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Research Article

Assessment of Artificial Insemination Service and its Challenge in Dairy Farms of Wolaita Sodo District, Southern, Ethiopia

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Abstract

Artificial insemination (AI) is a common practice in most dairy farms in Ethiopia. A cross-sectional study was conducted from October 2019 to January 2020, in Wolaita Sodo district to assesses the Artificial Insemination (AI) service and factors that hinder the success of AI in the dairy population. A total of 110 cattle owners and 40 experts were interviewed using a pretested and semi-structured questionnaire. The major challenges raised by cattle owners regarding the AI service were lack of AI service in the vicinity (25.45%), lack of awareness (20.00%), low pregnancy rate (19.09%), low efficiency (17.27%) and lack infrastructure (10.00%). Furthermore, the most commonly identified reason for the failure of the cow to conceive, according to the dairy owners were incorrect time of insemination (28.18%), heat detection problem (26.36%), lack of skilled technician (21.81%), management problem (14.54%), unhygienic condition (5.45%) and different diseases (3.63%). Out of the total interviewed expertise, insemination time (27.5%), management problem (22.5%), poor skilled of the technician (20%), heat detection problem (10%), disease problem (12.5%) and condition (7.5%) were the major problems that hinder the success of AI service in the study area. Thus, awareness should be created among animal owners and technicians through training and extension programs to address the problems.

Keywords: *Artificial Insemination; Challenges; Dairy Farms; Wolaita Sodo*

Introduction

Ethiopia owns the largest livestock population and the total cattle population for the rural sedentary areas is estimated at 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 hybrid and exotic breeds, respectively [1]. Besides, livestock production accounts for approximately 30% of the total agricultural GDP and 16% of national foreign currency earnings [2,3]. However, the contribution and overall production, as well as the productivity of the livestock sector, are low as compared to their potential. This may be due to their low genetic potential for a specific product or enough knowledge that is not available on the indigenous breeds [4-6].

Artificial insemination (AI) is one of the earliest perfected technology and the most commonly used valuable biotechnology has been in operation in Ethiopia for over the past 30 years. It is a process by which sperm is collected from the male, processed, stored, and the semen is artificially or manually placed into the reproductive tract of the female by a method other than natural mating [7,8]. Semen collected from the bull is deep-frozen and stored in a container with liquid nitrogen at a temperature of minus 196 degrees centigrade and made for use. AI has become one of the most important techniques ever devised for the genetic improvement of farm animals. It has been most widely used for breeding dairy cattle and has made bulls of high genetic merit available to all [5,9,10].

The use of AI in dairy cattle is a common practice in most countries around the world. The dairy industry utilized and implemented this technology at its inception, recognizing the various benefits of the industry. AI has found widespread use since its commercial development in the 1950s [11,12]. Besides, AI service provision is practiced in a different part of the southern region for many years. Nowadays, the service is given by many AI Technicians in different peasant associations (districts) and breeding units. The breeds of cattle used for cross breeding in the region at present are pure HF, Jersey, HF cross (50%), and pure local zebu breeds. Although the use of AI in the smallholder dairy sector has been minimal or non-existent, its potential to improve smallholder dairy productivity cannot be overemphasized [5,13].

The use of synchronizing estrus and AI has allowed for a larger pool for sire selection, increased calving ease, more uniform calf crop, shortened calving season, and reduced labor during calving season. The disadvantages are increased scheduling and cattle management, greater feeding precision, more processing animals through the chute, and recruiting a technician or becoming trained in AI [5,7]. Improvement in service provisions, such as AI centers within the vicinity of progressive dairy communities, development of market structures and promotion of "value-adding" to products such as fresh or fermented milk products and packaging can ensure a consistent flow of income to dairy farmer's households [13-15].

