MEKELLE UNIVERSITY

COLLEGE OF VETERINARY SCIENCES

ASSESSMENT OF REPRODUCTIVE PERFORMANCE AND MAJOR REPRODUCTIVE HEALTH PROBLEMS OF LOCAL AND CROSS BRED DAIRY COWS, IN AND AROUND ADIGRAT CITY, NORTHEN ETHIOPIA

By:

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A Thesis Submitted to the College of Veterinary Sciences, Mekelle University, in Partial Fulfillment of the requirements for the Degree of Master of Science in Veterinary Reproduction and Obstetrics

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ADVISORS' APPROVAL SHEET -1

MEKELLE UNIVERSITY

(Submission sheet -1)

This is to certify that the thesis entitle "**Assessment of Reproductive Performance and Major reproductive health problems in local and cross Dairy Cattle in and around Adigrat City District, Eastern Zone, "**, submitted in partial fulfillment of the requirements for the degree of Master's with specialization in Reproduction and Obstetrics, of the graduate program of the Mekelle university college of veterinary medicine and is a record of original research carried out by **Hareya Gebreegziaber (ID. CVM/PR 017/13)** under my supervision and no part of the thesis has been submitted for any other degree or diploma. The assistance and the help received during this investigation have been duly acknowledged. Therefore, I recommend that the student has fulfilled the requirements and hence hereby can submit the thesis to the department.

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EXAMINERS' APPROVAL SHEET -1

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We, the undersigned, members of the board of examiners of MSc. Thesis open Defense Examination, have read and evaluated the Thesis prepared by **Hareya G/heir** and examined the candidate. This is therefore to certify that the thesis is accepted as fulfilling the requirement for the Degree of Master of Reproduction and Obstetrics.

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DEDICATION

This work is dedicated to my beloved mother, Amet Gebremariam, and my father, Gebreegziabher Hidaru, with special gratitude to my husband Dejen Asgedom, for their unwavering support and encouragement throughout the completion of this study.

BIOGRAPHICAL SKETCH

Hareya was born in 1987 from her father, Gebreegziabher Hidaru, and her mother, Amete Gebremariam, in the Eastern Zone of the Tigray region, Northern Ethiopia, in a district called Dibla Seat, near Adigrat. She began her education at Agoro Primary School from 1993 to 1999 and continued her secondary education at Adigrat Agaezi Secondary School, graduating in 2003. In 2004, she enrolled at Addis Ababa University to study Veterinary Medicine, completing her degree in 2009. After graduation, she worked as an Animal Clinician in Awi Zone, Enjibara Town, Amhara Region, for seven years. She later joined the Bureau of Agricultural and Rural Development, Tigray region, working at the Artificial Insemination Center, where she remains employed. In September 2020, she began pursuing her M.Sc. in Veterinary Reproduction and Obstetrics at Mekelle University's College of Veterinary Medicine, a program she is currently attending.

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my genuine work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfilment of the requirements for MSc degree at Mekelle University and is deposited at the university library to be made available to borrowers under the rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma or certificate. Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgement of the source is made. Requests for permission for extended quotation from or reproduction of this thesis in whole or in part may be granted by the head of the major department or the Dean of the School of Graduate Studies when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

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LIST OF ABBREVIATIONS

AFC	Age at First Calving
AFS	Age at First Service
AI	Artificial Insemination
CFS	Calving to First Service
CI	Calving Interval
CSA	Central statistical agency
DO	Days Open
FAO	Food and Agricultural Organization
ILRI	International Livestock Research Institute
NSPC	Number of Service Per Conception
PGF2	Prostaglandin F2 alpha
RB	Repeat Breeding
RBS	Repeat Breeding Syndrome
RFM	Retained Fetal Membrane
ROP	Retention of placenta’
SD	Standard deviation
SE	Standard error
SSA	Sub Saharan Africa

ABSTRACT

This study was conducted to assess reproductive performance and major reproductive health problems in cross and local bred dairy cattle in and around Adigrat city of eastern zone, Tigray Region from January 2024 to December 2024. A total of 138 dairy farm owners were randomly selected in this 384 local and cross bred dairy cows interviewed to obtain information on the reproductive performance and major reproductive problems of dairy cows. In the study area for local and cross bred dairy cows of the average age at first service, age at first calving, calving interval and number of services per conception were 39.02 ± 6.5 months, 48.81± 6.32 months, 27.09±4.73 months and 1.88±.85 times respectively. The cross bred were 25.95 ±6.5 months, 35.62±6.58 months, 16.09±5.64 months and 1.82±.91 times respectively. The reproduction performance the estimated mean of age at first service, age at first calving and calving interval for local bred cows and cross bred cows were significant statistically different ($P < 0.05$) among the districts of the study sites while the mean of number of service per conception for local bred cows and cross bred cows were not significant statistically different ($p>0.05$) among the districts of the study areas. In high prevalence in the present study area included anestrus 86 (22.40%), retained fetal membrane 35(9.11%) and repeat breeder 49 (12.76%) and whereas reproductive health problems with lower incidence rate included dystocia 13 (3.39%), uterine prolapse 4(1.04 %), and abortion 11(2.86 %).The reproductive health problems in this study showed statistical significance different ($p < 0.05$) with respect to breed, body condition, and mating system. However, this finding indicated that occurrence of shows no statistical insignificance different ($p>0.05$) compared to age, productive system, and feeding system of the dairy cattle. The prevalence of disorders more in local breed (74.42 %) than cross breed dairy cows (48.68 %). In general it is recommended that improvement in management system, appropriate timing of AI for breeding system, and balanced feeding should be corrected to minimize the incidence of reproductive performance and reproductive health problem of associated risk factors in the study area.

Keywords: - Cross Breeds; Dairy Cow; Local breed; Reproductive health Problem; Reproduction performance.

CHAPTER I: INTRODUCTION

Background

Ethiopia, a leader in livestock production in Africa and ranked 9th globally, has a cattle population of approximately 66 million. Female cattle make up 55.45%, with 98.66% being local breeds, while crossbreeds and exotics account for 1.19% and 0.14%, respectively. The livestock sector significantly contributes to the country's economy and holds great potential for further development (Hunduma, 2012; CSA, 2021).

Reproduction is a complex process in which individuals produce their offspring to perpetuate life. It is a crucial factor in determining the efficiency of cattle production (Ibrahim and Seid, 2017). In healthy, non-pregnant adult female bovines, sexual activity follows a cyclic pattern lasting 20 to 21 days, with variations ranging from 17 to 24 days for both heifers and cows (Lucy, 2001).

Despite Ethiopia having the largest cattle population in the country, their production and reproductive performance are very low (Belay *et al*. 2012; Melku *et al*. 2016). The reproductive performance of dairy cows also falls below optimal levels for profitable milk production in various parts of the country (Niraj *et al.* 2014; Nibret and Tadele 2014). This poor performance is likely due to genetic and environmental factors, including feed shortages, poor management, limited pasture, disease, and lack of proper husbandry practices, such as accurate estrus detection and timely insemination (Amin *et al*. 2021; Amin *et al*. 2022; Amin *et, al,*. 2023).

The most common indices of reproductive performance are age at the first service, age at first calving, calving interval, number of services per conception, and breeding efficiency. Maximum rates of breeding efficiency in dairy cattle are attained through regular calving of one viable offspring per breeding cow in the herd in a year. Lowered breeding efficiency rates can be due to the long calving interval of a dairy cow which is mainly due either to low conception rate and/or high early embryonic mortality. However, information is limited about the productive performance of dairy cows in smallholder dairy farms in the tropics, particularly in Ethiopia (Lobago *et, al,* 2007). The reproductive performance of the breeding female is probably the

single most important factor that is a prerequisite for a sustainable dairy production system and influencing productivity. Especially, the economics of dairy enterprise is based on the efficient reproductive performance of dairy animals (Merbau, *et,al*., 2020).

Reproductive performance is vital for dairy production, aiming for efficient pregnancy and profitable calving intervals. High reproductive efficiency requires a calving interval that optimizes milk production, supported by effective estrus detection, proper insemination, quality semen, and a healthy uterine environment (Plaizier *et al.,* 1997; Nebel, 1999; Ferguson and Galligan, 2000).

Numerous factors contribute to this inadequacy, but the most common one is the occurrence of various reproductive health problems (Arero, 2022; Alemu and Mathewos, 2024). It is well established that problems with reproductive health make cows less productive, which costs the dairy industry money. This includes lower milk production, lower calf harvest, early depreciation of potentially useful cows, longer inter-conception and calving interval, reduced reproductive rate, high medication costs, and increased risk of culling (Pinedo *et al.,* 2020; Sheldon *et al.,* 2020; Chebel, 2021; LeBlanc, 2023).

Infectious diseases directly affect the reproductive performance of dairy cows, potentially leading to abortion, dystocia, retained placenta, pyometra, metritis, prolapse (uterine and vaginal), anoestrus, and repeat breeding. These issues can occur before, during or after gestation (Shiferaw *et. al*, 2005; Lobago, *et. al.,* 2006). These studies have highlighted the most common reproductive disorders to be abortion, retention of fetal membrane (RFM), dystocia, vaginal/uterine prolapse, anoestrus, repeat breeding, metritis, and endometritis (Arero, 2022; Alemu and Mathewos, 2024).

These problems are categorized based on their occurrence before gestation (anestrus and repeat breeding), during gestation (abortion, vaginal prolapse, and dystocia) and after gestation (retained fetal membranes and uterine prolapse) (Lobago *et al*., 2006). The postpartum period is particularly critical as it coincides with peak milk production, uterine involution, resumption of ovarian activity, conception, and heightened susceptibility to infections (Juyal et,*al*., 2011).

Regular breeding relies on the proper functioning of the reproductive system. For regular reproduction, a cow must have healthy ovaries, exhibit estrous behavior, and mate, conceive, carry the embryo through gestation, calve, resume estrous cycles and recover uterine function

post-calving. Factors such as management, disease and genetics can impact these processes. If the reproductive system is compromised cows may not produce calves regularly (Arthur *et al.*, 1996).

