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Assessment of the Efficiency of Artificial Insemination Supported by Estrus Synchronization of Dairy Cows in East Gojjam Zone, Ethiopia

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Abstract The study was conducted to assess the breeding practices of dairy cattle in Dejene, Lumme, and Machakel districts. In the study, the effectiveness of prostaglandin hormone was evaluated, and different factors that affected pregnancy in synchronized cows were detected. The study was conducted using a questionnaire survey and a participatory group discussion method. A total of 180 households participated in the interview. A structured questionnaire to describe qualitative and quantitative traits was used. 180 cows or heifers were injected with prostaglandin hormone to evaluate its effectiveness based on estrus induction, conception rate, and number of services per conception. Descriptive statistics, frequency distribution procedures, and the chi-square test were used. The results of the survey indicated that the mean herd size of cattle per household was 7.43 + 0.30, 6.20 ± 0.58, and 6.25 ± 0.69 in Dejene, Lumame, and Machakel districts, respectively. About 12.7%, 11.4%, and 25.1% of the respondents practiced AI technology in Dejene, Lumame, and Machakel, respectively, while 3.3% of the respondent's practiced hormone plus AI technology only in Dejene and Lumame. On the contrary, about 7.1%, 7.1%, and 10.5% practiced hormones with AI in Dejene, Lumame, and Machkel, respectively. The primary objective of keeping their livestock milked in all the districts. About 66.7%, 61.7%, and 1.7% had a low perception concerning estrus synchronization practiced in the area.

Keywords Breeding practice, Estrus synchronization, Dairy

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1. Introduction

Ethiopia has the largest livestock population in Africa, with 65 million cattle, 40 million sheep, 51 million goats, 8 million camels, and 49 million chickens (CSA, 2020a). The contribution of livestock and livestock products to the agricultural GDP of Ethiopia accounts for 40 percent, excluding the value of draught power, transport, and manure (Kedija *et al*., 2008).

Unlike other African countries, such as Kenya, the large cattle population of Ethiopia has relatively limited numbers of exotic dairy cattle and their crosses. According to CSA (2016), 98.58 percent of Ethiopia's cattle have been reported to be indigenous breeds that are poor in major economically important traits. Consequently, productivity and production have remained low.

In order to improve the low productivity of the indigenous cattle breeds, selection of the most promising and crossbreeding of the indigenous breeds with high-producing exotic cattle has been considered a practical solution (Mekonnen *et al*., 2010). One of the most effective ways to improve both reproductive performance and genetic performance is by utilizing superior species through artificial insemination combined with estrous synchronization (Tadesse, 2011).

Estrus synchronization programs improve reproduction efficiency by reducing the length of breeding and calving seasons and increasing calf weaning weights (Gupta, 2008). Any estrous synchronization protocol's primary goal is to induce a compact estrous response, enabling cattle to inseminate at a predetermined time period with acceptable fertility (Noseir, 2003).

The efficiency of smallholder farmers to detect estrus, the success rate of AI, estrus synchronization, and the skills of the AI technicians have recently been questioned. In order to shed light on these issues, it is very important to carry out a comprehensive study with a systematic and detailed collection of information regarding the framer's management condition. Animal performance and application of the AI technique, estrus synchronization, and signs of heat expression are paramount to enabling the identification of AI, estrus synchronization efficiency, and limiting factors of AI service efficiency in smallholder farmers. Although there have been several technology adoption studies undertaken in East Gojjam, no detailed work has been done on artificial insemination, estrus synchronization efficiency, or the or the reproductive performance of dairy cows. Therefore, based on this problem, the objective is to assess the efficiency of estrus synchronization on the reproductive performance of dairy cows under farmer's management conditions.

2. Materials And Methods

2.1. Description of Study Area

The study was conducted in the three districts of East Gojam Zone (Dejene, Lumame, and Machakel). It is 298 km from Addis Ababa and 265 km from the capital city, Bahir Dar. The farming system practiced in the study area is a mixed crop-livestock production system. The area consists of different livestock compositions. According to CSA (2016), the study site had 1.96 million cattle, 1.37 million sheep, 508,984 goats,102,003 horses, 420,535 donkeys, 20,908 mules, 1.58 million poultry, and 151,047 beehives.

2.2. Sampling Procedures

The preliminary information was taken from the report of the zonal consultation and rapid assessment in the selected area. Secondary information from district and zonal agricultural and rural development offices was used to select the targated kebeles. During the questionnaire survey, household structure, land holding size, herd size, purpose of livestock rearing, livestock feed types, and mating system data were collected. Information on the management systems, breeding practices, presence of repeat breeding and synchronization, the objective of keeping cows, and the important trait that dairy farmers rear dairy cattle were also collected. A total of nine kebeles were identified from three districts, taking three kebeles from each district. Three kebeles were selected based on milk production, AI practice, accessibility and availability of livestock, and availability of infrastructure. A total of 20 farmers from each kebeles were selected randomly from the list of farmers who had five dairy cows as a cutting point based on the same criteria. In three districts, a total of 180 respondents were selected for this study. To collect the data, a structured questionnaire was used.