In Ethiopia almost all data used to evaluate breeding works, so far are from government ranches or research stations. Besides, there were few field studies made to evaluate the efficiency of AI service. Nevertheless, they are not representative of the farming condition in different towns and villages of the country. Furthermore, poor heat detection skills by the owner of the animal, inconsistent service and incorrect timing of insemination are some of the factors that limit the success of artificial insemination programs [5,16]. Wrong selection of AI bulls, poor motivations, and skills of inseminators are also factors that limit success rate artificial insemination service [7,10]. Artificial insemination service has been under progressive implementation in Wolaita Sodo town according to personal observation and data obtained from Wolaita Zone, Bureau of Agriculture and Rural Development. Moreover, there are only a few scientific studies undertaken so far to assess the efficiency of AI services and key challenges influencing its success in dairy cows managed under different production systems. Thus, the current study was conducted to assesses the Artificial Insemination (AI) service and factors that hinder the success of AI in the dairy population in Wolaita Sodo district.

Materials and Methods

Study area

The study was conducted from October 2019 to January 2020, in and around Wolaita Sodo town, Southern Nation Nationalities and People Regional, located at 390 km south of Addis Ababa. It is situated at the latitude of 8°50°N and longitude of 37°45°E with an altitude of 2025 meters above sea level. The study area has a mean annual temperature of 20°C and receives rainfall of 450 - 1446 mm [17].

Study farms and study population

The study farms were represented by smallholder dairy owners who were beneficiaries of artificial insemination service and its challenge in selected dairy farms in and around Wolaita Sodo city. Smallholder farmers could be defined as "those farmers owning small-based plots of land on which they grow subsistence crops and one or two cash crops relying almost exclusively on family labor". Besides, both dairy cows kept under extensive and semi-intensive production systems were purposively selected and considered for this study. The current study also includes Artificial insemination technicians (AITs), DA, animal health professional and dairy cattle owners from the woreda that represented in the human study population.

Study design and sampling technique

A cross-Sectional study design was employed using a semistructured questionnaire to assess the advantage and the major challenges of AI in the selected dairy farm found in and around Wolaita. A total of 150 participants were involved in the questionnaire survey and

were interviewed during the study. Out of the total 150 participants, 110 were smallholders' dairy owners and 40 were experts (AI technicians, animals health professionals and veterinarians) and asked accordingly. The farms were selected purposively based on locations of a dairy farm, volunteerism, accessibility and the presence of a sufficient dairy cattle population.

Study methodology

Method of data collection

The pre-tested semi-structured questionnaire was prepared and used to collect data through a face to face interviews using their local language 'Wolaitigna'. A purposive sampling technique was applied to collect data from different smallholder farms located in and around Wolaita Sodo city. In addition, the questionnaire paper was distributed for artificial insemination technicians (AITs) and animal health professionals to collect data on the status of AI service and major constraints associated with AI service. Before the commencement of the interview, every respondent was briefed about the objectives of the study. Then the questions were presented to the respondents for a quantitative study. The respondents were interviewed with both open and close-ended questionnaires.

Data management and analysis

All data collected from the questionnaire surveys and observations were entered into Microsoft Excel 2016 spreadsheets and analyzed using Stata version 13 statistical software. Descriptive statistics used to summarize the results frequency and percentage were used to determine the possible association factors.

Results

Artificial insemination service and its challenge in smallholder dairy farmers

According to the present questionnaire survey, out of 110 respondents, 25.45% of the respondents said that lack of the AI service in the vicinity was the most important challenge followed by lack of awareness (20.00%), low pregnancy rate (19.09%), low efficiency (17.27%) and lack of infrastructure (10.00%) were other constraints of AI in the study area (Figure 1).