The Tigray, regional state significantly contributes to the country's cattle population, with approximately 3.5 million cattle (CSA, 2012). Population growth and urbanization have driven a rising demand for milk and dairy products (Fisseha, 2010). As a result, there has been a notable increase in the number of individuals engaged in small-scale intensive, large-scale intensive and smallholder dairy farming around the city. This growth has been supported by government extension programs, including door-to-door Artificial Insemination (AI) services aimed at enhancing genetic potential and boosting milk production because AI success depends on understanding reproductive challenges.

Despite the presence of numerous dairy farms in and around Adigrat city, comprehensive studies on the reproductive performance and major reproductive health problem of dairy cows are limited. This study seeks to evaluate the reproductive performance and identify key reproductive health problems in dairy cows in and around Adigrat city, northern Ethiopia.

1.1. Statement of the Problem

Population growth and urbanization in the study area have increased the demand for dairy products, highlighting the need for efficient dairy farming practices reliant on good reproductive performance. Dairy farming is vital for income but suboptimal reproductive performance and common reproductive health problem like abortion, anestrus, RFM, repeat bred and dystocia hinder dairy productivity and fertility. However, in the study area, Adigrat city, have limited studies on reproductive performance and health problem in dairy cattle. In addition, despite the town having a large population of crossbred dairy cattle in the region, milk production has decreased, and significant infertility issues in the dairy cows have been observed due to the effects of the recent two-year war, drought, and inadequate access to artificial insemination services.

Research can identify barriers to reproductive efficiency and provide sustainable solutions to improve calving intervals, conception rates, and productivity. Adigrat city has limited research

on reproductive performance and related health problems, highlighting the need for region-specific studies to address these challenges and inform evidence-based decision-making and policy development. Therefore, it is crucial to generate valuable insights into the reproductive performance and major reproductive health problems of dairy cattle in the study area.

1.2. Objective of the Study

1.3.1. General objective

The general objective of this study was to assess the reproductive performance of dairy cattle and identify the major reproductive health problem that may hinder their reproductive efficiency in and around Adigrat city.

1.3.2. Specific objectives

- To evaluate the reproductive performance of dairy cattle;
- To identify the common reproductive health problem in the study area.
- To determine the associated risk factors of the health problem of dairy cow in and around Adigrat city.

1.3. Significance of the Study

In general, assessing reproductive performance and identifying health challenges is vital for improving dairy productivity, animal health, and sustainability in the dairy sector. This study enables to collect the base line information on reproduction performance and major reproductive health problems of dairy cattle in the study area. The findings of this study contribute to improving reproductive problem, as reproductive performance directly influences calving intervals, which are crucial for sustaining consistent milk yields. Additionally, improved reproductive efficiency has economic advantages by reducing costs associated with prolonged calving intervals and reproductive treatments. Early detection of reproductive health problem, such as abortion, metritis and retained placenta, enables timely treatment, minimizing long-term effects. Addressing these health problems also enhances animal welfare by reducing pain and discomfort. Furthermore, assessing reproductive performance aids in selecting high-performing animals for breeding, thereby enhancing the genetic quality of the herd. Ultimately, the data may guide the development of policies and programs aimed at improving livestock health and productivity.

2. CHAPTER II: LITERATURE REVIEW

2.1. Reproductive Performance

Reproductive efficiency is expressed by the extent of reduction of reproductive wastage and it affects lifetime milk and meat production (Nuraddis and Ahmed, 2017). The expression, reproductive performance, does not usually refer to a single trait, but to a combination of many traits. Economic losses because of poor fertility can be attributed to the cost of prolonged calving interval, increased insemination costs, reduced returns from calves born and forced replacements in the event of culling. A delay in conception because of poor fertility increases calving interval mostly due to the increase in the number of days from calving to conception, (Nishida *et.al*, 2006). Based on the review of (Assemu and Dilip, 2014) the main indicators that would be considered in evaluating reproductive performance are age at first service, age at first calving, calving interval, days open and the number of services per conception.

2.1.1. Age at First Service (AFS):

Includes the period from the birth of heifer to first insemination at the age when animal has reached breeding age (Teketay *et, al*., 2014). Age at first service is influenced by genotype, nutrition and other environ-mental factors (Zewdie wondatir, 2010). The variation in age at first service among heifers might be due to the access of feed, management during calf age, supplementation of concentrate feeds during weaning age and breed of the heifer. High plan of nutrition could hasten puberty by increasing the growth rate of heifers. It is imperative that the feeding and management of calves and heifers must be improved to achieve low AFS and the best future productions (Hafez and Hafez, 2000). Age when an animal reaches sexual and breeding maturity has been the center of attention for long in regards to the possibility for shortening of the generation interval and it is determined within defined time limits. Several non-genetic factors. Feed availability and the management of the animals as a, whole also influence the AFS (Haftamu *et, al*, 2010). (Teketay *et, al*, 2014).The higher AFS may be, ascribed to low access nutrients both in quantity and quality, poor heifer management across the different ages besides incidences of diseases and parasites. The trait may also be ascribed to the genotype by environmental interaction over the growing seasons which often vary both between and within herds (Bisrat *et al.,* 2016). Age at first effective service is one of the most important fertility

properties in dairy cattle. It has direct impact on age at first calving since duration of gestation has physiologically constant value.

Age at first breeding combined with reproductive efficiency to first and subsequent breeding determines age at first calving because gestation length is a fixed interval (282 days) once conception occurs. Thus, the major reproductive challenge for breeding age heifers is to achieve conception by 14 to 16 months of age. Rearing heifers to initiate puberty by 11-13 months so that breeding can occur in a timely fashion is critical to the overall success of a heifer-rearing program. (Habib. 2011) and (Amin *et,al*, 2013) reported that average age at first effective service was 40.2 months and 42 months respectively. The local breeds 44.97 months reported by mebrahtom and hailemichael, 2016 and 43.44±.08 months reported by (Abera,2016) cross breeds , 18.7±3.7, 24.8 and 28.27 months finding by (Genzebu *et,.al*. 2016), (Alemselam *et, al* 2015) and (Mebrahtom and Hailemichael, 2016) respectively.

2.1.2. Age at First Calving

Age at first calving determines the beginning of the cow productive life and influences her lifetime productivity (Ojango and Pollott, 2001). Reproductive efficiency of dairy cows is influence by different factors including genetic, season, age, production system, nutrition, housing and management, environment and disease (Shiferaw *et,.al*. 2003). Different study reported that nutritional supplementation of heifers during their period of growth reduces the interval from birth to age at first service and birth to age at first calving (Amin *et,. al*. 2013). The overall estimated average age at first calving was found to be 37.95 ± 9.4 months for crossbred cows. Age at first calving is the earlier measure of reproductive performance in dairy cattle; only after the first calving production cycle commences (Dabdoub, 2009). the average age at first service of local bred and cross breed heifers were found to be 53.97 months, 57.08 ± 0.61 months, 47.112 ± 1.08 months and 59.7 ±10.22 months of Horro cattle, were reported by (Mebrahtom and Hailemichael 2016), (Amenu *et,.al*. 2017), (Zereu and Lijalem, 2016) and (Demissu *et al*. 2013) respectively. Age at first service of crossbred cows were reported by (Mebrahtom and Hailemichael, 2016), (Amenu *et,.al*. 2017), (Tadele and Nibret, 2014) and (Demissu *et al*. 2013) found to be37.32 maonth, 40.79 ± 1.23 month, 39.8±5.6month and 42.2 ±11.45 (F1 Horro-Jersey cross), respectively.

2.1.3. Calving Interval

The gap between two successive calving is called calving interval (Mulugeta Ayalew and Belayeneh Asefa, 2013). Calving interval can be divided into three periods, gestation, post-

partum anoestrus (from calving to first estrus), and service period (first postpartum estrus to conception). Length of postpartum anoestrus and service periods are sometimes called the "days open" period and is the part of the calving interval that can be shortened by improved herd management (Joe *et al.*, 2004) and calving interval (CI) is the period between successive calving and is a function of days open (period from calving to next conception) and gestation length. Since gestation length is more or less constant for a given breed the number of days open to conception becomes the sole variable of calving interval. According to (Arthur, 2001), (Gebrekidan *et al.*, 2012) and (Yifat *et al*., 2012) reported that crossbreeds have slightly shorter calving intervals than local cattle. The reasonably short calving intervals of 12-13 months indicate an optimum combination of good management and sound physiological condition of the cow. Longer calving interval affects whole lifetime production and reproduction performance through reduced milk production and less number of calves being born. The shorter the length of calving interval in turn the higher will be lifetime productivity. The CI itself is influenced by cow and management/environment-related factors such as method and efficiency of heat detection type and efficiency of breeding service and the ability of the cow to resume regular ovarian cyclist after calving display an overt heat signs, and conceive with the given service (Mulugeta and Belayeneh, 2013). Calving interval of local and crossbred cows in different parts of Ethiopia were there found 23.6± 4.4 month and 22.03±0.37month the calving interval with local breeds, reported by (Belay, 2016) and (Ayalew and Feyisa, 2017). Calving interval in crossbred there found 17.1±4.5 months, 16.2±0.7 months. Reported by (Belay, 2016) and (Mureda and Zeleke, 2007).

2.1.4. Number of Service Per Conception

Number of service per conception (NSPC) is, defined as the number of services/ inseminations required for a successful conception (Menale *et al*., 2011). Physiological stress from increased milk production or heat stress, reproductive disorder (i.e. retained placenta, metritis, mastitis, cystic ovaries affected the NSC (Motlagh *et, al*., 2013) found that the number of services per conception tends to increase significantly with an increase in age.

