Journal Of Harmonized Research (JOHR)

Journal Of Harmonized Research in Medical & Health Sci.
3(1), 2016, 14-37

ISSN 2395 – 6046

Original Research Article

ASSESSMENT OF PROBLEMS AND CONSTRAINTS ASSOCIATED WITH ARTIFICIALIN SEMINATION SERVICE IN THE TWO SELECTED DISTRICTS OF ARSI ZONE

Tegenu Gizaw, Feyera Gemeda Dima

School of Veterinary Medicine, Jimma University, Jimma, Ethiopia

Abstract: Artificial insemination is recognized as the best biotechnological technique for increasing reproductive capacity and has received wide spread application in farm animals. A cross sectional study was conducted from November, 2014 to April, 2015 with the objective of assessing the problems and constraints associated with artificial insemination service in two districts of Arsi zone and coming to applicable recommendation. In this study, a structured questionnaire was used and 431 respondents (384 smallholder dairy farmers, 34 Animal health and production professionals (AHPPs) and 13 Artificial insemination technicians) were included. Retrospective data was also included in the study to evaluate the situation of AI service in the study site. According to the study result, 122(31.8%) of the smallholder dairy farmers have got AI service regularly without interruption while 262(68.2%) of them do not due to unavailability of AITs 108(28.1%), discontinuation of service on weekends and holidays 60(15.7%), high cost of service 87(22.7%) and lack of inputs 35(9.1%) with statistical significance between districts (P<0.05). Repeat breeding 287(74.6%), absence of service on weekends 60(15.5%), lack of easy access to animal health 240(60.5%), unavailability of AITs 108(28.1%), disease 327(85.2%), long distance 154 (40.1%), and high cost of service 87(22.6%) were the major identified problems and constraints of AI delivery system in the study area. 60.7 % of farmers take their caws to AI station to get the service while others use phone calling the AI technician. Generally, the questionnaire surveys indicated that artificial insemination service is not in good condition in both districts of the zone. Therefore, artificial insemination service requires urgent measures to change the situation to achieve success.

Key words: *Artificial Insemination, Dairy Cattle, farm owners, Problems, service.*

For Correspondence:
qafayera.game@gmail.com
Received on: March 2016
Accepted after revision: March 2016
Downloaded from: www.johronline.com

1. Introduction: Agriculture is the mainstay of Ethiopian economy employing approximately 85% of the total population [1]. Livestock production accounts approximately 30% of the total agricultural GDP and 16% of national foreign currency earnings [1].The total cattle population for the rural sedentary areas of

Ethiopia is estimated to be 43.12 million, of which 55.41% are females. Out of the total female cattle population, only 151,344 (0.35%) and 19,263 (0.04%) heads are crossbred and exotic breeds, respectively [2]. The indigenous cow average lactation length is 6 months and a daily milk production of 1.44 liters. This suggests that the total number crossbred female cattle were produced through crossbreeding for more than five decades in the country and the number is quite small. This again suggests that Ethiopia needs to work hard on improving the work of productive and reproductive performance improvements of cattle through appropriate breeding and related activities [2].

In order to improve the low productivity of local cattle, selection of the most promising breeds and crossbreeding of this indigenous breed with highly productive exotic cattle has been considered a practical solution [3]. Thus, the need for clear strategies on the improvement and maintenance of indigenous cattle genetic resources is required along with clear breeding programs for sustainable genetic improvement. To date, artificial insemination (AI) is recognized as the best biotechnological technique for increasing reproductive capacity and has received widespread application in farm animals [4].

In spite of the presence of large and diverse animal genetic resources, the productivity of cattle remains low in many developing countries including Ethiopia for various reasons such as inadequate nutrition, poor genetic potential, inadequate animal health services, and other management related problems. Cattle breeding are mostly uncontrolled and appropriate bull selection criteria have not been established in Ethiopia [5]. This uncontrolled breeding creates genetic improvement in cattle very difficult. Although artificial insemination, the most commonly used and valuable biotechnology[6].It has been in operation in Ethiopia for over 30 years, the efficiency and impact of the operation has not been well-documented.It is widely believed that the AI service in the country has not been successful to improve reproductive performance of dairy industry. From the previous, little study [7].AI service is weak and even declining due to inconsistent service in the smallholder livestock production systems of the Ethiopian highlands. The problem is more aggravated by wrong selection and management of AI bulls along with poor motivations and skills of inseminators [8].

It is therefore the objective of this research is to assess and identify problems and constraints associated with artificial insemination service, to share information for the better application on the sector and to recommend and give feedback to decision makers to appropriate and outermost action on the service in Tiyo and Sagure districts of Arsi zone.

2. Litrature Review

2.1. Cattle Production in Ethiopia

Ethiopia takes the lead in livestock population in Africa, with an estimated number of small and large ruminant populations of 40.3 million cattle, 20.7 million sheep and 16.3 million goats [9]. The livestock sector in Ethiopia has substantial contribution to the economy. Ethiopia’s economy is agriculture dependent and the role of livestock as farm input including traction and manure use is quite considerable. Despite the large number of livestock there has been a decline in national and per capital production of livestock and livestock products, export earnings from livestock, and per capital consumption of food from livestock origin since 1974. The per capital consumption in compared to other African countries is low [10]. Diseases in farm livestock have always been constraints of considerable importance to farmers. Due to lack of any recording system and extensive way production, information on diseases is not well documented. The measurement of the account of infectious diseases in a population assists in determining their importance and the efficacy of control campaign [11].The indigenous cattle breeds of Ethiopia have the capacity to cope with the harsh environmental conditions of the country. They often have special adaptive traits for disease resistance, heat tolerance and ability to use poor quality feed which they have acquired natural selection over several generations. Therefore, they need relatively less environmental modification to achieve high

productivity [12]. Despite this adaptation, *Bosindicus* cattle have some unique reproductive characteristics that contribute to low reproductive efficiency. Artificial insemination after estrus detection may be limited in tropical areas because *Bosindicus* cattle have short length of estrus behavior with high incidence of estrus occurring during the dark hours [13].On the other hand, temperate livestock breeds, although they have the genetic capacity for high production, their performance under the existing environment is not attractive, and they are not viable. The focus of breed improvement in Ethiopia so far has been through cross breeding of the local cattle with exotic breeds [14].

2.2. Reproductive Biotechnology and Artificial Insemination in Ethiopia: There are a number of reproductive biotechnologies being applied to transfer desirable genetic materials. These include artificial insemination, embryo transfer, and ovum pick-up, in- vitro fertilization and maturation, and cloning. Among these, only AI is the most commonly using technology in developing countries [15]. Artificial insemination (AI) has been defined as a process by which sperm is collected from the male, processed, stored, and artificially introduced into the female reproductive tract for the purpose of conception. Semen is collected from the bull, deep-frozen and stored in a container with Liquid Nitrogen at a temperature of -196^{0C} and made for use. Artificial insemination has become one of the most important biotechnology ever devised for the genetic improvement of farm animals. It has been widely used for breeding dairy cattle as the most valuable management practice available to the cattle producer and has made bulls of high genetic merit available to all [16].

In livestock rearing, the producer makes efficient use of the generous supply of sperm available from an individual male in a manner that greatly increases genetic progress, as well as improving reproductive efficiency in many situations. Today, many bulls have been reported to produce sufficient semen to provide enough sperm for 40,000 breeding units in one year. Using the long accepted standard of 10 x 10^6 motile sperm at the time of insemination with an average initial motility of 60% and a 33.3% loss of sperm during freezing and thawing, the number of breeding units would entail 1 x 10^{12} total sperm. The author also suggested that by using sexual stimulation and more frequent collections, many sperm have been obtained from most bulls in a year without adversely affecting conception rate. The use of AI in Ethiopia is growing but estrus detection is difficult owing to poorly expressed estrus of Zebu breeds have shown that the short duration and low intensity of estrus signs in Ethiopian Zebu cattle caused most estrus detection failures which indicates a need for the use of current advances in AI such estrus synchronization [16]. The national artificial insemination service mainly focuses on cattle to boost milk production and uses exotic and local semen as appropriate. Exotic semen includes Friesian and Jersey, while the indigenous include Fogera, Horro, Borena and Begait. Having recognized the importance of AI in dairy development, the government embarked on the technology at a wider scale and established the NAIC at Kaliti. The center was initially designed to accommodate 25-30 bulls at a time and AITs training center. The center operates semen processing laboratory and LN producing plants. From the total semen produced, the major share is from Friesian (75.3%) followed by Jersey (10.5%). NAIC is now the only center that produces semen in the country. On average, about 120,000 doses of frozen semen and 40,000-50,000L of LN are produced annually at Kaliti.[17].

2.3. Historical Development of Artificial Insemination:

The first successful AI was performed in Italy in 1780 and over 100 years later, in 1890, it has been used for horse breeding. In Russia, however, the method was first taken up seriously as a means of improving farm animals. According to Webb (2003), the history of AI is interesting in that old Arabian documents dated around 1322 A.D. indicate that an Arab chieftain wanted to mate his prize mare to an outstanding stallion owned by an enemy. He introduced a wand of cotton into the mare's

reproductive tract, and then used it to sexually excite the stallion causing him to ejaculate. The semen was introduced into the mare resulting in conception. The author further indicated that Anthony Van Leeuwenhoek, inventor of the microscope, first observed human spermatozoa under magnification, which led to further research. In fact, Spallanzani has been recognized as the inventor of AI. His scientific reports of 1780 have indicated successful use of AI in dogs. In 1899, Ivanoff of Russia pioneered AI research in birds, horses, cattle and sheep, and was apparently the first to successfully inseminate cattle artificially.Mass breeding of cows via AI was first accomplished in Russia where 19,800 cows were bred in 1931 [18].

