fekadu~~

AMENE FEKADU.