Numerous other factors that affect this efficiency include heat detection efficiencies, heat stress, semen quality and quantity, failure to inseminate at appropriate time, insemination technique, nutrition, body condition and clinical and sub clinical mastitis (Haque *et al*., 2011). Above all, the skill of the technician, the health status of the animal and the proper time of insemination are

among the important factors affecting number of service per conception (Yohannes *et,.al.*, 2017). At four breeding stations of the Institute of Agricultural Research (IAR) (presently known as EIAR Ethiopia, NSC ranged from 1.76 to 1.95 in Zebu and Crossbred cattle, respectively (Azage *et al.*, 1981, Beyene 1992) found no significant effect of season and year on NSPC. The NSPCs for wet and dry regions were 1.5 and 1.6 respectively. Similarly, Mekonnen and Goshu 1987) working on Fogera and 50% and 75% Friesian X Fogera crosses reported NSPC of 1.41 ± 0.11, 1.37 ± 0.14 and 1.29 ± 0.24, respectively. At the Asela Research Station, the value ranged from 1.82 to 2.5 in Arsi breed and Crossbred dairy cows (Kiwuwa *et al.* 1983).

2.1.5. Days Open

Days open (DO) until conception is, defined as the interval from calving to the day of conception, which includes the post-delivery anestrous interval and service period. Days open is the most variable determining component of calving interval. It is mostly influenced by the length of time for the uterus to completely involvements reopening of normal ovarian cyclist, occurrence of silent ovulations, accuracy of heat detection and management decisions on how soon to rebreed following parturition, fertility of a bull or semen and efficiency and/or skill of inseminator. The average days open until conception of dairy cattle is 155.7±1.72 days. Feed shortage, silent estrus and lack of proper heat detection might contribute considerably to the long days open (Belay *et al*., 2012). Days open is the part of the calving interval that can be shortened by improved herd management. Long days open and consequently prolonged calving interval may affect the overall economic revenues of the dairy herd (Hammoud *et al.*, 2010). The duration of this period is also influenced by nutrition, season, milk yield, parity, suckling and uterine involution **(**Dayyani *et al*, 2013***)***. Zebu X Holstein Friesian day open 155 days reported by (Belay *et. al*., 2012), Horro(zebu) and 134 days (Gizaw *et al*. 2011).

2.2. Factors Affecting Reproductive Performances of Cows

The reproductive performances of animals depend not only on their genetic merits, but also on other factors such as nutrition, management, health and environment. Many factors influence the reproductive performances of lactating dairy cows. Management factors such as accuracy of heat detection, inseminating techniques, semen handling and herd health policies can directly influence the reproductive performances of a dairy herd. In addition other factors beyond the

immediate control of management may impact fertility; these factors include milk production of the cow, age of the cow and season of year (Shiferaw, 2003).

2.2.1. Stress Factors

High ambient temperature imposes adverse effects on conception rates in cattle. It shortens the duration of oestrus. In hot weather most cows come to heat during the night when no one observes them, thus missed heats are common in the summer. High temperature can also prolong anoestrus in lactating cows (Ibrahim and Olaloku, 2000).

2.2.2. Herd Size and Housing

Confinement represents the most recent example of large scale, mandible alterations in the environment in which cattle exist. It is reasonable to assume that, as with any environmental change, confinement has increased the stress imposed on cattle. Concrete flooring reduces the expression of estrous intensity and lameness, which is one of the consequences of housing. Flies are abundant in confined housing and some data indicate that exposure to flies exacerbates problems of heat stress (young. 2007).

Closely associated with increased herd size, there is a reduction in the accuracy and efficiency of estrous detection. In large herds cows loss their individual identity, they are not so accurately identified and hence the slight changes in behavior, which in a small herd might warn the herd's man of approaching estrus are not seen. Confined spaces and muddy floors sometimes prevent cows from showing signs of estrus (Arthur, *et, al*, 1989).

2.2.3. Reproductive Health Problems

Obvious pathological lesions of the reproductive organs infectious diseases, impaired uterine environment deficiency and chronic degeneration of endometrium cause impairment of reproductive performances (Noakes.2018). Retained placenta and postpartum reproductive problems are more frequent after dystocia and results in uterine infection, delayed postpartum estrus, reduced fertility and extended CI. Infectious diseases such as vibriosis, leptospirosis, brucellosis, trichomoniasis and salmonellosis interfere with the reproduction of dairy cattle (Joe. 2004).

2.2.4. Breed

Both weight and age at puberty differs substantially among breeds of cattle and both are decreased by heterosis. Bos indicus heifers generally reach puberty at an older age than Bos taurus heifers. Bos indicus, zebu or their crosses are more heat tolerant and have a higher fertility during spring, summer and fall months in countries near equator. They tend to be less fertile in the winter month. European cattle or cattle of the temperate zone are less adapted to hot climate (Stephen, 2002)

2.2.5. Nutrition

Nutrition affects the age at puberty. Low nutrition intake will delay puberty because the time of onset of puberty appears more of size than age. In tropics under conditions of very poor nutrition and high degree of environmental stress, some heifers may in fact not attain puberty until 3 years of age. The duration of postpartum anestrus is affected by season of the year and level of nutrition before and after parturition. Adequate nutrition before and during the postpartum period is even more critical in primiparous animals because of the nutritional requirements for growth in addition to those of lactation during the postpartum period. Inadequate or improper nutrition during postpartum period induce delayed postpartum estrus, silent estrus, delayed ovulation, decreased ovulation rate, low conception rate and increase embryonic mortality reported nutritional condition that vary seasonally and yearly have major effect on calving interval. Conversely long term feeding at high levels has been shown to reduce pregnancy rates, increasing the proportion of barren animals and increases the prevalence of dystocia (Noakes, 2018).

2.2.6. Breeding System

Reproductive performance is influenced by cow and management/environment-related factors, such as method and efficiency of heat detection, type and efficiency of breeding service, the ability of the cow to resume regular ovarian cyclicity after calving and to display an overt heat signs and conceives with the given service (Arbel.,2001). Number of service per conception depends largely on the breeding system used. Some heifers fail to show overt signs of estrus yet have normal cyclical activity, a condition referred to as “silent heat”. This may however, be due to failure of the herd’s person to observe the signs rather than a failure of the cows to show signs (Noakes, 2018). Incorrect time of insemination, incorrect AI technique and inadequate handling

and storage of semen are some of the causes of repeat breeding. The correct timing of AI is depend up on the true, accurate and early identification of estrus, the accurate identification of the individual animal and informing the AI organization at the correct time (Arthur.1989).

2.3. Reproductive Problem of Dairy Cow

Reproductive disorders are the most common problems affecting the production and productivity of dairy cows (Dinka, 2013). The presence of the reproductive problems result in considerable economic loss to the dairy industry due to lesser number of calves crop, slower uterine involution, prolonged inter-conception and calving interval, early depreciation of potentially used cows, decreased milk yield per lactation as well as overall lifetime production, and increased costs due to veterinary services and earlier culling of cows (Lobago *et al*. 2006; FAWC, 2009). Reproductive and production disorders of cross-bred dairy cattle significantly reduce their productivity because of reproductive disorders. These disorders are of great concern of dairy producers because of their effect on the future fertility of dairy cows (Khair *et al*. 2013). The major reproductive problems that have most important influence on reproductive performance of dairy cows are include abortion, dystocia, RFM, prolapse (uterine and vagina), anoestrus, and repeated breeding. These reproductive problems could be categorized as prepartum and postpartum reproductive problems (Shiferaw *et, al*. 2005; Lobago *et al*., 2006; Dinka, 2013; Benti and Zewdie, 2014).

2.4. Major Reproductive Health Problems in dairy cattle

2.4.1. Abortion

Abortion is defined as the premature exclusion of fetus between 42 days (the estimated time of attachment and approximately 260 days of gestation (the age of the fetus in which fetus can survive outside of the uterus). It is the most common problem of dairy cows which restricts the cow's ability to produce a calf yearly and can largely affect the profit of the dairy farm (Peter, 2000). (Sarder *et al*., 2010) also define abortion as a condition in which the fetus is delivered live or dead before reaching the stage of viability where the delivered fetus is visible by naked eyes. If death occurs at 1 or 2 months of gestation, it is usually termed "early embryonic death." When the fetus in near term and born dead it is often called "stillbirth". This stillbirth could have occurred due to difficult birth and the death of the fetus, or it may have died in utero due to disease and was expelled. The etiologic diagnosis of abortion in livestock is difficult and often

frustrating task, and the diagnosis success rate is relatively low; 30-40% for bovine and numerous factors complicate diagnosis. Often, abortion follows initial infection by weeks or month so that the causative agent is no longer apparent by the time abortion occurs. In general term the cause of abortion are classified in to two groups; infectious and non-infectious (Hutchinson, 2009) The infectious agents (bacteria, viruses, protozoa, and fungi) and non-infectious (toxic agents, heat stress, and genetic abnormalities).Infectious agents are the most identified cause.(Jamaluddin *et al.*1996) examined 595 abortion submissions in California and found that infectious agents accounted for 37.1%; non-infectious agents, 5.5%; and undetermined causes, 57.3%. Among the 37.1% due to infectious agents, bacteria accounted for 18.0%; protozoa, 14.6%; viruses, 3.2%; and fungi, 1.3%.

Numerous bacterial, viral, protozoan and fungal pathogens have been associated with infertility and abortion in cattle. These pathogens can result in substantial economic losses, indicating the need for control measures to prevent infection or disease. Embryonic or fetal death may result in resorption, mummification, maceration, or abortion. Factors that impact the outcome of embryonic fetal death includes gestation, age, cause of death and source of progesterone for pregnancy maintenance. Aborted fetuses may be autolytic due to death within 24–48 h before abortion (Givens and Marley, 2008).

The infectious cause includes bovine viral diarrhea (BVD), infectious bovine rhinotracheitis (IBR, bovine herpes virus 1), letopirosis, brucellosis, mycotic abortion (due to aspergillus species), trichomoniasis, salmonellosis, campylobacteriasis, listeriasis and chalamydiosis this all infectious disease (Richard W.1993). The noninfectious cause includes genetic defect, multiple fetuses, injuries, toxicities and drug induced abortions, hypoxia and acidosis, high material temperature due to pyrexia, severe trauma and heat stress that causes fetal death (Kennedy, 2014). Abortion in cattle is a significant cause of reproductive wastage and is of economic importance as a single abortion event in a dairy herd is estimated to cost more and abortions are due to infectious diseases, several of which are zoonotic.