Denmark was the first European country to establish an AI cooperative association in 1936. E.J. Perry of New Jersey visited the AI facilities in Denmark and established the first United States AI cooperative in 1938 at the New Jersey State College of Agriculture. The first artificial vagina (AV) was reportedly devised by G. Amantea, which was used to collect semen from the dog. In the years that followed, numerous Russian researchers developed artificial vagina for the bull, stallion, and ram. The method of semen collection using artificial vagina has been reported to be closest to the natural conditions and is assumed to yield the most normal ejaculate of all methods used. An attempt has been made to simulate the normal or best temperature, pressure, lubrication, and position to obtain the optimum response of the male. The AV consists of an outer rigid or semi-rigid support with an inner jacket containing controlled-temperature water and pressure and collecting funnel and container. In Ethiopia, AI was introduced in 1938 in Asmara (the current capital city of Eritrea), the then Part of Ethiopia, which was interrupted due to the 2nd World War and restarted in 1952. It was again discontinued due to unaffordable expenses of importing semen, liquid nitrogen and other related inputs requirement. In 1967, an independent service was started in the then Arsi Region, ChilaloAwraja under the Swedish International Development Agency (Sida). The technology of AI for cattle has been introduced at the farm level in the country over 35 years ago as a tool for genetic improvement [18].

The present National Artificial Insemination Center (NAIC) was established in 1984 to coordinate the overall AI operation at national level. The efficiency of the service in the country, however, has remained at a very low level due to infrastructure, managerial, and financial constraints, as well as poor heat detection, improper timing of insemination and embryonic death [19].Cattle breeding are mostly uncontrolled in Ethiopia making genetic improvement difficult and an appropriate bull selection criteria have not yet been established, applied and controlled. Although artificial insemination, the most commonly used and valuable biotechnology has been in operation in Ethiopia for over 30 years, the efficiency and impact of the operation has not been well-documented. It is widely believed that the AI service in the country has not been successful to improve reproductive performance of dairy industry [20]. From the previous little studies, it has been found that AI service is weak and even declining due to inconsistent service in the smallholder livestock production systems of the Ethiopian highlands. The problem is more aggravated by lack of recording scheme, wrong selection procedures, and poor management of AI bulls associated with poor motivations and skills of inseminators. Beside, reproductive problems related to crossbreed dairy cows under farmers' conditions are immense and significantly contributes to weak AI success in the country [21].

2.4. Advantages and Disadvantages of Artificial Insemination

2.4.1. Advantages of AI

AI is an essential technique in breeding programs with progeny testing. AI provides the opportunity to choose sires that proven to transmit desirable traits to the next generation and minimizes the risk of spreading sexually transmitted diseases and genetic defects. So far, AI using frozen semen has played an important role in increasing genetic progress by upgrading the reproductive rate of the male. It increases

the selection intensity since less bull is needed and this is the basis for selection progress [22].

One of the major advantages of artificial insemination is the elimination of the costs and dangers of maintaining a bull on the farm. The use of AI is the cumulative beneficial effects on dairy caws because of the opportunity of choosing sires that are proven to transmit superior genetic traits. The risk of spreading sexually transmitted diseases or genetic defects is also decreased when AI is practiced on a dairy farm. Natural mating allows transmission of venereal transmitting diseases like brucellosis, listerosis, leptospirosis, trichomoniasisetc between males and females. Some pathogens can be transmitted in semen through artificial insemination, but the collection process allows for the screening of disease agents. The progeny testing can be done at an early age. The semen of a desired size can be used even after the death of that particular sire. The semen collected can be taken to the urban areas or rural areas for insemination. It makes possible the mating of animals with great differences in size without injury to either of the animal. It is helpful to inseminate the animals that are refusing to stands or accept the male at the time of estrus. It helps in maintaining the accurate breeding and calving records and increases the conception rate. It helps in better record keeping. Old, heavy and injured sires can be used [22].Collected semen is also routinely checked for quality, which can help avoid problems associated with male infertility [23].

2.4.2. Disadvantages of AI

Artificial insemination requires accurate time of insemination to ensure the best chances of conception. The whole reproductive success of a stud farm can be reliant on the skills of inseminators and there is room for human error. Artificial insemination is a trained skill, taking a lot of time and practice to carry out efficiently and effectively each time. Because of this, a qualified vet or animal technician will be needed and these can be costly. Other disadvantages of AI include poor conception rates due to poor heat detection, low efficiency of AI technicians and dissemination of reproductive diseases. High cost of collection, processing, storage and transport of semen, as well as budget and administrative problems and inefficiency of AI technician is also another disadvantage of AI [24].

When receiving semen from other state or country, the timing becomes even more imperative, as it needs to arrive within the correct time frame to thaw out and place in the cow. AI can be quite labor intensive when it comes to lining up the cow to inseminate and so becomes costly due to regular vet checks. AI decreases the value of stock and increases chances of cattle being larger in bred [25].Artificial insemination can be limiting if the proper resources are not available, so there are some disadvantages. AI requires specialized knowledge, trained individuals, and the time required to properly execute an effective AI program is considerably more than with natural service. The extra help and time can often mean added expense [26].

2.5. Semen Collection and Assessment of Ejaculates

Semen collection has been considered like harvesting any other farm crop since effective harvest of semen involves obtaining the maximum number of sperm of highest possible quality in each ejaculate to make maximum use of sires. This involves proper semen collection procedures used on males that are sexually stimulated and prepared. The initial quality of semen has been determined by the male and cannot be improved even with superior handling and processing methods. However, semen quality can be lowered by improper collection and the processing techniques. Several methods of obtaining semen have been developed. Namely, use of artificial vagina, Electro-stimulation method and massaging the ampulae of the ducts differences through rectal wall. Among these methods, the artificial vagina method is most widely used today for the collection of bull semen [27].Cleanliness must be practiced to avoid contamination and deterioration of semen quality. Proper and careful treatment of the bull is essential to bring about adequate pre collection stimulation which will increase quantity and quality of semen obtained. Obviously the collection of semen

from a bull is a specialized skill and should be attempted only by those with the proper equipment, training and experience [28].

Monitoring of qualitative semen characteristics has been indicated to be an important function of the AI Laboratory. Seasonal and even daily fluctuations in a bull's seminal characteristics are possible. Therefore, to maintain a quality AI program constant vigilance is required. An integral part of this monitoring is an accurate system for keeping records of the bull's seminal quality. Such records document the bull's history of seminal quality and provide information on which to base production – related decisions [29].

Evaluations routinely conducted by the AI laboratory that have been used to determine whether the semen that is collected and processed for use could be used for practical purpose are screening tests for quality and number of spermatozoa in order to eliminate any substandard ejaculates. This initial screening also avoids wasting expensive supplies, antibiotics, semen extenders, etc., because substandard samples are not processed [29]. Semen that passes initial screening have been further extended, cooled, packaged into straws, and frozen. After freezing, a representative sample is normally thawed and evaluated using various laboratory tests. These post-thaw evaluations not only reflect the ability of the semen to with stand the processing conditions (process quality control) but also can give some indication of the potential fertility of the semen (fertility prediction). Assessing the progressive motility of the semen sample is probably the most common evaluation made for post-thaw viability [29].

2.6. Semen Dilution, Storage and Transportation

Semen is diluted in an 'extender'. This provides an appropriate concentration of spermatozoa, allowing more inseminations from each sample. A dilution of around 50 times is usual. The extender also nourishes and protects the spermatozoa during storage and distribution. Typically, the extender contains: milk or egg yolk to protect against cold shock; glycerol as a cryoprotectant; a buffer (usually citrate) to prevent pH changes; glucose (and/or other sugars) to provide an energy source for the spermatozoa, as well as the correct overall water potential for their survival; antibiotics, to kill pathogens. Semen is packed into the plastic straws and stored in liquid nitrogen at -196^{0}C. Each straw contains around 20 million spermatozoa. There is slow deterioration of the effectiveness of semen with time. For use, the straws are thawed in warm water for a few seconds before insemination to reactivate the spermatozoa. Frozen semen is transported around the world and domestically most commonly in 'dry shippers'. This is a shipping container that contains no free liquid nitrogen in the container whilst holding the semen at (-196^{0}C). This enables frozen semen to be transported without being as dangerous goods (Nelson, 2010).Freezing of semen for successful preservation of spermatozoa, for long period is of great importance in livestock breeding and farm management. There are two methods of freezing and storing semen: dry ice and alcohol (-73.3^{0}C) and liquid nitrogen (-195.5^{0}C). Frozen semen will not deteriorate in quality over time provided that the storage tanks are not allowed to 'go dry' [30].

2.7. Application of Artificial Insemination

2.7.1. Estrus and Estrus Detection

Estrus has been defined as a period when the female shows characteristic sexual behavior, such as immobility, raising the hind quarters or arching the back, pricking of the ears-features that are collectively termed lordosis in small laboratory animals; mounting and riding behavior between females is also common [30].