A group discussion was used for collecting the data and for verification of the data collected during the questionnaire survey. The targated populations of group discussion were women, village leaders, and social leaders, individuals who are known to have better knowledge of the present and past social and economic status of the area. The perceptions of the farmers about synchronization, the source of AI and synchronization, and the and the major problems associated with AI and synchronization were collected.

2.3. Methods of Data collection

The data collected for this study came from both primary and secondary sources. A semi-structured questionnaire was administered to 180 respondents to collect data on the perceptions of the farmers who participated in previous mass synchronization programs. Village development agents, zonal land districts, agriculture offices, animal health offices, and production employers were included in the assessment. The interview also included whether estrus synchronization was practical or not, which hormones had been used, the amount and frequency of hormones given to the cow, the period of last birth, how the follow-up was to detect estrous synchronization, the interval between the last treatment (hormone administration) and artificial insemination, and the response of AI in terms of productivity (becoming pregnant or not).

Group discussions were held in three groups (one from each study area), with the recommended group size (8–10) encompassing different social segments. A focus group discussion was also practiced with extension workers, elderly female and male members of society who are known to have better knowledge on the present and past social and economic status of the area to strengthen the reliability of the survey.

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2.5. Methods of Data Analysis

The data collected during the study were the body condition score of the animals, parity of the cow, date of hormonal administration, date of heat detection, date of insemination, time of insemination and treatment, and date of conception. All the collected the collected data was fed to Microsoft Excel (2010). The data were analyzed using statistical Analysis System software (SAS, version 9.2). Descriptive statistics were employed todescribe qualitative variables. Data on estrous rate and conception rate were analyzed using frequency distribution (SPSS version 20). A chi-square test was employed to test the effect of classification variables on estrous rate and conception rate. The survey of quantitative data was analyzed using the General Linear Model Procedure (univaraite), and the qualitative data were assessed using nonparametric tests (chi square/$\chi 2$). Index analysis was used to calculate the ranking for the purpose of keeping livestock and trait preference according to the method suggested by Kosgey (2004). The ranking was expressed as an index = the sum of (5 times first order + 4 times second order + 3 times third order + 2 times fourth order + 1 times fifth order) given for individual variables divided by the sum of (5 times first order + 4 times second order + 3 times third order + 2 times fourth order + 1 times fifth order) for all variables.

3. Results And Discussions

3.1. Household Characteristics of the Study Districts

The major household characteristics of the respondents are shown below in Table 1. On average, the majority (80%) of the total respondents were male-headed households, and the rest (20%) were female-headed households. The proportion of female-headed households was higher in Dejene than in the other two districts (Lumame and Machakel). This result is nearly similar to the report of Zewdie (2010) and Fekede*et al*. (2013) about 86.7% male, 13.3% female in the central highlands, and 84.4% male, 16.6% female. The overall average age of the respondents was 40 years, and it ranged from 20 to 60 years. There was a significant difference in the average ages of the respondents in the Machakel district compared to Dejene. The overall average family size of the responding households in all the study areas was 7 persons and ranged from 2 to 14 persons.

Variables	Districts	Overall (N=180)		
Sex	Dejene (N=60)	Lumame (N=60)	Machakel(N=60)	Over all mean
Male %	75.0	85.0	80.0	80.0
Faemale%	25.0	15.0	20.0	20.0
Total %	100.0	100.0	100.0	100.0
Family size	6(2-12)	8(2-16)	7.5(2-15)	7(2-14)
Age of household				
Average age				
Below 25 yr%	7.1	4.5	3.6	5.07
25yr to 35yr%	14.3	19.5	10.7	14.84
36 yr to 45y%r	39.3	40.6	39.3	39.74
46 to 65yr%	39.3	35.3	42.9	39.18
Over 66yr%	-	-	-	-
Total %	100	100	100	100