The clinical signs of abortion differs depending on their causative agent but the most common are fetal death and abortion, placentitis, necrotic cotyledon and edematous, infertility and its prevention and control depends on the causative agents and the common control and prevention method is control of exposure to the causative agent, regular immunization against disease that

cause abortion, proper housing, handling and environmental control regarding sanitation, artificial insemination and balanced nutritional programs is essential (Lucy. 2001).

2.4.2. Retained Fetal Membrane

Several authors defined retained placenta as follows (Drillich *et al*. 2006) defined retention of fetal membranes, it is the failure or delay in separation/expulsion of fetal membranes. Retention of fetal membranes from 6 to 24 hours post parturition is defined as retained placenta (Swiefy, 2003). Retention of placenta is the inability of fetal membrane to be expelled within 8 hrs after parturition and ranging of the retention from 8 to 48 hours post-partum (Beagley *et al*. 2010). The normal physiological stages of birth during parturition include dilatation of parturient canal, delivery of the fetus and expulsion of the fetal membranes. In normal condition, fetal membranes are usually expelled within two to eight hours of parturition. It is one of the most common diseases after parturition. A fetal membrane is an essential organ for prenatal transfer of nutrients and oxygen from the dam to the fetus (Hanafi, 2011). It usually drops within short time postpartum (within 8 hrs of parturition), if it is retained up to 12 hrs then it is called delayed removal and if retained for more than 24 hrs of parturition then it is called as 'Retention of placenta' (ROP). Such retention makes a number of problems by allowing microorganisms to grow inside the uterus instigating inflammation, fever, weight loss, decreased milk yield, longer calving intervals and may result in an open cow during the next year and if the infection is so bad the animal may actually die. It is one of the most common circumstances occurring in dairy cows following parturition (Patel and Parmar, 2016). Its incidence varies from 4.0-16.1% but can be much higher in problem herds. The achievable factors involved in the precipitation of the problem includes specific infections such as Brucella, Leptospira, Campylobacter, listeriosis, infectious bovine rhinotracheitis (IBR) and others, and non-specific infections by a broad range of bacteria and viruses that occur during pregnancy or at calving, twine birth, nutritional deficiency and deficiency of selenium, vitamin E, vitamin A are connected with an increased prevalence of retained placenta (Sheldon IM, *et al*, 2008).

2.4.3. Endometritis

Endometritis is an inflammation of the endometrium characterized by reddish brown, white to yellow mucoprollent, vaginal discharge along with thickness of uterine wall detected in trans-rectal palpation (Takele *et al*, 2005).The possible factors involved in the development of

endometritis are some trauma to the endometrium, comprising stillbirth, twins, male and beef sire calves, dystocia, cesarean section operation, (Potter *et al.*, 2010). retentions of fetal membrane, injury to the reproductive tract due to the difficult in calving or excessive force used to assist at calving or injury at the time of breeding or uterine treatment contamination of the reproductive tract at calving, use of uterine boluses (sometimes), over conditioning which may predispose cows' to many health problems at the time of parturition or during early lactation including RFM and endometritis (Gilbert, 2016). Clinical and subclinical endometritis negatively affect the performance of the world's dairy industry; economic losses are related to delay in the resumption of ovarian activity, increased number of services per conception, decreased milk yield, and costs of treatment of the disease (Cheong, *et al*, 2011; Leblanc, 2008).

2.4.4. Pyometra

Pyometra is characterized by the accumulation of purulent or mucopurulent fabric within the uterine lumen and distension of the uterus, in the presence of a closed cervix and an active corpus luteum (Sheldon *et,. al*. 2008). Postpartum pyometra is uncommon, with an incidence rate of less than 2%, and is thought to be caused by the growth of pathogenic bacteria in the uterine lumen after the formation of the first corpus luteum on the ovary. Delaying of the luteal phase may be attributed to increased concentrations of luteo tropic prostaglandin PGE2 associated with an endometrial bacterial infection. Pyometra can happen if ovulation occurs too early in the post-partum period and corpus luteum is formed during uterine infection (Sheldon *et,. al*. 2008). The common clinical signs are decreased milk yield, dullness or other signs of toxemia, including fever and purulent vaginal discharge(Sheldon *et, al*., 2006). Administration of PGF2α or its analogs at normal luteolytic doses and lavage of the uterus using large volumes of fluid are the appropriate treatments, but the condition frequently recurs, and permanent cure in these cases requires hysterectomy.

2.4.5. Dystocia

Dystocia is defined as an abnormal and difficult birth in which the first or specially the second stage of parturition was markedly prolonged and subsequently found impossible for the dam to deliver without artificial aid (Benti and Zewdie, 2014). Dystocia is most commonly known as difficult calving and defined shortly as prolonged or difficult parturition is a problem where most of the dairy producers encountered (Mee, 2008). Improper cervical dilation, failure of uterine

expulsive forces (uterine inertia) and neoplasms of vagina, vulva and uterus could be the maternal causes of dystocia in cows (Purohit *et, al*. 2011). As substantial time, effort, and expenses are spent in ensuring that a cow conceives, by artificial insemination (AI) or natural service, dystocia can have a huge economic impact on producers due to calf morbidity and mortality (Abera, 2017), increased veterinary prices, decreased production, reduced fertility (Purohit *et,. al.* 2012), and in dangerous cases, injury to or death of the dam (Bicalho *et,. al*. 2008). Current research implies that dystocia can also have potential long-term effects on the calves born, reducing survival rate to adulthood and subsequent milk production in them (Atashi *et,.al*. 2012).

2.4.5.1. Dystocia of maternal origin

Dystocia, which result from the mother due to maternal factors, are caused either by narrowing of the birth canal or by a deficiency of expulsive forces. The constricting forms of which the most important are pelvic inadequacies, incomplete dilation of the cervix, and uterine torsion (Noakes *et,. al*. 2001). Failure of cervical dilation and uterine torsion is the most common cause of dystocia of maternal origin. Failure of cervical dilation is associated with long-term progesterone supplementation during pregnancy (Mekonnen and Moges, 2016). Dystocia caused by the small size of the dam is occasionally seen if females are bred for the first time when they reach at least 65% of adult weight and height. Narrowing of the birth canal may be caused by space-occupying lesions or masses. Uterine inertia, arising from weak or absent uterine contractions, is sporadically seen in older animals or animals with prolonged pregnancy. Low calcium level may also be involved in secondary uterine inertia (Megahed, 2018).

2.4.5.2. Dystocia of Fetal Origin

The fetal origins of dystocia in cattle can be classified into those caused by excessive fetal size relative to the maternal pelvis (Feto-pelvic disproportion) and those caused by abnormalities of the fetus (Fetal monsters, fetal diseases, and fetal maldisposition). Furthermore, the fetal origin of dystocia can be divided in general to the abnormal 3P's (P1=presentation, P2=position, and P3= posture) (Kebede *et al.*, 2017; Noakes *et al.*, 2018). Presentation is the relation between the long axis of the fetus and the maternal birth canal; position indicates the surface of the maternal birth canal to which the fetal vertebral column is applied and posture refers to the disposition of the movable appendages of the fetus and involves flexion or extension of the fetal neck or limbs. Thus, in this review, fetal dystocia is reviewed according to fetal oversize and fetal abnormalities

(Purohit *et, al.* 2011). Dystocia caused by an oversized calf in a normal anterior longitudinal presentation is common in beef cattle. The normal delivery is made longitudinal, in the anterior presentation, dorsal sacral position; with bilateral foreleg extension (Cebra *et,. al*. 2014).

In order to prevent and treat dystocia one must know history of previous occurrences of difficulty calving for each animal, such as any previous zoonotic diseases which caused an early abortion and current gestation length and the length of time that the animal has been in labor are early predictors of dystocia. If heifer or cow exceeds an adequate amount of time for the first 2 stages of labor, then the dairyman should examine the animal. Since heifers are new to calving, they should be allowed longer time period to give birth (Radostits, Blood, 2001). The hormonal imbalances in the uterus reduce the expression of oxytocin receptors in the uterus by changing the preparation of the soft tissues resulting in weak uterine contractions and weak dilatation of soft tissues (Sorge *et,. al*. 2008).

2.4.6 .Repeat Breeding

Repeating breeding is one of the major infertility problems of herds. A repeat breeder cow is a cow that looks apparently healthy and has regular estrous cycle (Katagiri, 2011). Cow(s) called as repeat breeder when it has unsuccessful to conceive even after three or more number of services, has regular estrus cycle length, no aberration in the vaginal discharge, no palpable abnormality in the reproductive tract, has calved at least once before and less than ten years of age (Wodaje and Mekuria, 2016).

Repeat breeder syndrome (RBS) is a major economic loss in the dairy industry due to greater insemination costs and increased calving interval. Repeat breeder animals exhibit normal cycle every 18 to 24 days without any clinical abnormalities, but fail to conceive even after at least three successive artificial inseminations (Kumar *et, al*., 2014). Infectious causes may be due to the explosion of some specific and nonspecific bacteria, viruses, and protozoa which result in unfavorable conditions of the uterus for implantation of the fetus. The occurrence of repeat breeding in dairy cows, worldwide, ranges from 3 to 10%. The possible causes of the repeat breeding mostly include pathological, endometritis, nutritional deficiency especially vitamin A, the age of the dam, improper problems such as dystocia, retained fetal membranes and heat detection, and endocrine dysfunction (Ahmed, 2009). The possible factors involved are embryonic or early fetal mortality caused by trichomoniasis, leptospirosis, and excessive manipulation of reproductive tract by rectal examination and in appropriate time of mating

(breeding) i.e. breeding too early or too late in relation to time of copulation, use of low fertile sires, use of semen damaged in storage or handling, poor insemination technique, Nutritional insufficiency, poor management, natural servicing with sub-clinically infected bulls or heat stress could also be the potential causes of repeat breeding series imbalances or deficiencies of vitamins (minerals) (Ahmed, 2009). The effective treatment of repeat breeder cows could be uterine lavage and Corpusluteum dysfunction decreases Prostaglandin concentrations and then negatively affects fertility the autolytic effect of prostaglandins has been used to treat repeat breeding in cow and also treatment aims to achieve better heat detection and to increase the number of cows in heat (Kimura, *et,.al*.1987).