Heat detection is basic to reproductive success in artificially breeding herds, yet estrus detection rates have decreased in recent years. Reduced heat detection success tends to blamed on increased herd size and more cows per person, as well as higher milk production per cow. Higher milk production is related to negative energy balance, which occurs when cows simply cannot eat enough to replace body weight used to produce milk. Researchers have generally attributed delayed first ovulation and smaller follicle size factors contributing to reduced fertility rates to negative energy

balance. Part of the negative relationship between fertility and high milk production may be genetic. However, the genetic component in cow fertility performance tends to be small [31]. Worldwide there are reports that indicate low rate of service in artificially inseminated cattle, mainly due to problems in the detection of estrus. While few cows are detected in heat losses occur in significant herd reproductive efficiency, and commitment of the artificial insemination program. This commitment is even higher in *Bosindicus* cattle, whose breeding behavior has special features of heat of short duration with a high percentage of expression during the night [32].Both conceptions per breeding and heat detection efficiency increase when milk production increases. This indicates that producers can have greater milk yield along with good reproductive performance. Effective heat detection encourages a procedure to take advantage of the superior genetics available through AI [33].

2.7.2. Control of Estrus Cycle

The main reasons for estrus control are: induction of estrus in lactating dairy cows that are not observed in estrus by 45 days post-partum, synchronization of groups of heifers for insemination with semen of easy calving bulls, reduction of the time necessary for estrus detection, to facilitate the use of AI under extensive conditions, synchronization of donor and recipient cattle for embryo transfer and induction of ovarian activity in beef cows with lactation anoestrus. Although the estrus cycle of the female is mainly governed by hormones that are secreted internally, there are other factors that exert a considerable influence on it, either directly or indirectly. The extent of their influence varies both between and within species and breeds. Apart from the abnormality of disease the most important factors affecting estral cycle appear to be the plane of nutrition, the length of the day and ambient temperature. The inadequately fed female animal grows slowly and her sexual maturity, and hence the onset of her estral cycle, is delayed. Very large numbers of tropical cattle have to subsist on low level of nutrient intake for long periods during the year. As the consequence the first effective heat periods of heifers are often delayed until they are two years or older. Environmental factors such as high temperatures decrease estrus activities. Estrus behavior was greatest in dairy cows observed twice daily when ambient temperatures were less than 25^0C compared with temperatures above 30^0C (Todd, 2012). A combination of both visual observation and one or more of the detection aides increase the efficiency of estrus detection compared with visual observation or detection aides alone [34].

Heat synchronization is a slight modification of ovsynchronization. The ovsynchronization procedure involves the administration of GnRH seven days before an injection of PGF_2''. The injection of GnRH provokes either atresia or ovulation of antral follicles. PGF_2 then induces luteolysis of any luteal tissue, whether they are from a spontaneous ovulation or the GnRH-induced ovulation seven days earlier. OvSynchronization then utilizes a second injection of GnRH 48 hours later to provoke a timed ovulation. Heat synchronizations employs an injection of estradiol cypionate (ECP) 24 hours after the injection of PGF_2 rather than the second injection of GnRH. Heat synchronization then requires timed AI 48 hours later 72 hours after the injection of PGF_2[35].

The first results with ovsynchronization indicated that all non-pregnant cows could be enrolled into the protocol regardless of their stage during the oestrus cycle. To achieve success with these hormonal protocols, each farm has to develop a system to administer the correct injections to the correct cows on the correct days, then subsequently AI the correct cows. A standard pre synchronization /ovsynchronization protocol for submitting cows for first AI service requires that each individual cow receive 5 consecutive injections at the appropriate injection interval [36].

Protocols using GnRH and PGF_2 have afforded acceptable results in *Bostaurus* females (pregnancy rate 50%), but lower pregnancy rates have been reported for *Bosindicus* cows. However, a commercial source of estradiol is not available for oestrus cycle manipulation in many countries so other products (e.g. GnRH, LH, or HCG) have been used to induce

ovulation of dominant follicles and follicular wave synchronization. The mechanism by which GnRH induces new wave emergence is based on inducing ovulation of dominant follicles, and its success is dependent on the presence of a dominant follicle with ovulatory capacity at the time of treatment, which is acquired when ovarian follicles are 8.5mm in diameter in *Bosindicus* cattle [37].

2.8. Artificial Insemination and Fertility Rates

Fertility is measured by calving rate to first service for artificially inseminated dairy cattle. Conception rate at first breeding provides a useful estimate of the conception rate for a herd. However, it is a measurement that combines the effects of semen quality, fertility of the cow, timing of insemination, semen handling and insemination techniques, as well as factors such as high environmental temperature and stress. The number of services per conception is directly related to the conception rate in the [38]. Female fertility, male fertility, environmental factors, and techniques used in AI are the four general multitude factors that determine the ultimate outcome of conception per insemination. Female fertility refers to any factor directly related to the heifer/cow that may alter her probability of becoming pregnant, including condition of the reproductive tract, nutritional status, changes in body condition from calving to insemination, age, and breed [39]. Male fertility cannot be controlled by the dairy producers. The mean first service conception rate for Virginia Dairy Herd Institute herds over the past 12 months in USA has been found 40 ± 13%. In Ethiopia, Several factors have been reported to influence the number of services per conception. Breeding taking place during the dry season required more services per conception than the short and long rainy seasons. Management factors such as accuracy of estrus detection, timing of insemination, insemination technique, semen quality, skill of pregnancy diagnosis have been reported to affect number of services per conception [40]. In postpartum cows, the mean number of services per conception as 2.4 and 2.7 for sub clinical endometritis positive cows, fourth and eighth weeks postpartum, respectively as compared to 1.7 for sub clinical endometritis negative cows showing that sub clinical endometritis has a significant effect on number of services per conception [41].

This has been supposed to be due to the fact that incentives and bonuses which used to be given to AITs for each insemination resulting in conception was later stopped and subsequently resulting in increased number of services per conception. The role of incentives for inseminators is also well documented to increase reproductive efficiency [42].

Table 1: Relationship between conception rate and services per conception and between breeding per conception and level of fertility

Conception rate (%)	Service/conception	Level(breeding per conception)	Interpretation(Level of fertility)
95-100	1.0	Under 1.8	Excellent
87-94	1.1	1.8 to 2.0	Adequate
80-86	1.2	2.0 to 2.3	Slight problem
75-79	1.3	2.3 to 2.8	Moderate problem
69-74	1.4	Over 2.8	Sever problem.

Source:[43].

2.9. Factors Affecting success of Artificial Insemination

2.9.1. Semen Quality

When choosing a male for breeding, especially for AI, it is imperative to assess its potential fertility by undertaking clinical and laboratory examinations. The *in vitro* semen evaluation, complementary to the clinical examination, is of high diagnostic value for assessing testicular and epididymal function, and/or the genital tract of the male, allowing elimination of clear-cut cases of infertility, or potential sub-fertility [44].

Likewise, the degree of normality of the semen before being processed for AI can be analyzed. The semen analysis routinely includes an immediate assessment of volume, appearance (i.e. color, contamination, etc.), sperm concentration and motility, as well as later determination of sperm morphology and the presence of foreign cells [45].

Sperm Concentration: Accurate and precise determination of sperm concentration in an ejaculate is important for AI stations in order to produce uniform insemination doses containing an adequate number of sperm. A certain safety margin is often used by AI stations to ensure that all insemination doses contain a minimal number of sperm. This also implies that some insemination doses contain an excessive number of sperm and that males of high genetic value are not used efficiently. This safety margin also affects the average revenue per ejaculate for the AI station. The hemocytometer has often been referred to as the "gold standard" for assessing sperm numbers [46], [47], and [48].

Sperm Motility: Most frequently, the semen quality of dairy bulls and boars in AI centers is evaluated using sperm concentration and motility in fresh semen and motility in post-thaw samples for bulls. While some authors established a correlation between motility and field fertility, others did not [49].Good progressive motility of spermatozoa is an indicator of both unimpaired metabolism and intactness of membranes. Estimation of motility has fundamental importance in daily quality control of semen. The percentage of motile spermatozoa is used to calculate the required degree of dilution and to estimate the number of intact spermatozoa per insemination dose. It is recommended to estimate the different forms of motility, including proportions of progressive spermatozoa [50].

Sperm Morphology: Morphological abnormalities of sperm can have a detrimental impact upon fertilization and embryonic development [51]. Bulls and boars used for commercial AI are selected to a certain degree on the basis of a low incidence of morphologically abnormal spermatozoa, so that statistical calculations concerning their correlation with fertility are not very informative, although some evidence for a relationship between sperm morphology and fertility in bulls has been presented [52]. A complete morphological examination is recommended when bulls are introduced into the AI station and during subsequent regular routine examinations. Principles for determining sample size for morphological assessment of spermatozoa were extensively discussed by [53].A number of classification systems exist for morphological abnormalities of sperm, including primary and secondary defects, which classify sperm abnormalities on the basis of their presumptive origin; major and minor defects, a revised system where sperm defects are classified in terms of their perceived adverse effects upon male fertility, compensable and uncompensable[53].