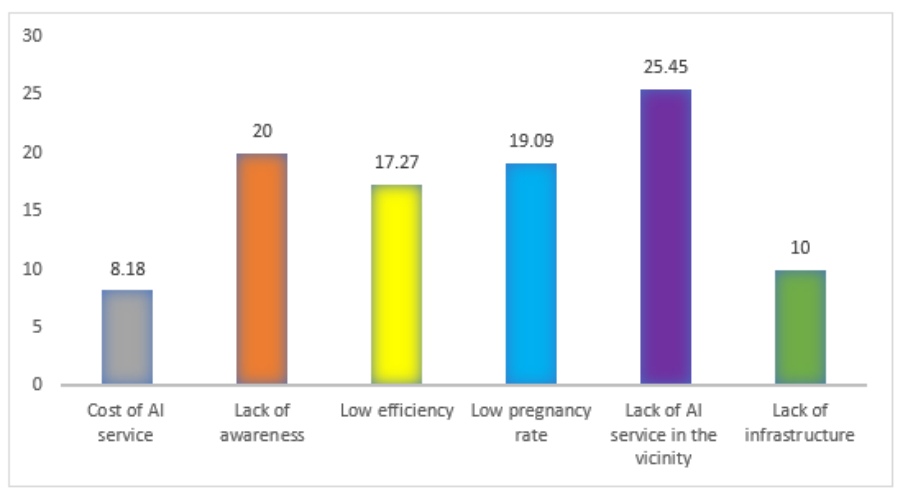

Figure 1: *Constraints of artificial insemination in the study area.*

Moreover, out of 110 respondents, 34.54% of them were satisfied with artificial insemination service and 66.46% were not satisfied with the AI service. Besides, about 28.18% of the respondents said that failure of timely insemination was the major identified reason for the failure of the cow to conceive followed by heat detection problem (26.36%), lack of skilled technician (21.81%), management problem (14.54%), lack of sanitation or unhygienic condition (5.45%) and disease (3.63%) were identified as other constraints of AI in the study site (Figure 2).

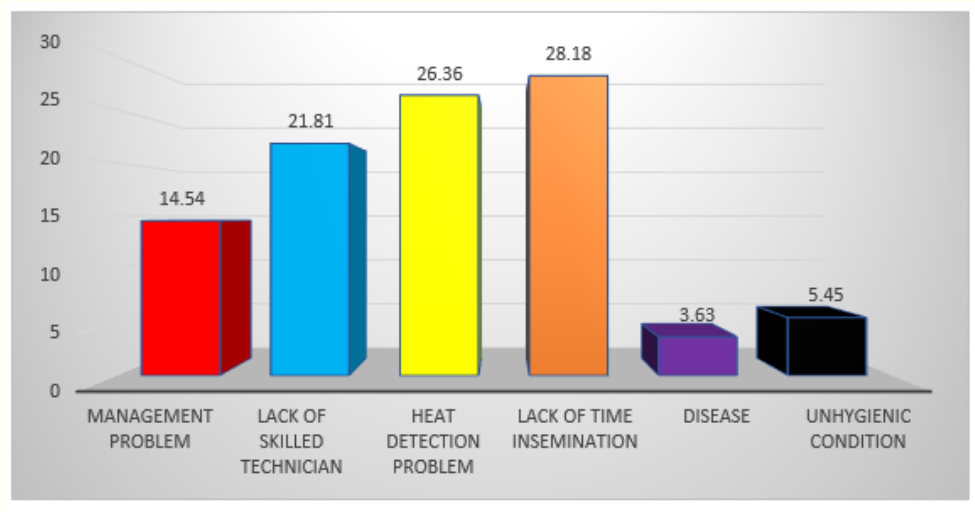

Figure 2: *Dairy owners response on reasons for failure of the cow to conceive.*

As shown in figure 3, 74.54% of the respondents kept their dairy cattle under a semi-intensive management system whereas 20% and 5.45% of the respondents kept their cattle under intensive and extensive management systems, respectively. Besides, most of the respondents (58.18%) do not provide enough supplementary feed to their dairy cattle.