2.4.7. Anestrus

Anestrus is a functional loss of the reproductive cycle which is characterized by absence of overt signs of estrus manifested either due to lack of expression of estrus or failure of its detection. If estrus has not been exhibited in a dairy cow by 60 days postpartum the condition is defined as Post-Partum Anoestrus (PPA), whether she is cycling or not. Anoestrus is observed in post-pubertal heifers, during pregnancy, lactation, and in early postpartum period in adult animals (Kumar *et,. al.* 2014). It is a multi-causative factor associated problem, but its occurrence signals the inadequate nutrition, environmental stress, uterine pathology and improper manage mental practices (Yavas and Walton, 2000).The anoestrus is usually associated with the presence of inactive ovaries even in the presence of follicular development where none of the growing follicles become mature enough to ovulate (Montiel and Ahuja, 2005). Anoestrus is categorized in to four clinical forms: silent heat; cystic ovarian disease; ovarian a function and corpusluteum pseudo-graviditatis (Mwaanga and Janowski, 2000; Zdunczyk *et al*., 2002).

Anoestrus is a result of managerial, physiological, pathological and nutritional factors. These factors include age, breed, pre- and postpartum nutrition, body condition at calving, milk yield, suckling, calving season, presence or absence of the bull, delayed uterine involution, dystocia and general health status influence duration of postpartum anoestrus (Yavas and Walton, 2000; Webb *et al*., 2004; Hess *et al*., 2005; Montiel and Ahuja, 2005; Peter *et al*., 2009). The incidence of postpartum anoestrus (10-40%) varies from herd to herd as reported by many researchers (Mwanga and Janowski, 2000; Zdunczyk *et al*., 2002). Treatment of anoestrous depends on cause, diagnostic facility, availability and efficiency of drugs, response of the animal to the drug, dose of administration and health status of the animal.

2.4.8. Uterine Prolapse

Uterine prolapse is the coming out of the uterus with or without vagina and cervix through the vulva commonly shortly after parturition and hanged out with the inner surface outer most. It may be caused by increased intra-abdominal pressure associated with increased size of the pregnant uterus, intra-abdominal fat or rumen distention supper imposed up on relaxation and softening of the pelvic girdle, the excessive force of delivery or uterine inertia (the uterus stops contracting) due to metabolic problems (i.e., milk fever) (Tigre W. 2004). Uterine prolapse is the most common obstetrical problem, influencing the productive and reproductive performance of cattle by reducing the postpartum return to estrus, conception rate, and calving interval in dairy cattle (Kumar and Yasotha, 2015). Prolapse is either partial or complete turning inside out of the organ, in which the inside comes to the outside through the lips of the vulva and hangs down, sometimes as far as the hocks (Ward and Powell, 2018). It is considered a medical emergency. This condition is life-threatening in animal species, particularly in cows. If the affected cow not treated promptly, she could go into shock or die from blood loss. If the uterine prolapse repaired correctly, the cow may uphold a normal reproductive existence. However, a secondary infection of the replenished uterus may make the cow slow to rebreed or unable to breed back at all (Ward and Powell, 2018).

3. CHAPTER III: MATERIALS AND METHODS

3.1. Description of the Study Area

This study was conducted in dairy farms found in and around Adigrat city which is located at the distance of 125 km north of Mekelle city which is the capital of Tigray Region, Ethiopia (Fig 1). Geographically, Adigrat is located at latitude of $14^0$16 north and $39^0$27 easts and the city is within the plateau weather where the altitude ranges from 1500 – 2500m above sea level (m.a, s.l). The mean minimum and maximum rain fall is 600 mm and 4000mm respectively and the mean annual temperature have 9.28^0c minimum value and 21.94^0c maximum value. The rain fall pattern of the area is bimodal, with short rainy period from February to April and long rainy season from mid-June to end of August (CSA, 2015). In the study area, extensive and intensive types of cattle production systems practiced and the cattle breeds reared in the area were local, exotic (Holstein) and cross-bred (local × Holstein) (Eastern Zone Agriculture Office, 2020).

According to (Adigrat city administration, 2024) report, the major local livestock resources are cattle (19293), shoat (26867), poultry (55975) and equine (6103) (Adigrat city administration annual report, 2024).

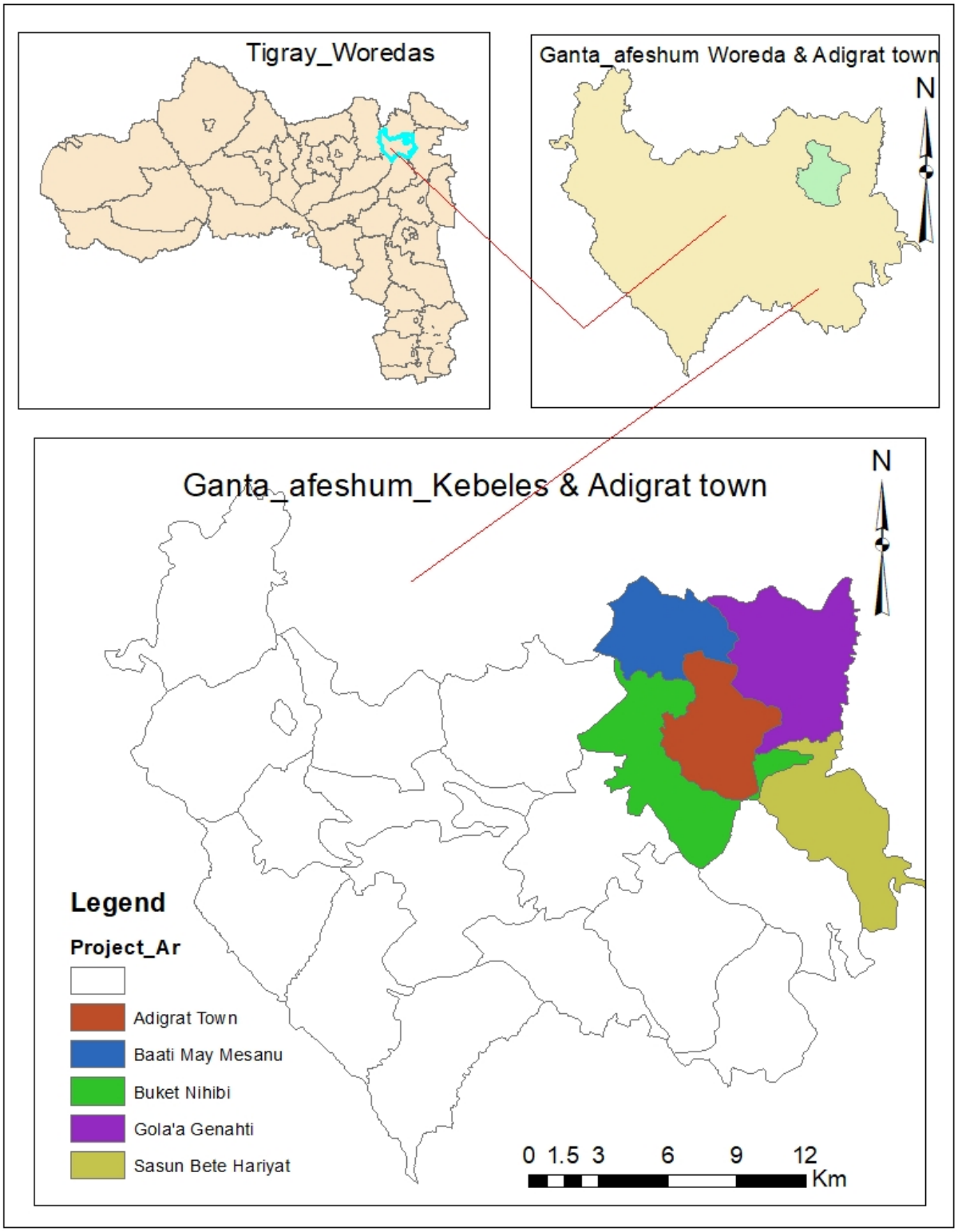

Figure 1: Map of Tigray region showing the selected of the study site

3.2. Study Animals

The study focused on dairy cow owners random selected farms within the study area. Data collection involved participants of breeds and various age groups who owned at least one dairy animal. The research covered both local and crossbred dairy cattle managed under different systems. The sampled animals exhibited a range of body conditions, production methods, feeding managements, and mating practices.

3.3. Study Design

A cross-sectional study was conducted from January 2024 to December 2024 using a questionnaire survey to collect information on reproductive performance and assess the major reproductive health problems of local and crossbred dairy cows.

3.4. Sample Size and Sampling technique

The sample size for this study was estimated by the formula recommended by (Arsham, 2005) for the questionnaire surveys:

$$N = 0.25/SE^2$$

Where N represents the required sample size (number of sampled farms) and SE is the standard error. With the standard error of 0.043 and a 95% confidence interval, the calculation yielded N=0.25/ (0.043)2 = 138. Thus, a total of 138 dairy farm owners were interviewed for this study. These farms housed 384 dairy cattle, 341 crossbred (local x Holstein Friesian) and 43 local bred dairy cows during the study period. The farms were selected purposively based on their accessibility and availability of infrastructures.

Sampling technique was simple random sampling technique using lottery method.

3.5. Data Collection Method

A semi-structured questionnaire was administered to selected dairy cow owners, focusing primarily on the household's socio-economic characteristics. The questionnaire also covered reproductive traits, including age at first service, age at first calving, calving interval, postpartum estrus onset and breeding practices such as artificial insemination, natural mating and parity. Additionally, questions addressed major reproductive problems at the individual cattle level, such as abortion, dystocia, stillbirth, retained fetal membranes, uterine prolapse, anestrus, repeat breeding, and other related problems.