The educational level of the respondents ranged from illiterate to those with greater than grade 12 education. Based on Table 2 below, overall, 40.3% of the respondents were illiterate, and 59.7% had attended different levels of formal education. About 60% of AI service users and 70% of bull practitioners in Dejene attended formal education. In addition, about 50% of uncontrolled bull service user respondents were illiterate in Dejene. As indicated below in Table 2, 50% of AI users and 65% of controlled bull service practitioners attended formal education in Lumame. However, about 55.5% of uncontrolled bull service practitioners among respondents attended formal education in Machakel. About 40% of AI service users' and 30% controlled bull service practitioners of respondents were illiterate in Dejene. From formally educated AI users, Dejen had a higher number of respondents than Machakel and Lumame, whereas Machakel had a higher formally educated uncontrolled bull service practitioners than Dejene and Lumame. Based on the research findings, the level of education of dairy farmers was an important determining factor for the adoption of new technologies and the overall intensification of dairy production. In general, of the overall AI user respondents, 56.67% and 43.33% were formally educated and illiterate, respectively. Gebremikael (2015) revealed that 42.77%, 22.22%, and 35% of interviewed households used artificial insemination, artificial insemination with estrus synchronization, and natural mating, respectively. About 19.40% of urban farms and 44.24% of rural farms depended on natural and uncontrolled mating systems. The participation of the majority of farmers in the study synchronization program implied that they were interested in dairy cattle synchronization technology at the beginning of the program. While non-participation was seen as a lack of information about the technology, which indicates a limitation in information dissemination and the need for extension work prior to the implementation of new programs, Access to extension services creates a platform for the acquisition of relevant information that promotes technology adoption **(**Getaw*et al.,*. 2017).

Table 1. The education level of households that practicing different mating types

Type of breeding system	Dejene		Machakel		Lumame		Overall		*P value*
	Iillitrate	Formal edu	Illitrate	Formal edu	Illiterate	Formal edu	illiterate	Formal edu	
Controlled Bull scheme (%)	54.5	45.5	29.4	70.6	65	35	50.0	50.0	0.01
AI services (%)	70	30	40	60	40	60	50.0	50.0	
Hormone +AI (%)	30	70	50	50	50	50	43.33	56.67	
Bull scheme and hormone +AI	60	40	65	35	75	25	66.67	33.33	
Uncontrolled natural mating	70	30	44.5	55.5	75	25	63.33	26.67	

3.2. Dairy Cows Herd Size and Structure

The overall average cattle herd size per household was 6.35 and accounted for about 80% of the total livestock herd owned by the households. Average cattle herd sizes per household were significantly higher ($p<0.05$) than in Machakel and Dejen Districts. Generally, 92% of the respondents in Dejene, 90% in Lumame, 96% of the respondents in Machakel, and 92.66% of all the respondents in the three districts owned 1–12 heads of mature dairy cows. With regard to breed composition, 40, 52.3, and 32.6% of the household owned crossbred cows in Lumame, Dejene, and Machakel, respectively. The average cattle herd size per household in Dejene, Lumame, and Machakel has been found to be 7.43 + 0.30, 6.20 ± 0.58, and 6.25 ± 0.69, which is almost higher than Sebeta, which was reported by Zewdie (2010). 98% of the total respondents owned dairy cows ranging from 1 to 12 heads, with an overall average of 3.2 heads per household. The cattle population reared in the study area was higher in Dedo.

followed by Seka Chokorsa and Mana with 8.42, 7.3, and 4.8, respectively. The average number of cows owned per household was not significantly different among districts. This agrees with the findings of Zewdie (2010), who reported a higher cattle herd size per household in peri-urban crop-livestock farms than in urban dairy production systems in central America. The variations could be attributed to differences in production objectives between urban and peri-urban farmers and also to the lack of sufficient space to accommodate large herd sizes in urban centers.

Table 3. Herd composition and size of districts

Variables		Machakel		Dejene		Lumame	P value
Dairy cows herd size and structure	**%**	Mean +SE	**%**	Mean+SE	**%**	Mean +SE	
Total cows	96	3.6		2.83		3.0	0.05
Crossbred cows	32.6	2.2		1.82		2.50	
Local cows	67.4	3.48		2.31		2.40	
Total dry cows	68.3	1.22		2.04		2.00	
Crossbred dry cows	28.3	2.04		1.33		1.60	
Local dry cows	58.3	2.07		1.87		1.76	
Total lactating cows	73.3	2.30		2.04		2.28	
Lactating crossbred cows	23.3	2.20		1.96		2.00	
Lactating local cows	65	2.24		1.84		1.90	

3.3. Farmer's perception on synchronization and AI

About 20% and 14.6% of respondents in Dejene had a medium and good perception of estrous synchronization, and 14.2% and 24% of respondents in Lumame had a medium and good perception of estrous synchronization, as shown in Fig. 1 below. The respondents reported that the reason for medium and good perception was that they got calves in the campaign of estrous synchronization. Access to extension information could influence a farmer's decision to adopt a new technology. Some of the reasons given by the sampled household for not adapting to estrous synchronization were reasonable, and there was technical failure during the campaign (Getahun, 2012). The reason given by the sampled respondents for the low perception of estrous synchronization was the low conception rate. The respondents reported for the reasons not to respond for treatment, conceiving, and pregnancy: heat detection problem (45%), inefficiency of AI technician (30%), absence of AI technician (15%), distance to AI center (5%), and disease (5%), as shown in Fig. 2 below.