2.9.2. Artificial Insemination Technician Efficiency

The site of semen deposition has been an important factor in the success of AI in cattle. Accurate placement is important for achieving good conception rates. Faulty insemination technique is a major factor causing low conception rate in many herds. Accurate insemination technique requires concentration, attention to detail, a clear understanding of reproductive anatomy and the ability to identify the target area and properly position the insemination rod [54].

2.9.3. Animal Health: Animal health is also the other constraints of AI service; it is challenged by a wide spectrum of disease which remains as one of the main constraints of livestock development in Ethiopia. Incidence of diseases such as Tuberculosis, Brucellosis, and Mastitis could increase with introduction of grade cattle [54]. Female reproductive tract diseases like indometritis results failure of conception. The success of AI depends upon various factors such as the efficiency, capacity and commitment of AI centers in procedurally and ethically producing, processing, handling and distributing semen; the commitments and efficiencies of AITs; presence of appropriate breeding policy along with proper control of indiscriminate

crossbreeding; proper heat detections by farmers and other factors [55].

2.9.4. Heat Detection and Timing of Insemination

Heat detection is basic to reproductive success in artificially bred herds. A frequent question concerning AI is: What time during estrus should cows is bred for greatest chance of conception? Since estrus may last from 10-25 hours there is considerable latitude in possible time of insemination. Maximal conception is obtained when cows are inseminated between mid-estrus and the end of standing estrus, with good results up to 6 hours after estrus. A successful heat detection program and subsequent proper timing of insemination will pay dividends in increasing reproductive efficiency [55].

Table 2: Showing proper timing of insemination

Cows showing estrus	Should be inseminated	To be late for good results
In morning	Same day	Next day
In after noon	Morning of next day or Early after noon	After 3pm next day

Source: (Webb, 2010).

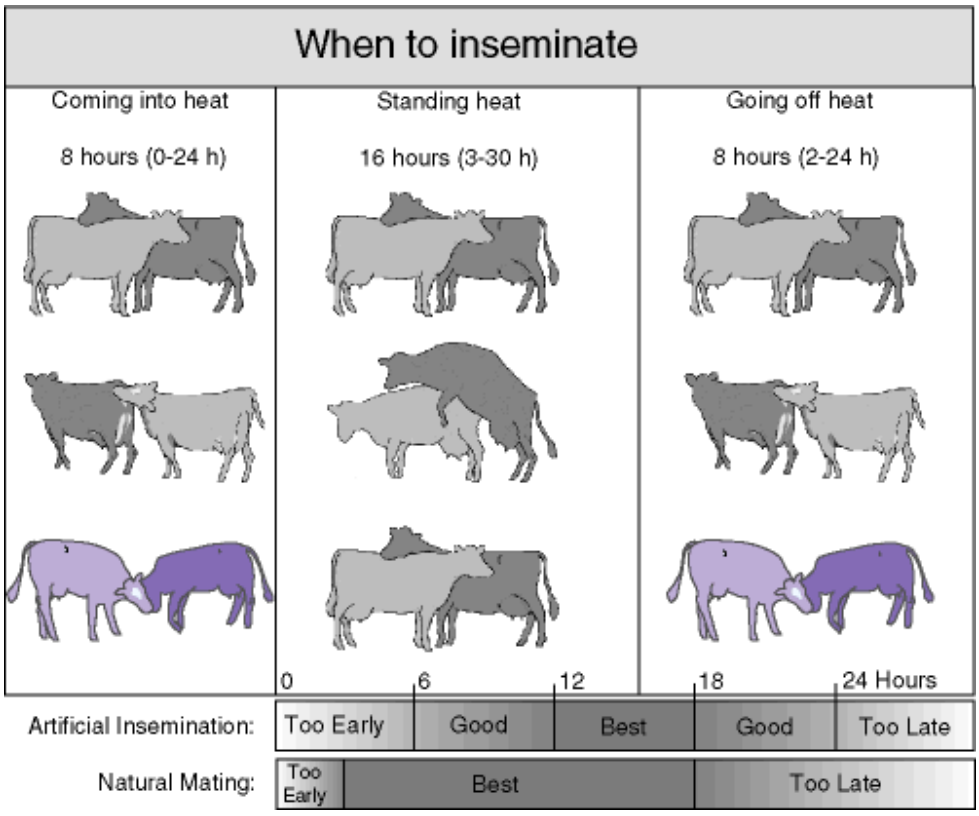

Figure 1: Showing timing of insemination or natural service for cows in heat**.**
Source: [56].

3. MATERIALS AND METHODOLOGY

3.1. Study Area

The study was conducted from November, 2014 to April, 2015 in urban and rural smallholder farmers in two selected districts (Tiyo and Sagure) of Arsi zone, Oromia regional state. Asella city is found in Tiyo district situated at $6^{o}59'$-$8^{o}9'$ N latitude and $38^{o}41'$-$40^{o}44'$E longitude in central Ethiopia and 175 km southeast of Addis Ababa. The ecology, topography and farming system of Sagure district is almost similar to Tiyo district. The altitude of the area ranges from 1780-3100 m and characterized by mid subtropical temperature ranging from 5^{o} c-28^{o} c. The annual average rainfall is 1,200 mm. The area covers 23,674.72 square Km and topographically has highland escapement and lowland areas. The high land areas are found centrally and the low lands dominate the periphery of the area. These study areas were purposively selected because these areas are the one where AI service is widely exercised in Arsi zone.

Mixed crop-livestock farming is the predominant production system in the rural area. The main livestock types kept in the area include cattle, sheep, goat, equines, and poultry. Cattle are used as a source of draft power, manure, milk, and meat. Local cattle are found all over the zone and there are crosses of Holstein-Friesian and zebu cattle in some places. The major livestock diseases prevalent in the area include black leg, pasteurolosis, dermatophilosis, mastitis, internal parasites, and lumpy skin disease. The main livestock feed source in the area are natural pasture, hay and crop residues like maize Stover and wheat straw. In the area, native pasture is the major source of feed for ruminants in the extensive management system.

3.2. Study Population

Artificial insemination (AI) personnel, animal health and production professionals (AHPPs) of the districts and smallholder dairy farmers in districts were represented in the study population. In addition to this, retrospective data was obtained from inseminator's recording book.

3.3. Study Design and Methodology

A cross-sectional study supported by questionnaire survey was carried out from November, 2014 to April, 2015 in the urban and rural smallholder dairy farmers in the selected districts of Arsi zone to evaluate Problems associated with Artificial Insemination in the study site. In questionnaire survey, questionnaire survey format was used and 384 smallholder dairy farmers, all artificial insemination technicians and all animal health and production professionals were interviewed accordingly. During the interview process, every respondent included in the study was briefed about the objective of the study before presenting the actual questions. Then the questions were presented to the respondents. Then after, the adjusted questionnaire was administered to the sampled households to collect information on the following attributes, such as challenges of AI service, the status of AI service, level of awareness of households and other stockholders about AI, perception of households about AI service and reasons for not using AI service, number of cattle inseminated, number of cow and heifers conceived, feed, health and housing management.

In the retrospective study, data was collected from records of AI service covering the period from 2011/12 to April, 2015. The data was obtained from inseminator's recording book. Thus, the number of cattle inseminated number of participatory farmers, number of pregnant caws and number of female and male calves born were recorded to evaluate the success rate and conception failure encountered at study site.

3.4. Sampling Procedure

In the sampling procedure, the two major districts, which are major users of AI service in the zone, were purposively selected to conduct the study. Smallholder dairy farmers were selected using systematic random sampling and all artificial insemination technician as well as all animal health professionals were included. A total of 384 dairy farm owners were randomly selected from small-scale dairy farmers of Tiyo and Sagure districts.

Table 3: Distribution of farmers, AITs, and AHPPs in the three districts

Category	**Districts**		
	Tiyo	Sagure	**Total**
No of farmers	197	187	**384**
No of AIT	9	4	**13**
No of AHPP	18	16	**34**

***Key*:** AIT=Artificial Insemination Technician, AHPP=Animal health and production professionals

3.5. Sample Size Determination

Sample sizes were determined by the following formula [10].

Total no of cows (n) = $Z_{\alpha}^{2} x \frac{p_{ex}(1-p_{ex})}{d^2}$

Where:

P (expected prevalence) = 0.5

d (desired absolute precision) = 0.05

$Z\alpha$ = 1.96.

Based on this formula, the total numbers of smallholder dairy farmers selected for questionnaire survey were 384. In addition, all animal health and production professionals (34) and all artificial insemination technicians (13) were included in the study site.

3.6. Data Management and Statistical Analysis: All data were entered in to Ms-Excel after completing data collection work from the two study districts. Then the analysis work was done using SPSS (statistical package for social studies) software version 22. The data was summarized using descriptive statistics such as mean and percentage and chi-square in order to assess the magnitude of the difference of comparable variables.

4. Results

4.1. Results of Farmers Questionnaire Survey

Smallholder farmers in the two districts rear local and crossbreed cattle. The distribution of local and crossbred cows in the two locations was found almost the same. However, the number of crossbred cattle exceed from the local cattle.Results of smallholder dairy farmers questionnaire survey revealed that among 384 of dairy farmers 48 (24.4%) in Tiyo and 74 (39.6%) in Sagure districts have got the AI service regularlyand without interruption while 149(75.6%) in Tiyo and 113(60.4%) in Sagure couldn't get the AI service regularly due to shortage of AITs, discontinuation of service on weekends and holidays, high cost of service, shortage of input and long distance with statistical significance between districts ($P<0.05$).