3.6. Body condition scoring

For all of the animals under study body condition was scored in order to assess the nutritional status of the animal and the prevalence of post parturient reproductive health problems. Therefore, animals were grouped in to 1, 2, 3, 4 and 5 body condition scores later on classified as poor (score 1 to 2), medium (score 3) and good (score 4 to 5) (Benti and Zewdie. 2014). The measurement was done through palpation and visualization of the transverse and spines processes for the lumbar vertebrae (loin) and tail head respectively.

Definition body condition scoring

Score 1. Individual short ribs have a thin covering of flesh. Bones of the chine, loin, and rump regions are prominent. Hook and pin bones protrude sharply, with a very thin covering of flesh and deep depressions between bones. Severe depression below tail head and between pin bones. Bony structure protrudes sharply, and ligaments and vulva are prominent.

Score 2. Individual short ribs can be felt but are not prominent. Ends of ribs are sharp to the touch but have a thicker covering of flesh. Short ribs do not have as distinct an "overhanging shelf " effect. Individual bones in the chine, loin, and rump regions are not visually distinct but are easily distinguished by touch. Hook and pin bones are prominent, but the depression between them is less severe. Area below tail head and between pin bones is somewhat depressed, but the bony structure has some covering of flesh.

Score 3. Short ribs can be felt by applying slight pressure. Altogether, short ribs appear smooth and the overhanging shelf effect is not so noticeable. The backbone appears as a rounded ridge; firm pressure is necessary to feel individual bones. Hook and pin bones are rounded and smooth. Area between pin bones and around tail head appears smooth, without signs of fat deposit.

Score 4. Individual short ribs are distinguishable only by firm palpation. Short ribs appear flat or rounded, with no overhanging shelf effect. Ridge formed by backbone in chine region is rounded and smooth. Loin and rump regions appear flat. Hooks are rounded and the span between them is flat. Area of tail head and pin bones is rounded, with evidence of fat deposit.

Score 5. Bony structures of backbone, short ribs, and hook and pin bones are not apparent; subcutaneous fat deposit very evident. Tail head appears to be buried in fatty tissue

3.7. Data Management and Analysis

The questionnaire data were entered and coded into the Microsoft Excel 2010 spreadsheet application program and imported to STATA version-15 statistical software for descriptive statistical analysis and test of association between different risk factors and outcome variables. Pearson's Chi-square test was used to detect the existence of an association between variables. A p-value of less than 0.05 was considered statistically significant.

4. CHAPTER IV: RESULTS

4.1. Respondents' Socio-demographics Characteristics

The study found that out of 138 respondents, the majority were male (84.78%), while females accounted for 15.22% with diverse educational backgrounds and age groups in the respective assessed dairy farms owners. Among them, 22.46% had completed elementary education, while 38.41% had education levels between grades 8 and 12, as summarized in (**Table 1**).

Table 1: Demographic Description of the Respondents

Parameter	Frequency	Percentage (%)
Sex of respondents		
Male	117	84.78
Female	21	15.22
Total	138	
Age of respondents		
24-40 years	28	20.29
41-60 years	75	54.35
>60years	35	25.36
Total	138	
Level of education		
Illiterate	16	11.59
Reading and writing	13	9.49
1-7grade	31	22.46
8-12grade	53	38.41
College	25	18.12
Total	138	
Marital status		
Single	9	6.52
Married	110	79.71
Widow	12	8.70
Divorced	7	5.07
Total	138	

4.2. Animals Management

This study surveyed 138 dairy farms, housing a total of 384 dairy cattle, comprising 341 (88.8%) crossbred cows and 43 (11.2%) local breeds. Regarding body condition, nearly half of the animals were in poor condition (51.04%), followed by medium condition (37.76%) and good condition (11.20%). Among the 384 dairy cattle, 19.27% were managed under an intensive production system, 58.85% under a semi-intensive system, and 21.88% under an extensive system. Also, among the dairy cattle studied, 25% were bred by bulls, 60.42% through artificial insemination (AI), and 14.58% via a combination of AI and natural mating with bulls (**Table 2**).

Table 2: Factors of Frequency and Percentages of the study farm

Factors	Frequency	Percentage (%)
Breed types		
Local	43	11.20
Cross	341	88.80
Age		
<4 year	54	14.06
4-6year	122	31.77
6-8year	101	26.30
>8year	107	27.86
Body condition		
Poor	196	51.04
Medium	145	37.76
Good	43	11.20
Production system		
Intensive	74	19.27
Semi intensive	226	58.85
Extensive	84	21.88
Feed system		
Straw, concentration	56	14.58
Straw, hay	234	60.94
Straw, free grazing	94	24.48
Mating system		
Bull	96	25
AI	232	60.42
Both(bull and AI)	56	14.58

4.3. Reproductive Performance

The average age at first service (AFS) was 39.02 months for local cows and 25.95 months for crossbred cows, while the age at first calving (AFC) was 48.81 months for local cows and 35.62 months for crossbred cows. The calving interval (CI) was 27.09 months for local cows and 16.09 months for crossbred cows and the service number per conception (SNPC) was 1.88 times for local cows and 1.82 times for cross cows, as shown in **(Table 3**).

Table 3: Reproductive performance of local and crossbred cows

Parameter	Breed of cows	Mean ±Sd	p-value
AFS(months)	Local	39.02 ± 6.5	
	Cross	25.95± 6.5	0.00
AFC(months)	Local	48.81 ±6.32	
	Cross	35.62± 6.58	0.00
CI(months)	Local	27.09 ±4.73	
	Cross	16.09 ±5.64	.00
SNPC(times)	Local	1.88 ±.85	
	Cross	1.82 ±.91	0.335

Note: AFS = age at first service, AFC= age at first calving, CI= calving interval SNPC= service number per conception

4.4. Reproductive Health Problems

The study used a questionnaire to identify reproductive health problems reported by dairy owners, with prevalence data for crossbred and local breeds summarized in (**Table 4**). Out of 384 dairy cows studied, 51.56% (n=198) had at least one reproductive health problem. Thus, anestrus (22.40%), repeat breeding (12.76%), and retained fetal membranes (9.11%) were the most prevalent reproductive health problems. Other less common problems included dystocia, abortion, and uterine prolapse accounting 3.39%, 2.86%, and 1.04%, respectively.

Table 4: Reproductive disorder in dairy cows in the study area

Major reproductive disorders	Frequency	Percentage (%)
Abortion	11	2.86
Dystocia	13	3.39
Anestrus	86	22.40
Uterine prolapse	4	1.04
Retained fetal membrane (RFM)	35	9.11
Repeat breeder (RB)	49	12.76
Total	198	51.56%

As indicated in (**Table5**), this study revealed that reproductive health problems were significantly ($p<0.05$) linked to breed, body condition, and insemination type, whereas no association ($p > 0.05$) was observed with age, production system, or feeding system.

Table 5: Risk factors of major reproductive health problems in the study area

Risk factors	No, of cows Examined	No, of cows Affected	Percentage (%)	X^2	P=values
Breed					
Local	43	32	74.42	10.12	0.001
Cross	341	166	48.68		
Age					
<4years	54	35	64.81		
4-6 years	122	67	54.92		
6-8years	101	50	49.50	7.67	0.053
>8years	107	46	42.99		
Body condition					
Poor	196	95	48.47		
Medium	145	96	66.21	34.63	0.000
Good	43	7	16.28		
Production system					
Intensive	74	35	47.30		
Semi intensive	226	119	52.65	0.66	0.716
Extensive	84	44	52.38		
Feeding system					
Straw, concentration	56	26	46.43		
Straw, hay	234	124	52.99	0.79	0.673
Straw, free grazed	94	48	52.06		
Mating of insemination					
Bull	96	69	71.88		
Artificial insemination(AI)	232	101	43.53	21.9	0.000
Both (Bull and artificial insemination)	56	28	50.00		

In the study area, dairy breed showed a statistically significant effect ($p<0.05$) on anestrus. However, no significant differences ($p>0.05$) were observed for dystocia, abortion, RFM, RB, or uterine prolapse. As indicated in (**Table 6**), anestrus prevalence was notably higher in local dairy cows (34.88%) compared to crossbred cows (20.88%).

Table 6: Comparison of reproductive health problems between local and cross breeds dairy cow

Reproductive problems	Local breed		Cross breed		X^2	p=values
	No of cows	%	No of cows	%		
Abortion	1	2.33	10	2.93	.056	0.822
Dystocia	2	4.65	11	3.23	1.52	0.466
Anestrus	15	34.88	71	20.88	4.34	0.037
Uterine prolapse	1	2.33	3	.88	.077	0.379
RFM	4	9.30	31	9.09	.0021	0.964
RB	9	20.93	40	11.73	2.93	0.088
Total	32	74.42%	166	48.68%	10.12	0.001

The prevalence of reproductive disorders varied significantly ($p < 0.05$) across animals with poor, medium, and good body conditions for anestrus and retained fetal membranes (RFM). Anestrus was most prevalent in animals with medium body condition (28.97%), followed by poor (19.90%) and good (11.63%) body conditions. Similarly, RFM showed the highest prevalence in medium body condition animals (14.48%), compared to poor (7.14%) and good (0.00%) body conditions (**Table 7**)

Table 7: The association of major reproductive health problems and the body conditions

Reproductive disorder	Body conditions of dairy cows						X^2	p=values
	Poor		Medium		Good			
	No of cow	%	No of cow	%	No of cows	%		
Abortion	6	3.06	5	3.45	0	0.00	1.47	0.479
Dystocia	8	4.08	4	2.76	1	2.33	.612	0.736
Anestrus	39	19.90	42	28.97	5	11.63	7.17	0.028
Uterine prolapse	2	1.02	2	1.38	0	0.00	.614	0.736
RFM	14	7.14	21	14.48	0	0.00	10.28	0.006
RB	26	13.27	22	15.17	1	2.33	5.01	0.082
Total	95	48.47	96	66.21	7	16.28	34.63	0.00