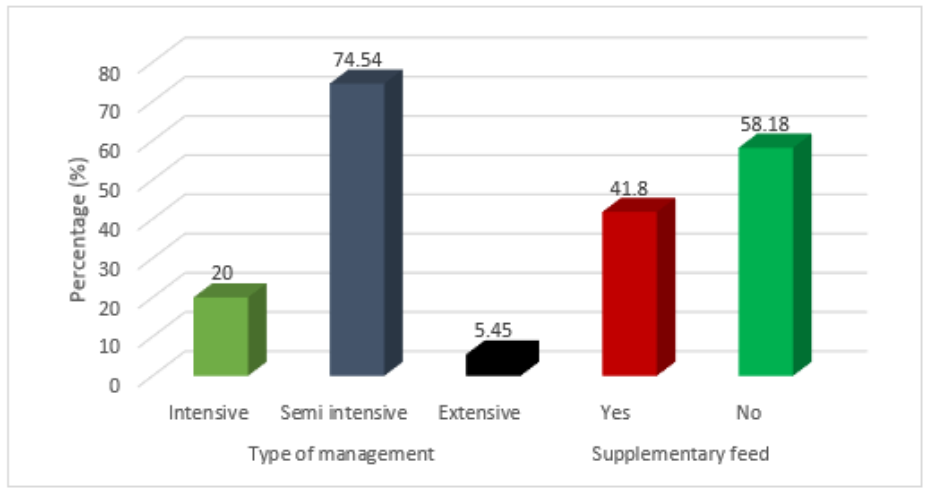

Figure 3: *Dairy farm management and supplementary feed provision of the respondents.*

According to the assessment, about 36.36% of the smallholders dairy owners detect cow on heat by observing signs like bellowing. Besides, mounting of the cow on other animals (28.18%), clean mucus discharge (15.45%), frequent urination (14.54%), swollen red vulva (12.72%) and mixed signs (8.18%) were other methods of heat detection in cattle by the dairy owners. Out of 110 smallholder respondents, 54.54% of the respondents used both artificial and natural, whereas 39.10% of them used AI service only, and about 6.4% of respondents used natural service. However, when they face repeat breeding problem in their animals, (51.8%) used both local and cross, (34.5%) uses local and (13.64%) uses crossbreed cattle (Table 1).

Cause	Categories	Frequency	Percent (%)
Type of breed	Cross	15	13.64
	Local	38	34.5
	Both	57	51.8
Method of estrus detection	Clean mucus discharge	17	15.45
	Standing mounting	31	28.18
	Frequent urination	16	14.54
	Bellowing	40	36.36
	Swollen vulva	14	12.72
	All the above mentioned	9	8.18
Technique of service	Natural	7	6.4
	Artificial	43	39.10
	Both	60	54.54

Table 1: *Knowledge related questions to animal owners on breed, heat detection methods and AI service.*

Artificial insemination service and its challenge in professionals

According to the present assessment, out of 40 expertise in the study area, 27.5% of the experts said that failure to timely inseminate cows has a great impact for the low conception rate of cow. Besides, management problems (22.5%), lack of skilled technician (20%), heat detection problem (10%) and disease (12.5%) are also important factors that hinder the success of conception (Figure 4).