Table 4: Showing Artificial insemination service in WHS in the study site

Location	**WHS**			**X^2**	**P-value**
	Total	**Yes**	**No**		
Tiyo	197	93(47.2%)	104(52.8%)		
Sagure	187	79(42.2%)	108(57.8%)	**39.611**	**0.000**
Total	**384**	**172(44.7%)**	**212(55.3%)**		

***Key*:** WHS= Weekends and holiday service

4.1.1. The Results by which farmers communicate with AI technician

55.8% and 65.8% of respondents in Tiyo and Sagure districts respectively get the service at the AI station while 44.2% in Tiyo and 34.2% in Sagure districts get AI service at their farm through phone call to AI technicians. The on farm AI service is higher in Tiyo district as compared to service in Sagure district considering the behavior of the cow and distance of AI station with statistical significance between districts (P<0.05).

4.1.2. Results of Problems Identified on AI Service in the Study Site

The farmers in the study area are faced to many problems associated with AI service. These problems are listed below in table form.

Table 5: showing problems associated with AI service in the study site

Variables	**Response**	**Locations**		**X^2**	**P- value**
		Tiyo	**Sagure**		
AI service problem	Yes	170(86.3%)	179(95.7%)	**10.293**	**0.001**
	NO	27(13.7%)	8(4.3%)		
Problems	Long distance travel	66(42.9%)	88(57.1%)		
	Shortage of AITs	50(46.3%)	58(53.7%)		
	High cost of AI service	54(62.9%)	33(37.9%)		
	Input shortage	27(77.1%)	8(22.9%)	**18.871**	**0.000**
Repeat breeding problem	Yes	157(79.7%)	130(69.5%)	**5.263**	**0.022**
	No	40(20.3%)	57(30.5%)		
AI service satisfaction	Yes	61(31%)	85(45.5%)	**8.548**	**0.003**
	No	136(69%)	102(54.5%)		

4.1.3. Results of Awareness of AI Beneficiary on Time of Insemination

There was statistically significant difference (P<0.05) among the study districts in estrus detection and about 59.3% of smallholder dairy farmers have awareness about estrus sign so that they have got the service on time whereas the remaining 40.7% of farmers do not have awareness to detect the sign which contribute repeat breeding and conception failure.

Table 6: Awareness of AI beneficiary on time of insemination in the study site

When cows and heifers show heat at afternoon		**When cows and heifers show heat at morning**
Time of insemination	**No. of respondents (%)**	**No. of respondents (%)**
As heat sign is seen on it	72(18.8%)	77(20.1%)
Morning of the next day	210(54.6%)	-
As the technician ordered	102(26.6%)	61(15.9%)
The same day afternoon	-	246(64.1%)
Total	**384(100%)**	**384(100%)**

From total number of respondents, 234(60.9%) of them said that AI technology should rise even though it has some problems and constrains whereas 150(39.1%) of them argue that it should not be raised. when caws at heat fails to conceive at first service, 155(40.4%) of farmers use natural mating and the rest of them (59.6%) use AI again and again. Majority of smallholder dairy farmers (55.7%) in both Tiyo and Sagure

districts pass and wait for another twenty one days while 170(44.3%) use natural mating when artificial insemination technician are too late to come for servicing.

4.1.4. Results of Questionnaire Survey about Disease Condition in the Study Site

Animal health problem have negative effect in successfulness of AI service which could result conception failure. Health problem by which farmers faced with tentatively diagnosed are: mastitis 96(25%), reproductive problem 44(11.5%), external parasite infestation 33(8.6%), respiratory problem 120(31.2%), bloating 34(8.9%) and the remaining 57(14.8%) of respondents were free from animal health problem. While 37.5% of respondents get animal health service easily, 62.5% of them did not get the service easily.

Table 7: Diseases and animal health service in the study site

Variables	Response	Locations		X^2	P.value
		Tiyo	Sagure		
Animal health problem	Yes	158(80.2%)	169(90.4%)	**7.852**	**0.005**
	No	39(19.8%)	18(9.6%)		
Easy access to Animal health service	Yes	79(40.1%)	65(34.8%)	**1.168**	**0.280**
	No	118(59.9%)	122(65.2%)		

4.2. Results of Questionnaires of the AI Technicians

According to the results of questionnaires survey of the AITs showed that 15.4% of the AITs got semen obtaining problem on time, 30.7% of them got important equipment provision problem and 53% of them phased for transportation problem. Five (38.5%) of them responded that they never got on job trainings and other incentives at all. Seven (53.3%) of them were giving service on the weekend and holidays on personal agreements while 46.7% didn't give service because of no interest to do. 61.5% of the AI technicians responded that farmers did not report on time for insemination due to lack of knowledge in heat detection. All of the AITs confirmed that they started their careers as AITs after 1990 E.C. and the length of their training as well as the year they attended the AI- course varied even though, the training is not long enough which is from one to two month. Eight (61.5%) of them said that they do believe that they did not get the necessary support by the BoARD and district agriculture office to perform their duties appropriately with initiation. Eight (61.5%) of the AITs revealed that farmers are willing to pay more fees and the other did not because of conception failure and repeatedly breeding.

All of the AITs provide both stationed and mobile service delivery by using motor bike and they cover a maximum of 1-10 Km by 71.6% and 10-30 Km by 28.4% of them which is convenient for the service they deliver. The average numbers of cows being covered by AITs were ranged from 1-10 per day. However, all of them thought that the number of services varied between seasons.The most obvious heat sign that have practical importance used by AITs is mucus discharge from the vulva, bellowing, restlessness and reddening and swelling of the vulva. 85.6% of the technicians said that they checked for heat before they inseminated. Among thirteen AITs in the study site, seven of them perform pregnancy diagnosis in addition to AI servicing.

4.3. Results of Questionnaire Survey of AHPP: From 34 AHPPs in the study area where 29(85.2%) of them responded that there is no functionally effective responsible bodies at regional, zonal and district levels to coordinate the AI services and 35.7% of them confirmed that no proper mechanisms of controlling and monitoring artificial insemination service. Moreover, it was found that there are problems associated with the AI service as regards to properly carrying out responsibilities by the NAIC (12.3%) and the zone/ district agriculture bureaus (67.4%). 28(82.4%) of the AHPPs confirmed that there are no appropriate

collaborations and communications between the NAIC, regional, zonal, district and other stakeholders at all. In relation to this, 31.5% of them didn't have any information about the semen obtained from NAIC is believed to be the desired quality or not.

Twenty two (64.7%) of them said that, AI service is not a success at national regional and zonal level in general. Similarly, 23.5% of the respondents explained there is no any control mechanism employed in region, zone or district to evaluate semen for quality in terms of health, reproduction, etc. Animal health and production professionals raised inadequate budget allocation (10.43%), deficiency and irregular supply (liquid nitrogen and semen) of inputs (12.2%), shortage of AITs (39.1%), insufficient AI center (14.2%), insufficiency of concerned body support (11.2%) and poor awareness creation in dairy farmers about the AI service (13.5%) is the major problems associated with AI in the study area in particular. Similarly, 27(79.4%) of them confirmed that emphasis given to animal health in the study site is very low which result conception failure and repeatedly breeding causing reproduction and production problem. Less nitrogen plant center, lack of attention and incentives to AI technicians, limitation of inputs and facilities, shortage of AITs and poor collaboration of government bodies with NGO's, community and other concerned bodies are the major problems associated with AI in the country in general.

4.4. Retrospective Data Study Result

Retrospective data obtained from AIT recording book covering from year 2011/12- 2014/15 indicates an increment number of inseminated dairy cows from year to year in both Tiyo and Sagure districts. Similarly, as the numbers of dairy cows inseminated are increasing from year to year, the numbers of calves born are also increasing in relation to numbers of inseminated cows. Pregnancy diagnosis is also done well in both districts and identifies the pregnant from non-pregnant cows. The number of female calves born and male calves born varies. All inseminated cows did not conceive which could be due to reproductive problem of caws, technician inexperience, expired or abnormal semen and heat detection problem. In general, the result of this retrospective data revealed that the AI service at this study area is still weak as it is the area where service is started and it requires urgent measures to change the situation and to achieve a success.

Table 8: Retrospective data showing the number of dairy cows inseminated and calves born covering from year 2011/11-2014/15.

Districts			**Year of Insemination**				
			2011/12	2012/13	2013/14	2014/15	**Total**
Tiyo	No of caws inseminated		1506	1931	2521	3468	**9426**
	No of calves born	Female	212	273	144	426	**1055**
		Male	255	118	338	310	**1021**
Sagure	No of caws inseminated		1848	2118	2198	2329	**8493**
	No of calves born	Female	477	543	687	809	**2516**
		Male	482	572	684	774	**2512**

5. Discussion: Assessment of problems associated with artificial insemination services in Arsi zone was conducted on 384 smallholder dairy farmers,34 animals health and production professionals (AHPPs) and 13 artificial insemination technicians (AITs) supported by questionnaire survey in two different districts.A study result showed that high repeat breeding (74.7%) in the study districts is believed to be a serious problem. Problem of repeat breeders was also mentioned by farmers and hence needs to be seriously addressed. High numbers repeat breeders are the results of problems associated with poor semen quality, poor semen handling practices, poor insemination practices, poor heat detection and inappropriate time of insemination [57].