The mating system significantly influenced the prevalence of major reproductive disorders ($p < 0.05$). The general reproductive disorders were more common in bulls (71.88%) compared to AI (artificial insemination) (43.53%) and combined methods (bull and AI) (21.9%) (**Table 8).**

Table 8: The association between major reproductive health problems and the mating system

Reproductive disorder	Mating system						X^2	p=values
	Bull		AI		Both (bull and AI)			
	No of cow	%	No of cow	%	No of cow	%		
Abortion	2	2.08	6	2.59	3	5.36	1.52	0.466
Dystocia	5	5.21	6	2.59	2	3.57	1.43	0.488
Anestrus	28	29.17	46	19.43	12	21.4	3.44	0.179
Uterine prolapse	1	1.04	1	.43	2	3,57	4.315	0.116
RFM	14	14.58	18	7.76	3	5.36	4.935	.085
RB	19	19.79	24	10.34	6	10.71	5.69	.058
Total	69	71.88	101	43.53	28	50	21.9	0.00

5. CHAPTER V: DISCUSSION

5.1. Reproductive Performances of Local and Crossbred Dairy Cow

5.1.1. Age at First Service and Age at First Calving

Age at first service (AFS) is the age at which cows attain sexual maturity to accept service for the first time. Delayed sexual maturity can lead to significant economic loss due to prolonged non-lactating, unproductive periods (Mukasa-Mugrewa *et al*., 1989). In the current study, the overall mean of age at first service for local and crossbred cows were 39.02±6.5 and 25.95±6.5 months respectively. Statistically significant differences ($P<0.05$) were observed between local and crossbred cows for age at first service.

In this study, the age at first service for local cows was higher than the 34.8 months reported by (Dinka 2012) but shorter than the 44.97±7.57 months reported by (Mebrahtom and Hailemichael 2016). (Belay,2016) found a similar result of 3.68 years with the result of current study in the Sidama zone, Southern Ethiopia. The age at first service for crossbred cows in this study was in accordance with (Mekuriaw, 2007), who reported 25.6 months in Dire Dawa. However, it is shorter than the 28.27±5.66 months reported by (Mebrahtom and Hailemichael 2016) and longer than the 23.2 months reported by (Nuraddis *et al*. 2011) in Gonder town.

The age at puberty for local breed cow (Bos indicus) ranges from 16 to 40 months, which is later compared to crossbred (Bos taurus x Bos indicus) or purebred (Bos Taurus) cattle. This suggests that local breed (indigenous) cattle have a longer age at first service than crossbreeds. The delay is influenced by genetic and environmental factors such as nutrition, disease, temperature, and season of birth, all of which impact heifer growth rates (Mukasa-Mugrewa *et al*., 1989; Masama *et al*., 2003). According to (Ayalew and Feyisa 2017), improved management, including nutrition, housing, and healthcare, accelerates heifer growth and early first heat by influencing hormone and metabolite levels, which can affect reproductive performance.

Age at first calving (AFC) marks the beginning of a cow's productive life. In this study, the average age at first calving (AFC) was 48.81±6.32 months for local cows and 35.62±6.58 months for crossbred cows respectively. Statistically significant differences ($P<0.05$) were observed between local and crossbred cows for AFC.

The mean age at first calving (AFC) reported in this study aligns with (Taju, 2018), who found an AFC of 48.9 months for local heifer in the Dawro zone. However, it is longer than the 44 months reported for Bos indicus cattle in the tropics by (Mukasa-Mugerwa, 1989) and the 47.6 ± 0.77 months for Fogera cattle at Metekel Ranch reported by (Addisu 1999). Conversely, the AFC in this study is shorter than the 57.08 months reported by (Amenu *et al*. 2017) for local heifers in Gindeberet, West Shoa zone, and the 51.9 months reported by (Belay, 2016) in the Sidama zone. The age at first calving for crossbreeds in this study was longer than the 29.52 months reported by (Sena *et al*. 2014) in Debre Tabor and 32.1 months by (Yifat *et al*. 2009) in Ziway but shorter than the 37.32±5.66 months reported by (Mebrahtom and Hailemichael 2016).

The prolonged age at first calving in this study may be attributed to poor nutrition and limited access to artificial insemination, worsened by last year's drought and the impact of the recent war around Adigrat town. The difference between the current study and previous report might be due to environmental conditions and husbandry practices affecting growth, puberty, fertility, and conception. Well-managed, well-fed heifers grow faster, are served earlier, and yield greater economic benefits through increased milk, calves, and sales (Yifat *et al*., 2009; Meaza, 2017).

5.1.2. Calving interval and Number of service per conception

The calving interval (CI) refers to the duration between two successive calving and serves as a critical indicator of reproductive efficiency. An optimal CI of 12 to 13 months allows cows to produce a calf annually, maximizing productivity. In this study, the average calving interval for local and crossbred heifers was 27.09±4.7 and 16.09±5.6 months, respectively. The difference in calving intervals between local and crossbred cows was statistically significant ($P<0.05$).

The results from the study areas for local breeds were higher than those reported by (Mebrahtom and Hailemichael, 2016), who found a calving interval of 23.91±4.97 months in North Gondar, Amhara Region, and (Zereu and Lijalem, 2016), who reported 19.91 months for local cows in rural Wolaita Zone. In contrast, the calving interval for crossbred cows in this study is longer than the 15.5 months reported by (Belay, 2012) for crossbred cows but shorter than the 17.91±3.11 months reported by (Mebrahtom and Hailemichael, 2016) for crossbreeds. However, it aligns closely with the 16.2 months reported by (Emebet and Zeleke 2007) for lowland crossbred cows.

Poor nutrition and inadequate management practices, such as low-quality semen, silent estrus, ineffective heat detection, and continuous calf suckling throughout lactation, could be the factors prolonging the calving interval in the study area.(Bayou *et al.* 2015) identified poor feed quality, breeding management, diseases, parasites, and prolonged calf suckling as causes of longer CI in local cattle. Other factors include cow age, breed, calving season, and forage availability (Yifat *et al.*, 2012).

The number of services per conception (NSPC) in cows refers to the average number of inseminations or mating required achieving pregnancy. An ideal NSPC ranges from 1.5 to 2, with a lower NSPC indicating better reproductive efficiency. In this study, the average numbers of services per conception for local and crossbred heifers were 1.88±0.85 and 1.82±0.91, respectively. The difference between local and crossbred cows was not statistically significant ($P > 0.05$). The NSPC in this study was higher than that reported by (Mebrahtom and Hailemichael, 2016), who found 1.34 services per conception for local cows in Endamehoni district, Tigray. However, (Demissu *et al*. 2013) reported an NSPC of 2.1, (Belay, 2016) reported 2.4, and (Kumar *et al*. 2014) reported 2.2, all of which were higher than the findings of this study. For crossbred cows, the result was similar to the 1.8 reported by (Tadesse *et al*. 2010) but higher than the 1.4 reported by (Moges, 2012) in Gonder. In contrast, (Meaza 2017) reported a higher NSPC of 2.1 for crossbred dairy cows in and around Wolaita Sodo.

5.2. Major Reproductive Health Problems

Out of the total dairy cows examined, 51.56% (n=198) were found to have major reproductive health problems based on a questionnaire survey. This prevalence is higher than the rates reported by (Tadele, 2021) and (Tulu and Negera, 2022) which were 40.5%and 37.8% respectively. However, it is lower than the findings of by (Tolosa, 2021) and (Mitiku, 2022) who recorded prevalence rates of 66.15% and 61% respectively in Ethiopia. These differences in prevalence may result from factors such as environmental conditions, animal breeds, variations in study parameters, and differences in management practices across dairy farms. This study found no statistically significant effect ($p > 0.05$) of the production system and feeding system on the cumulative prevalence of major reproductive health problems assessed.

This study identified anestrus (22.40%), repeats breeding (12.76%), and retained fetal membranes (9.11%) as the most common reproductive health problems in the study area. Less frequent reproductive health problems included abortion (2.86%), dystocia (3.39%), and uterine prolapse (1.04%). Furthermore, reproductive health problems were more prevalent in locally bred dairy cows (74.42%) than in crossbred dairy cows (48.68%). The lower prevalence in crossbred cows could suggests that they receive better care, including improved feeding and healthcare, compared to local dairy cattle.

The prevalence of reproductive problems was higher in cows bred through natural service by bulls (71.88%) compared to those bred through artificial insemination (AI) (43.53%) and those bred using both AI and natural service (50%). The higher prevalence in cows bred by natural service may be attributed to the transmission of venereal diseases, which can lead to conditions such as endometritis, repeat breeding, stillbirth, and abortion. In contrast, AI benefits from better control during semen processing, ensuring high-quality semen, while the combined use of AI and natural service shows lower prevalence could be due to the effectiveness of bulls in detecting estrus, leading to improved conception rates and reducing cases of repeat breeding and anestrus. The significant variation among the three mating systems might be influenced by the educational level of cattle owners (Ayana and Gudeta, 2015).

The body condition score of the study animals in this study was influenced the prevalence of reproductive health problems, with higher prevalence observed in cows with medium body condition (66.21%) compared to those with poor (48.47%) or good (16.28%) body conditions. The variation in reproductive health problems based on body condition was statistically significant ($p < 0.05$). Regarding the production system, the prevalence of reproductive disorders was slightly higher in the semi-intensive management system (52.65%) compared to the extensive (52.38%) and intensive (47.30%) systems. However, the differences in prevalence across production systems were not statistically significant ($p > 0.05$).

The prevalence of repeat breeding (12.76%) observed in this study is slightly comparable to the 13.8% reported by (Haile *et,.al*,2014) but higher than the 11.42% reported by (Hadush *et al*. 2013) in central Ethiopia. However, it is lower than the 15.9% prevalence reported by (Getachew and Nibret, 2014). Repeat breeding can result from various factors, including sub-fertile bulls,

hormonal imbalances, malnutrition, reproductive tract infections, and poor management practices such as incorrect timing of insemination, inadequate heat detection, improper semen handling, and faulty insemination techniques (Mandefro, 2014). The differences between this study's findings and those of previous studies may be attributed to these factors.