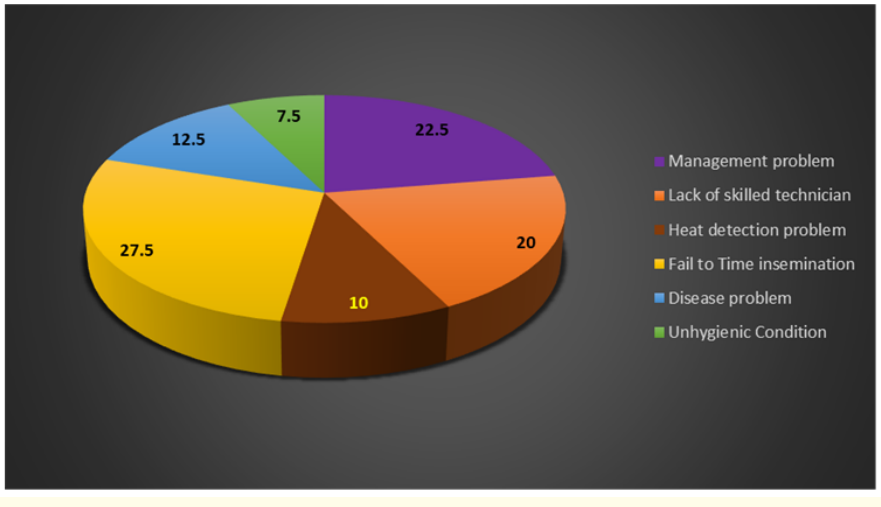

Figure 4: *Professionals response on reasons for the failure of the cow to conceive.*

As indicated in figure 5, about 25% of animal health professionals responded that a lack of AI service in the vicinity was the major problem. Moreover, low efficiency (20%), both lack of awareness and infrastructure (17.5%), as well as lack of incentive (15%) had also affected the success of AI service in the study area.

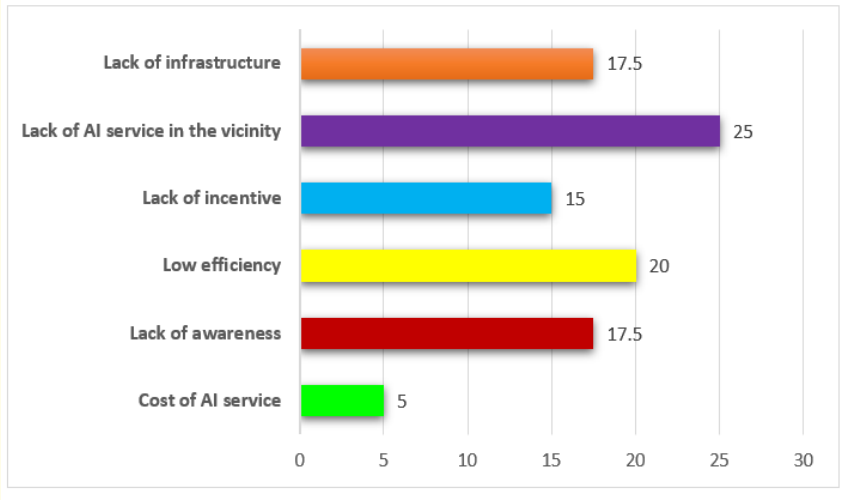

Figure 5: *Most important constraints of AI in the study area by different animal health professionals.*

Discussion

The current research result indicated that out of 110 respondents, 34.54% of the smallholder dairy farmers have got AI service regularly and were satisfied with artificial insemination service and 66.46% were not satisfied in the area. The current finding was comparable with the result of Kassa and Wuletaw [10] in Essera district which was 41% of the owner got AI service while 59% do not get AI service whereas this result is lower than the result reported by Gebremedhin., *et al*. [18] (27.7%, satisfied with AI service and 72.3%, not satisfied) and Kebebew and Bekele [7] (3.2% satisfied with AI service and 96.8%), in Adama towns. Furthermore, the current result showed that the satisfactory status is very low as compared to the study recorded by Ashebir., *et al*. [19] which was 27.6% dissatisfaction of the smallholders studied in the Tigray region. This might be due to the uneven distribution of AITs and the number of dairy cattle owners in the study area.

Out of the 110 respondents, 25.45% of the owners complained that a lack of AI service in vicinity or accessibility is the main constraints in the study area. This is because of small herds; disperse locations, limited production intensity, lack of means of communication, and lack of infrastructure like road, lack of motorcycles. About 28.18% of the respondents explained that the failures in the proper timing of insemination have also a great impact on failure to conceive after AI, this result is similar to the report of Samson [20] conducted in and around Addis Ababa.

Moreover, 26.36% of the respondents of the animal owner also explained that improper heat detection is responsible for the failure to conceive after AI. Because heat detection is key to reproduction success in artificially breeding herd's estrus detection rates have decreased in recent years. Reduced heat detection success tends to decrease herd size, this result is similar to previous reports by different authors in a different parts of Ethiopia [7,10,21].