Way of communication systems and long distance travelling to AI beneficiary area make the AI service challenge full for some farmers. As a result transportation, telephone, infrastructure and other agricultural practice need further attention for the development of AI activity. Efficiency of AITs and input for AI activity were also serious problems for AI delivery system. A study result shows that about 31.8% of the AI users have got AI service regularly and 68.2 % of them didn't have continuous AI service due to shortage of AITs (28.1%), unavailability of service on weekends and holidays (15.7%) and shortage of inputs (9.1%) with significant difference between districts ($P<0.05$) which is greater and less than the study result reported by [23]. (27.7 % and 72.3%) conducted at Kaliti and Ephrem (2011) (3.2% and 96.8%) conducted at WolaitaSodo respectively. In this study, there was statistically significant difference in problems associated with the service ($P<0.05$) between the districts, this might be due to 28.1% unavailability of AITs, 40.1% long distance to get the service, 22.7% high cost of the service and 9.1% input shortage. Shortage of AITs could be due to uneven distribution of AITs and increment of dairy cattle and number of dairy cattle owners. Long distance problem was due to limited AI station constructed and are obligated to pay high cost when AITs are called to home for servicing in which in line with the findings of [23] and [58].

Almost both Tiyo and Sagure districts are on the same status in AI service use. The current study revealed that 44.3% AI beneficiaries use natural mating and 55.7% of AI users pass and wait for another 21 days for service when the AITs are too late for servicing and when the service discontinued due to different factors these were the possible solutions of AI users when the service discontinuous due to holiday and absence of AITs during time of onset of cows and heifers on heat which is greater and less than the result reported by Milkessa (2012) (20% and 78.6%) respectively conducted at Ambo. From 384 cattle owners only 146(38%) of respondents were satisfied and 238(62%) of them were not satisfied in AI service because (74.9%) of cows and heifers were passing without breeding. There was difference among the study districts in pass without breeding and used natural mating because, the assessment indicate that there were shortage of AITs and inputs and less service were given in weekends and holidays. This result agrees with the reasons identified as problems of AI by IAEA (2005), [59]. On the other hand, 144(38%) were satisfied in AI service, this result is greater than the reports of Zerihun*et al*., (2013) (30.83%)[60].

The major diseases reported in the study area were mastitis, external parasite infestation, gastrointestinal parasite, bloat, respiratory diseases and problems associated with reproduction with 85.2% which is greater than the result of [61]. (9%) and Milkessa (2012) (36.9%) for diseases prevalence as a whole. This variability could be attributed to differences in management practices, increment in cattle population owned by an individual and breed considered. There was statistically significant difference ($P<0.05$) among the study districts in estrus detection.[62].

About 59.4% of the dairy farmers detect their dairy cows by observing mounting of the cow on other animals, vulva discharge bellowing, swelling, redness and mucus discharge of the vulva, restlessness and nervousness, both restlessness and loss of appetite, and decreased

milk production. This study result is greater than the result reported byMilkessa[59]. (32.6). About 59.4% of AI beneficiaries inseminate their cows and heifers at the right time of insemination. Thus, when the cow shows heat sign at the afternoon of the day and morning, they allow their cow to be inseminated at early morning of the next day and late afternoon of that day respectively while 19.5% and 20.75% of smallholder dairy farmers allow the service as soon as the caw is in heat and as the AITs ordered respectively. This result is greater than the result reported by Milkessa[59].This difference is due to the awareness of the community when to inseminate the caw which is in heat. Due to poor perception about time of insemination, the AI beneficiaries exposed to loss of time, money and energy to perform AI at the allocated center repeatedly. Having profound knowledge and skill on aforementioned points the best recommendable insemination time to achieve maximum conception rate was at standing heat (more specifically, from the middle of standing heat to 6 hrs after standing heat) [63].Stationed, daily run and on call basis were the delivery system of the service in the study area with 23%, 38.5% and 38.5% respectively.

The outcome of the assessment of AI technicians regarding to the evaluation of the quality of training, (55.5%) of them evaluated as good, (31.3%) of them evaluated as very good and 13.2% of them evaluated as poor. seven (53.8%) of them responded that input availability including liquid nitrogen is poor, 2(15.4%) and 4(30.8%) of them responded as good and satisfactory respectively. Again, it was revealed that all concerned bodies is not giving proper attention to the AI service indicating that decision makers need to work hard to change the current situation of the AI operation at national level. Furthermore, the outcome of the study revealed that absence of appropriate collaboration and communications among the farmers, NAIC, regional, zonal, district concerned bodies and other stakeholders consequently contributed to the unsuccessfulness of the service.

The retrospective data result covering from year 2011/12 to April, 2015 indicates that, as number of AI users increasing from year to year, rational increment in the number of participatory farmers and the numbers of calves born also increasing in relation to numbers of inseminated cows. Even the numbers of AI users and calves born is increasing; the AI service at this study area is not at good level as it is the area where AI service was started. This is due to low attention to this sector, poor communication of concerned bodies and stakeholders, and lack of awareness of farmers about heat detection and overall management system.

The most outstanding constraints of AI service identified in this study area were absence of weekend and holyday work(55.3%), long distance to get service(40.1%), deficiency of inputs (9.1%), insufficiency of concerned body support (22.3%), repeat breeding (74.7%), shortage of AITs (28.1%), poor awareness creation in dairy farmers about the AI service (16.7%), disease (85.2%), high cost of service (22.7%), problem of conception failure and ways of communication of dairy cattle owners with AITs. Moreover, according to this study result 69% of the AHPPs confirmed there is no appropriate collaboration and communications between the farmers, NAIC, regional, zonal, district concerned body and other stakeholders at all and 95.8 percent of them and 97% of the AI technicians indicated that lack of attention and incentives to AI technicians, limitation of inputs and facilities, poor collaboration of government bodies with NGO's, community and other concerned bodies and lack of breeding policy were identified as other major problems. These findings are in agreement with the suggestions of [9] and [59].

6.Conclusion and Recommendation

According to the results of the study on assessments of problems and constraints associated with artificial insemination service in two districts of Arsi zone, AI service has been given low emphasis from concerned body though it is an important and the most widely practiced animal biotechnology all over the world. The success rate in the study site is still

very low due to a number of technical, financial, infrastructural and managerial and heat detection problems. Less than half (31.8%) of smallholder respondents have got the AI service regularly and without interruption and the repeat breeding situation was a very alarming finding (74.7%).The most important constraints and problems associated with AI service in the study site include lack of easy access to animal health, conception failure, AITs problem, long distance ,high cost of service when service is given at home, lack awareness of community, insufficiency of concerned body support, loss structural linkage between AI Center and service giving units, absence of collaboration and regular communication between NAIC, zonal, district and other stakeholders, lack of breeding policy, inadequate resource in terms of inputs and facilities, and absence of incentives and rewards to motivate AI technicians. Hence, it can generally be concluded that the AI service in the area is not satisfactory unless urgent corrective measures are taken on all concerned and responsible bodies in the study site.

Based on the problems and constraints identified in this study in regarding to artificial insemination service, the following are recommended:

- The linkage between federal, regional, zonal and district should be strong enough to encourage the AIT and farmers to increase the involvement of stakeholders in the activities of AI in the country;
- Develop compulsory training and refresher courses for AI-technicians to increase the efficiency of them at federal and/or zonal level to minimize artificial insemination failure;
- Awareness should be created by developing courses for farmers focusing on heat detection, time of insemination and herd management, etc to enhance their knowledge about AI service;
- The private sector should be encouraged to be involved in the AI service but with strong monitoring of them;
- Endeavors should be made to improve the current status of conception rates at large by improving the efficiency of AI and heard health;
- The government should provide motorbikes for AITs and animal health professionals to perform fast and active service for the community.

7. REFERENCE

1. Lobago, F. (2007): Reproductive and Lactation Performance of Dairy Cattle in the Oromia Central Highlands of Ethiopia with Special Emphasis on Pregnancy Period. **PhD Thesis**, Swedish University of Agricultural Sciences, Uppsala.
2. CSA, Central Statistics Agency, Federal Democratic Republic of Ethiopia (2006): Agricultural Sample Survey 2006/07, **II**. Report on livestock and livestock characteristics. Statistical Bulletin 388. Addis Ababa, Ethiopia. Pp. 9-10, 25- 27.
3. Tadesse, B. (2008): Calf Sex Ratios in Artificially Inseminated and Natural Mated Female Crossbred Dairy Herd. **In**: *Proceedings of the 13th annual Conference of the Ethiopian Society of Animal Production*. Addis Ababa, Ethiopia. Pp. 227.
4. Gizaw, M., Bekana, M. and Abayneh, T. (2007): Major reproductive health problems in small holder dairy production in and around Nazareth town, Central Ethiopia. Vet. Online Int.http://www.fourmilab.ch/rpkp/experiments/analysis/chiCalc.html.
5. Tegegn, A., Kassa, T. and Mukassa-Mugerwa, E. (1995): Aspects of bull production with emphasis on cattle in Ethiopia. **II**. Sperm production capacity and semen characteristics. In: Proceeding of the Third National Conference of Ethiopian Society of Animal production. Pp. 83-99.
6. Webb, D.W. (2003): Artificial Insemination in Cattle. University of Florida, Gainesville, IFAS Extension, DS 58. Pp. 1-4.
7. Dekeba, A., Ayalew, W., Hedge, P.B. and Taddese, Z. (2006): Performance of the Abernossa Ranch in the production of Ethiopian Boran x Holstein crossbred dairy heifers in Ethiopia. In: Ethiopian *Journal of Animal production***6:** 33-53.