The prevalence of retained fetal membranes (RFM) in this study was 9.11%, which is slightly comparable to the 10% reported by (Fasil *et al*. 2016). However, it is higher than the 8.5% by Mitiku et al. (2022) and lower than the 21.3% found by Tadele et al. (2021) in Ethiopia. The variation in RFM prevalence could be attributed to differences in nutritional status, management practices (such as lack of exercise and poor sanitation), breed, service delivery, age, and parity. (Gashaw *et al*.2011) also highlighted dystocia and abortion as significant predisposing factors for RFM.

The prevalence of uterine prolapse in the present study was 1.04%, which is lower than the 3.44% reported by (Haile *et al*. 2014) and the 2.7% observed by (Benti,2014) in indigenous Borena breed cows in the Borena zone of southern Ethiopia. However, it is higher than the 0.56% prevalence reported by (Dawit and Ahmed 2013). This variation may be linked to the incidence of dystocia, which is a known risk factor for uterine prolapse.

The prevalence of abortion in this study was 2.86%, which is similar to the 2.9% reported by (Tulu and Gebeyehu, 2018) in different regions of Ethiopia. However, the prevalence in this study is notably lower than the 14.3% reported by (Deresa et al. 2020), 13.8% by (Tadele et al. 2021) and 17.8% by (Tulu and Negera, 2022). Additionally, it is lower than the 5.3% abortion rate reported by (Getachew and Nibret, 2014), but higher than the 1.00% reported by (Gashaw *et al*. 2011). These differences in prevalence may be attributed to factors such as breed, management systems (especially feeding and sanitation), study methodologies, and geographical location (Gashaw *et al.*, 2011).

In this study, the prevalence of dystocia was 3.39%, which is consistent with the 3.3% reported by (Tulu and Negera, 2022), but higher than the 2.3% reported by (Tulu and Gebeyehu, 2018). However, the current finding is lower than the 12.4% found by (Mitiku , 2022) in Ethiopia. The variation in these findings may be attributed to differences in factors such as the size of bulls used, the size of the fetus, and the birth canal of dairy cattle in the study areas. Other factors such as the age of the animals, breed, and parity may also contribute to the variation in the occurrence of dystocia. Inseminating cows with semen from large bulls or mating heifers with large bulls,

without considering factors like cow size, fetal oversize, twinning, or maternal health issues, can lead to a mismatch between the birth canal and fetus size, contributing to dystocia.

The prevalence of anestrus observed in this study (22.40%) is lower than the 10.26% reported by (Adane 2014) in southern Ethiopia and the 12.9% reported by (Hadush *et al*. 2013) in dairy cattle in Debre Zeit. It is also lower than the 37.8% prevalence reported by (Alemselam, 2015) in dairy cattle in Tigray, northern Ethiopia. These variations may be due to differences in factors such as age, heat detection methods, breed, management systems, and environmental conditions.

6. CONCLUSION AND RECOMMENDATIONS

The results showed that both local and crossbred cows had low reproductive performance, with significant breed differences, as local cows performed worse than crossbred cows according to reproductive performance indicators. The reproductive challenges identified in the dairy cattle of the study area included late age at first service and calving, as well as long calving intervals. The most prevalent reproductive health problem were anestrus, repeat breeding, and retained fetal membranes, while less common problems included dystocia, abortion, and uterine prolapse. Additionally, the study found that reproductive health problems were significantly associated with Shortage of feed and shortage of AI facilities was the major constraints affecting dairy reproduction system. Age, body condition, breeds and management system are some of risk factors identified for the occurrence of reproductive health problems in the study area.

Based on the above conclusion, the following recommendations are forwarded:

- Even though, the genetic makeup of local cows and cross breeds have both low reproductive performance crossbreed are better than local. Therefore, it is better to improve the genetic makeup by crossbreeding with exotic breeds.
- All parameters of management practice should enhance in order to improve the reproductive performance and health problems.
- The regional agriculture bureau should focus on enhancing non-genetic factors to improve the reproductive performance of local dairy cows, alongside genetic improvements.
- Awareness campaigns should be implemented for farm owners and attendants to improve dairy management practices, thereby increasing the reproductive efficiency of dairy cows in the region;
- Further longitudinal studies should be conducted to examine the relationship between risk factors, reproductive health problem and reproductive performance in the study area.

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8. APPENDICES

Questionnaire Survey for the Assessment of Reproductive Performance and Major Reproductive Health Problems the Associated of Risk Factors of Dairy Cows

Questionnaire used to collect data from farmers

Enumerator's Name_____ Date _____

1. Demographic Characteristics of the Households in the Study Area

Please circle the appropriate answer where applicable.

1. District _____ kebele _____

2. Name of household head: _____ sex _____ Age_____

3. Sex: - Marital status: - 1) single 2) Married 3) divorced 4) widow

4. Total numbers of household members including household head

No	Age Category (in years	No. of members in the household		
		Male	Female	Total
1	Below 25 years			
2	25-35 years			
3	36-45 years			
4	46-64 years			
5	>65 years			

5. What is your level of education? 1) Illiterate 2) Reading and writing 3) 1-4 grades

4) 5-8 grades 5) 9-12 grades 6) College/University

7. Type of farm: ----------Intensive ---------Semi-intensive ----------Extensive

8. Number of livestock by type, sex & age

No	Livestock Type	Sex type		Breed type		Total
		Male	Female	local	cross	
1	Calves					

2	Heifer					
3	Bull					
4	Dry cows					
5	Lactating cows					

Housing management

1. How do you house your animals?

   a. In separate house b. In the same house with family

2. What is the floor of the house made from?

   a. Soil b. concrete c. Other, specify

3. What is the roof made from?

   a. Thatch b. korkoro c. other, specify

4. Do you clean the house regularly? a. Yes b. No

5. If yes, what is the frequency of house cleaning? ----------

Progeny history survey

1. What is the breed of this cow? a) Local b). Crossbred

2. What identification method do you use for the cow?

   a. Ear tag, b. Name, c. Coat color, d. Other,

3. Age of cow? ----------

4. Body condition of the heifer and cows----------

5. How many cows and heifers in the farm? Cow ---------- heifer----------

6. What is the reproduction performance of the cows?

No	Reproduction Performance		Local cow	Cross bred cow
1	Age at first service (year)	a		
		b		
		c		
		d		
2	Age at 1st calving (year)	a	.	..
		b		

		c		
		d		
. 3	Calving interval (year)	a		
		b		
		c		
		d		
4	Day open (days)	a		
		b		
		c		
		d		
5	Number of services per conception	a		
		b		
		c		
		d		

7. Types of feed cows or heifers are fed:

a) Hay b) Straw c) Concentrate d) all

8. How many times do animals get feed per day?----------

9. What is the source of water for your animals?

a) River b) Pond water c) Well water d) Pipe water

10. How many times do you allow your animals to drink water in a day?

a) Once b) Two times c) Three times d) Other, specify

Breeding practices

1. Which breed of dairy cattle do you keep? a) Local b) Cross

2. What type of breeding practices do you prefer for your cows? a) Natural (Bull service)

b) Artificial insemination (AI) c) both

3. As a user of AI, do you get the service regularly and without interruptions? a. Yes, b. No

4. If your answer is to the above question is no, what is the reason for this?

a. Because the service is not available on weekends & holidays b. Because there is a shortage of AITs c. Because there is the shortage of inputs/liquid nitrogen, semen/ d. all of

the above

Reproductive problems

1. Which breed of dairy cattle do you keep? a) Local b) Cross

2. How many cows and heifers in the farm? cow---------- heifer----------

3.Did this cow encounter reproductive problems in the past?

a. Yes b. No.

4. If your answer is yes, list the local name or symptom of disease (Rank the most common first).

a) ----------

b) ----------

c) ----------

5. Did any of your cows suffer from abortion in the past? a) yes b) no

6. If yes, how many of your cows suffered from abortion? ----------

7. What is the local name for disease that causes abortion? If any ----------

8. Did any of your cows suffer from dystocia in the past? a) yes b) no

9. If yes, how many of your cows suffered from dystocia? ----------

10. What is the local name for disease that causes dystocia? If any ----------

11. Did any of your cows suffer from anestrus in the past? a) yes b) no

12. If yes, number of cows or heifers suffered from anestrus? _____

13. What is the local name for disease that causes anestrus? If any ----------

14. Did any of your cows or heifers suffer from vaginal, cervical or uterine prolapse in the past?

a) Yes b) No

15. If yes, number of cows or heifers with vaginal prolapse? _____; Cervical prolapse?_____ or uterine prolapse?_____

16. Did any of your cows encounter retained fetal membranes (RFM) in the past? a. Yes b. No

17.If yes, how many of your cows suffered from retained fetal membranes(RFM)? ----------

18. What is the local name for disease that causes retained fetal membranes (RFM)? If any ----------

19. How did you solve the problem?

_____

20. Have any of your cows or heifers been repeater (repeat breeder)? a. Yes b. No

21. If yes, how many of your cows suffered from repeat breeder? ----------

22. What is the local name for disease that causes repeat breeder? If any ----------

23. What measure did/do you take to get the animal----------

24. Did any of your animals come to estrus, but missed insemination or mating in the past?

a.Yes b.No

25. If yes, why was the animal not inseminated or mated?

a. Lack of bull b. Lack of AI technician c. Lack of means of communication to AI technician d. Called AI technician, but did not come to inseminate or did come very late e. Reproductive tract problem f. Size of the animal was very small to breed g. Lack of nutrition h. All or some of the above causes

26. Did any of your animals suffer from any health problem other than reproductive health?

_____

27. What is your future plan to improve the reproductive performance of your animals?

_____

28. Do you have any comment?

_____

Thanks!!

Good management farm and good body condition)

Medium management farm

Poor management farm and poor body condition