According to the present questionnaire survey, out of the total respondents (110) in the study area, the majority of the respondents 74.54% uses semi-intensive farm management system followed by intensive (20%) and extensive (5.45%) management system and most of the respondents (58.18%) do not provide enough supplementary feed to their dairy cattle. Moreover, 8.18% of the respondents said that expensive costs were the most important constraints of AI in the study area. This result is comparable with the findings of Karihaloo and Perera [22]. This might be due to the higher AI costs as compared to those of keeping herd bulls and additional costs resulting from extended calving intervals because of low heat detection rates when AI is used.

According to the assessment, most of the smallholders dairy owners detect cow on heat by observing signs like bellowing (36.36%). In addition, mounting of the cow on other animals (28.18%), clean mucus discharge (15.45%), frequent urination (14.54%), swollen red vulva (12.72%) and all above-mentioned estrus sign (8.18%) are also other methods of detection by the dairy owners. The current finding was in agreement with the finding of Smith [23], Desta [24] and Risco [25] reported that accessing an AI service has many technical and logistic hurdles contributing to the failure of the timely service of estrous cows hence results in poor reproductive performance.

Out of 110 smallholder respondents, (54.54%) used both artificial and natural, whereas (39.1%) of them used AI service, and 6.4% of respondents used natural service. However, when they face repeat breeding problem in their animals, (51.8%) of the dairy owners used both local and cross bull for natural service of their cow, whereas (34.5%) uses local and (13.64%) uses crossbreed cattle. This finding is in agreement with Engidawork [26], Rodriguez-Martinez [27] and Zewdie., *et al* [28]. On the other hand, the most outstanding problems of AI delivery system in the study site were time insemination (28.18%), followed by heat detection problem (26.36%), not skilled technician (21.81%), management problem (14.54%), unhygienic problem (5.45%) and Disease problem (3.63%). This finding is lower than the finding of Nebel and Jobst [29] and Dalton [30].

According to the AI technicians in the present survey indicates that the most common factors responsible for the failure of AI are: lack of AI service in vicinity, lack of infrastructure and awareness regarding AI, both low efficiency and awareness were the main constraints encountered during service delivery. In most of the cases, the constraints of using AI service were described to have resulted from that lack of AI service in the vicinity (25%), both low efficiency (20%), lack of awareness, and lack of infrastructure (17.5%). The current result is comparable with the findings of Ashebir., *et al*. [19] that was conducted in Tigray region and reported that lack of awareness having own bull, lack of infrastructure and low conception rate in the proportions of (33.3%), (17.3%), (30.6%) and (18.6%) respectively.

Conclusion and Recommendations

Artificial insemination technology maximizes animals' productivity and produces individual sires with traits of superior quality through the use of outstanding males, disseminating superior genetic material, improvement of the rate and efficiency of genetic selection, introducing new genetic material by the import of semen rather than live animals and enables the use of frozen semen even after the donor is dead. It also reduces the risks of spreading sexually transmitted diseases. According to the results of this study, many constraints are responsible for the unsuccessful AI program in the study area Among these, the most important constraints associated with AI in area includes time of insemination, lack of AI service in vicinity, heat detection problem, lack of technician, unskilled technician, and lack of awareness about AI. Besides, loss of structural linkage between AI center and service giving units, absence of collaboration and regular communication between dairy owner and AI technicians lack of breeding policy and herd recording system inadequate resource in terms of inputs and facilities, absence of incentives and rewards to motivate AI technicians are also considered as main challenges for the sector. Thus, all these contributes to different problems such as poor production systems, inadequate financial profit, and keeping animals without conceiving for many months or years with additional cost for these animals. Hence, awareness should be created among animal owners and attendants through training and extension programs. Whereas, private sectors should be encouraged to be involved in the AI service sector.

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