8. GebreMedhin, D. (2005): All in one: A Practical Guide To Dairy Farming. *Agri-Service* Ethiopia Printing Unit, Addis Ababa. Pp. 15-21.
9. Tadesse, A. (2010): The status and constraints of AI in cattle in the three selected districts of WesternGojjam Zone of Amhara Region, Ethiopia. Department of Animal Production and Technology, College of Agriculture and Environmental Sciences, School of Graduate Studies Bahir Dar University. *Journal of Agriculture and Social Sciences*. ISSN printing 1813-2235; ISSN: 1814-960X. Pp. 103.
10. Thrusfield, M. (2005): Veterinary epidemiology. 3rd ed. Blackwell Science Ltd., Oxford, Great Britain. Pp. 182-198.
11. Azage, T., Berhanu, G. and Dirk, H. (2010): Livestock input Supply and Service Provision in Ethiopia: Challenges and Opportunities for Market-Oriented Development. IPMS, IRLI, Addis Ababa, Ethiopia.Pp.10-12.
12. Filho, O.G. and Vasconcelos, J.M. (2010): Treatments to Optimize the Use of Artificial Insemination and Reproductive Efficiency in Beef Cattle under Tropical Environments. UNESCO, SP, Brazil.
13. Million, T., Tadele, D., Gifawesen, T., Tamirate, D. and Yohannis, G. (2006): A study on age at first calving, calving interval and breeding efficiency of *Bostaurus*and *Bosindicus* and their crosses in the highlands of Ethiopia. *Ethiopian journal of animal production*. Debrezeit Agricultural Research Center, Ethiopia.**6** (2): 3.
14. FAO, (2000): The appropriateness, significance and application of biotechnology options in the animal agriculture of the developing countries. Electronics Forum on Biotechnology in Food and Agriculture.
15. Bearden, H.J., Fuquary, J.W.and Willard, S.T. (2004): Applied Animal Reproduction. 6thed. Mississippi State University. Pearson, Prentice Hall, Upper Saddle River, New Jersey 07458. Pp. 155-233.
16. Zewdie, E., Mussa, A., Melese, G.M., HaileMariam, D. and Perera B.M.A.O. (2006): Improving artificial insemination services for dairy cattle in Ethiopia. Improving the reproductive management of smallholder dairy cattle and the effectiveness of artificial insemination services in Africa using an integrated approach. International Atomic Energy Agency (IAEA). Pp. 17-19.
17. Shiferaw, Y., Tenhagen, B.A., Bekana M. and Kasa T. (2003): Reproductive performance of crossbred dairy cows in different production systems in the central highlands of Ethiopia. Trop Anim Health Prod.**25:** 551-561.
18. Sinishaw, W. (2005): Study on semen quality and field efficiency of AI bulls kept at the National Artificial Insemination Center. **MSc thesis**, Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit.
19. Bekele, T. (2005): Calf Sex Ratios in Artificially Inseminated and Natural Mated Female Crossbred Dairy Herd. In: proceedings of the 13th annual conference of the Ethiopian Society of Animal Production. Addis Ababa, Ethiopia, Pp.225-230.
20. IAEA, (International Atomic Energy Agency) (2003): Artificial Insemination of Cattle. Wagramer Strasse,Vienna, Austia. Availableat:http://www.naweb.iaea.org/nafa/aph /resources/technology-ai.html. Accessed on April o5,2015.
21. Chatikobo, P. (2009): Artificial Insemination in Rwanda.In: Exploring Opportunities, Overcoming Challenges, **III**. EADD, Rwanda, IRLI, Techno serve, ABSTCM and ICRAF.
22. Johnson, P. (2011): Artificial Insemination in Cattle. Available at: http://www.buzzle.com/articles/artificial-insemination-in-cattle.html. Accessed on April 05,2015.
23. Desalegn, G. (2008):Assessment of problems/constraints associated with artificial insemination service in

Ethiopia. **MSc Thesis**, Addis Ababa University, Ethiopia.

24. Shehu, B.M., Rekwot, P.J., Kezi, D.M., Bidoli, T.D. and Oyedokun, A.O. (2010): Challenges to Farmers' Participation in AI Biotechnology in Nigeria: *An Overview*. Ahmadu Bello University, Zaria.**14 (2):** 123-124, 126-127.
25. Gentry, A. (2010): Pros and Cons of Artificial Insemination in Cattle. Available at: http://www.ehow.com/about_5075461_ pros-cins-artificial-insemination- cattle.html. Accessed on March 12, 2015.
26. TNAU, (2008): Artificial Insemination. Available at:http://agritech.tnau.ac.in/animal-husbandry /animhus-cattle-AI.html. Accessed on April 22, 2015.
27. Webb, D.W. (2010): Artificial Insemination in dairy cattle. Available at: http: //edis.ifas.ufl.edu/pdffiles/DS/DS08900. pdf. Accessed on April 10, 2015.
28. Herman, H.A., Mitchell, J.R. and Doak, G.A. (1994): A Handbook and Laboratory Manual: The Artificial Insemination and Embryo Transfer of Dairy and Beef Cattle. IPP, Interstate Publishers, INC. Danville, Illinois. Pp. 3-7; 45-244.
29. Nelson, M. (2010): Cattle Artificial Insemination Techniques. Available at: http://www.ehow.com/list-6760227-cattle-artificial-insemination-techniques.html. Accessed on April 12, 2015.
30. Bekana, M., Gizachew, A. and Regassa, F. (2005): Reproductive Performance of Fogera Heifers Treated with Prostaglandin F2a for Synchronization of Estrus. *Tropical Animal Health and Production*.**37:** 373-379.
31. Murray, B. (2010): Dairy Cattle Reproduction. Heat Detection and Timing of Insemination. Ministry of Agriculture, Food and Rural Affairs.
32. Costal, L., Nelson A., Araujo A. and Feitosa, J.V. (2012): Artificial Insemination in Farm Animals. Particularities of Bovine Artificial Insemination,Federal University of Ceara, Brazil. Pp. 153-166.
33. Graves, W.M. (2009): Heat Detection Strategies for Dairy Cattle. Assebility statement. The University of George and Ft.Valley State University, the U.S.
34. Todd, R. (2012): Strategies to improve Reproduction during summer. Available at: http://www.extension.org/pages/62993/strategies-to-improve-reproduction- during-summer. Accessed on April 23, 2015.
35. Looper, M. (2000): When Should Dairy Cows Be Inseminated? College of Agricultural, Consumer and Environmental Sciences, New Mexico State University.
36. Kesler, D. J. and Steckler, T. L. (2002): Synchronization of Estrus with Heat sync. University of Illinois.
37. Fricke, P., Burstein, D. and Guenther, J. (2012): Artificial Insemination Techniques for Dairy Cattle Spanish and English. University of Wiskon. Available at: babcock.wisc.edu/node/289. Accessed on March 12, 2015.
38. Filho, O.G., Vilel, E.R., Geary, T.W. and Vasconcelos, J.M. (2009): Timed Artificial Insemination with GnRH and PGF_{2a}. Strategies to improve Fertility in postpartum Multiparous *Bosindicus*Cows Submittedto a Fixed-Time Insemination Protocol with GnRH and PGF_{2a}.
39. Smith J.F. and Becker D.A (1996):The reproductive status of your dairy herd. College of Agriculture and Home Economics, New Mexico State University.
40. Nebel, R.L. (2002): What should your AI Conception rate be? : Reproductive management.http://www.ext.vt.edu/news/periodicals/dairy/2002-05/aiconception.html
41. Shiferaw, Y. (1999): Fertility status of crossbred dairy cows under different production systems in Holeta, Central Highlands of Ethiopia. **MSc thesis**, Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit.
42. Bacha, B. (2007): Sub clinical endometritis and its effect on reproductive performance in crossbred dairy cows in DebreZeit. **MSc**

Thesis, Addis Ababa University, Faculty of Veterinary Medicine.

43. Nebel,R.L.(1998):YourHerd'sReproductive. Status.VirginiaTech.http://www.ext.vt.edu/pubs/dairy/404-005.html#l4
44. Abate, H. (2006): Evaluation of artificial insemination service efficiency and reproductive performance in North Gondar Zone,Ethiopia. **MSc Thesis,** Haramaya University, Haramaya.
45. Martin-Rillo, S., Martinez, E., Garcia Artiga, C. and De Alba, C. (1996): Boar semen evaluation in practise. Reprod Dom Anim**31:** 519-526.
46. Rodriguez-Martinez, H. (2003): Laboratory semen assessment and prediction of fertility:Still utopia? Reprod Dom Anim**38:** 312-318.
47. Saacke, R.G. (2008): Sperm morphology: Its relevance to compensable and 8uncompensable traits in semen. Theriogenology**70:**473-478.
48. Christensen, P., Stryhn, H.and Hansen, C. (2005): Discrepancies in the determination of sperm concentration using Burker-Turk, Thoma and Makler counting chambers. Theriogenology**63:**992-1003.
49. Kuster, C. (2005): Sperm concentration determination between hemacytometric and CASA systems: why they can be different. Theriogenology**64:**614-617.
50. Pérez-Llano, B., Enciso, M., Garcia-Casado, P., Sala, R.andGosalvez, J. (2006): Sperm DNA Fragmentation in boars is delayed or abolished by using sperm extenders. Theriogenology**66:** 2137-2143.
51. Tardif, S., Laforest, J.P., Cormier, N. and Bailey, J. (1999): The importance of porcine sperm parameters on fertility in vivo. Theriogenology**52:** 447-459.
52. Johnson, L.A., Weitze, K.F., Fiser, P. and Maxwell, W.M.C. (2000): Storage of boar semen. AnimReprodSci**62:** 143–172.
53. Wilson-Leedy, J.andIngermann, R. (2007): Development of a novel CASA system based on open source software for characterization of zebra and fish sperm motility parameters. Theriogenology**67:** 661-672.
54. Al-Makhzoomi, A.,Lundeheim, N., Håård, M.and Rodriguez-Martinez, H. (2008): Sperm morphology and fertility of progeny-tested AI dairy bulls in Sweden. Theriogenology**70:**682-691. Androl**25(2):** 255-264.
55. Kuster, C.E., Singer, R.S., Althouse, G.C. (2004): Determining sample size for the morphological assessment of sperm. Theriogenology**61:**691-703.
56. Chebel, R.C. (2010): Mastitis and BCS Loss Affects Fertility. **DVM Thesis**, Department of Veterinary Medicine, University of Minnesota.
57. Sharif, A., Umer, M. and Muhammad, G. (2009): Mastitis control in dairy production. *J. Agric.soc.sci*, Punjab, Lahore, Pakistan. **5:** 102.
58. Mikel, A.W. (2009): Heat detection, natural service and Artificial Insemination. University of Wisconsin-Madison.
59. Milkessa, G. (2012): Artificial Insemination Challenges and Impacts on Dairy Cattle in and around Ambo town. **DVM Thesis,** Jimma University, Ethiopia.
60. Zerihun, B., Malede, B. and Tewodros, F. (2013): Assessment on Problems Associated with Artificial Insemination Services in West Gojjam Zone, Ethiopia.*Advances in Biological Research*. ISSN 1992-0067, © IDOSI Publications, 2013, DOI: 10.5829/idosi.abr.2013.7.2.72142. **7** (2): 59-66.
61. Haileyesus, A. (2006): Evaluation of AI service efficiency and reproductive performance of f1 Friesian Crosses North Gonder zone. **Msc Thesis**, Alemaya University, Ethiopia.
62. Oscar, A. (2003): Comparison of three oestrus detection systems during summer heat stress in a large commercial dairy herd. **In**: *Dairy science*, June 12th, 2003, Blacksburg, VA99.
63. Zewde, E. (2007): Artificial insemination and its implementation. Ethiopian Society of Animal Production (ESAP). Addis Ababa, Ethiopia. Pp. 7-14, 29, 45.

8. ANNEXES

Annex 1:Questionnaire used to collect Information from Dairy Farmers

Address: Name_____, District _____, Kebele ____Farmers ID_____.

Q1. As a user of AI, do you get the service regularly and without interruptions?
1. Yes 2. No

Q2. If your answer is to the above question is no, what is the reason for this?
1. Because the service is not available on weekends & holidays
2. Because there is shortage of AITs
3. Because there is shortage of inputs
4. Long distance to get the service
5. High cost of service 6. All of the above

Q3. Do you get AI service on weekends and holidays?
1. Yes 2. No

Q4. If your answer to the above question is no, what do you do?
1. Pass the date without breeding the cow 2. Use NM

Q5. How do you communicate with AI technicians?
1. AITs visit us daily
2. We take our cows to the AI station
3. We call AITs when we need them

Q6. Would you mind raising the service charge?
1. Yes 2. No

Q7. If you say no for the above question, why?And if you say yes, why?

Q8. Are you aware of heat detection?
1. Yes 2. No

Q9. When should your cow, which came in heat in the afternoon, be inseminated?
1. As heat sign is seen on it 2. On the next day morning
3. As the technician ordered 4. When I am not busy

Q10. When should your cow, which came in heat in the morning, be inseminated?
1. As heat sign is seen on it 2. On the afternoon of the same day
3. As the technician ordered 4. When I am not busy

Q11. In relation to the above answer, what do you do if the AIT comes too late for insemination?
1. Get the service any way
2. Reject the service and wait for another 21 days
3. Use NM

Q12. If your cows do not conceive with repeated t inseminations, then what do you do?
1. Use AI again and again 2. Use NM

Q13. Have you faced any animal health problem so far in your dairy herd?
1. Yes 2. No

Q14. If your answer is yes to the above question, what problems?
1. Mastitis 2. Respiratory health problem
3. External parasite infestation 4. Internal parasite infestation
5. Bloating 6. Reproductive health problem

Q15. Do you have easy access to animal health?
1. Yes 2.No

Q16. Do you have any problem in using AI service?
1. Yes 2. No

Q17. If your answer is yes, what problems?
1. Shortage of AITs 2. Input shortage
3. Long distance 4. High cost of the service

5. Conception failure and repeat breading

Q18. How do you evaluate the AI technician in giving you the service?

1. Cooperative 2. Non-cooperative

Annex 2:Questionnaire used to Collect Information from AITs

Address: Name_____, District _____

Q1. When did you start your career as AIT?

Q2. Where did you attend your training as AIT?

Q3. For how long did you attend your training as AIT?

Q4. How do you evaluate the quality of training?

1. V.good 2. Good 3. Poor

Q5. What is the method of service delivery?

1. stationed 2. Daily run 3. On call basis

Q6. Do you get on- the- job trainings and other incentives?

1. Yes 2. No

Q7. Do you get semen on time? If no why?

Q8. From where do you get semen?

Q9. In relation to the above question, do you face any problem while obtaining semen?

1. Yes 2. No

Q10. Do you provide services on weekends and on holidays?

1. Yes 2. No

Q11. If your answer to the above question is no, why not?

Q12. How do you judge the overall availability of inputs including liquid nitrogen and other consumables?

1. Good 2. Poor

Q13 Do you think the NAIC is carrying out its responsibilities properly?

1. Yes 2. No

Q14. Do you think there is a proper mechanism of controlling indiscriminate insemination?

1. Yes 2. No

Q15. Do farmers report on time for inseminations?

1. Yes 2. No

Q16. Are farmers willing to pay more for the services provided they get reliable and quality services?

1. Yes 2. No

Q17. How do you judge the quality of semen you are getting?

1. Good 2. Satisfactory 3. Poor

Q18. Do you perform other duties/responsibilities?

1. Yes 2. No

Q19. If your answer to the above question is yes, does this type of work affect your work in AI?

1. Yes 2. No

Q20. Do you get the necessary support by the district agriculture office to the AI service?

1. Yes 2. No

Q21. Do you generally believe that AI is doing well in your area?

1. Yes 2. No

Q22. What is the average number of cows you are covering per day?

1. 1-10 2. 11-20 3.21-30 4.31-40

Q23. What distance in kilometers do you cover daily to deliver the service?

1. 1-20 2.21-30 3.31-40 4.>40

Q24. Which transportation system do you use?

1. Stationed 2. On foot 3.Motorbike 4. Car

Q25. Is AI service delivery consistent in your area?
1. Yes 2. No
Q26. Are you satisfied and happy with your job?
1. Yes 2. No
Q27. What do you think are the major problems associated with the AI service in your area?
Q28. Do you have any idea on how to improve the AI service in the future?

Annex 3: Questionnaire used to collect Information from Zonal/District Level MOA

(From Animal Health and Production Professionals only in relation to the assumed and responsibilities following them)

Q1. Do you think that there are functional and effective responsible bodies at regional and district level?
1. Yes 2. No
Q3. Is it necessary to have a national responsible body to coordinate the AI services?
1. Yes 2. No
Q4. Is there any control mechanism employed in your region, zone or districts to evaluate semen for quality in terms of health, reproduction, etc?
1. Yes 2. No 3. Unknown
Q5. Is the semen obtained from NAIC believed to be of the desired quality?
1. Yes 2. No 3. Unknown
Q6. Is it important to have a national breeding policy in place soon to assist the AI service?
1. Yes 2. No 3. Unknown
Q7. Is there a strong collaboration between the NAIC and your zone or districts and other stakeholders?
1. Yes 2. No 3. Unknown
Q9. Are there any problems regarding the AI service as regards to the NAIC?
1. Yes 2. No 3. Unknown
Q10. Are there any problems regarding the AI service with regard to the zone/district?
1. Yes 2. No 3. Unknown
Q11. Is AI doing well in your area in general terms?
1. Yes 2. No 3. Unknown
Q12. Is the AI service a success at national level in general and in your area in particular?
1. Yes 2. No 3. Unknown
Q13. What are the major problems associated with AI in your area in particular and in the country in general?
Q14. Is there any idea on how to improve AI service in the future?