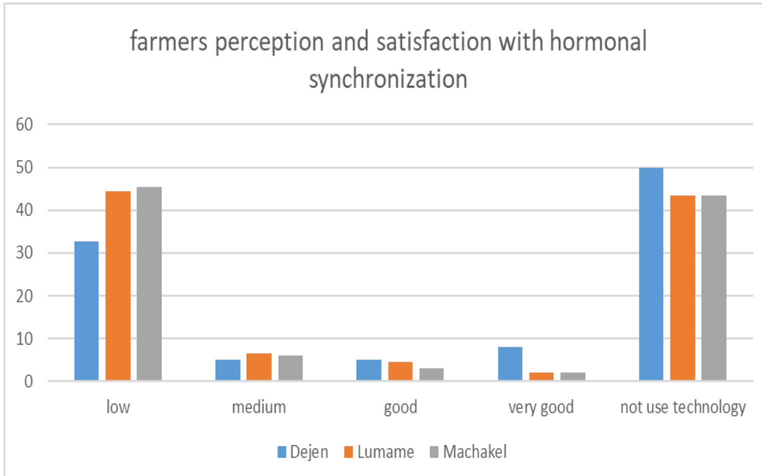
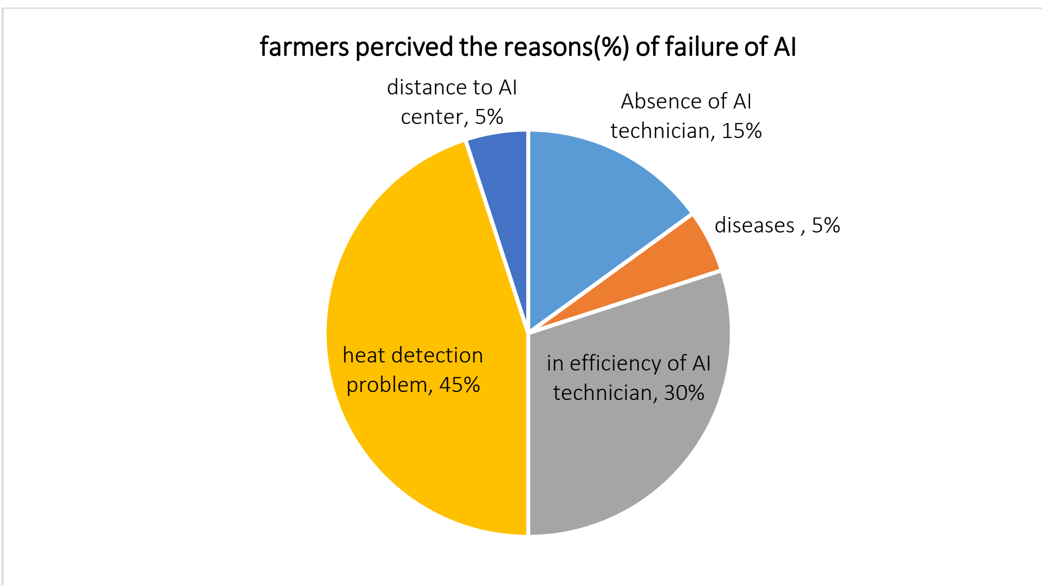


Figure 1. Farmers perception on the satisfaction of synchronization



3.4. Husbandry management of dairy cows

The interviewed households indicated that the most common feed resources were hay, natural pasture, atela, and crop residue. 77.5 percent of the households use the combinations of the above feed resources. Most of the households tied their cattle around their homes and fed their dairy with a cut-and-carry system. (Debir, 2016) reported that natural pastures predominate as the feed source in both agroecologies, especially during the wet season. The usage of crop residues was too varied across the seasons. According to Ketema (2014) and Tolera et al. (2012), natural pasture, aftermath grazing, crop residues, and hay were the major feed resources of dairy cattle.

The survey indicated that 9.8%, 87%, and 3.2% of households responded that their dairy cattle were given water from ponds, rivers, and pipe water, respectively. The majority of the household revealed that the water obtained from the river was not clean. 51.2% of the households said that the average distance of watering dairy cattle was estimated to be less than 1 km from their home, and 38.3% and 9.5% of households responded that the that the watering point was at home and 1–5 km far away from their home, respectively. The frequency of cleaning the house of dairy cattle in the study area was 57.5%, 32%, and 12.5% for daily, weekly, and monthly, respectively. The result revealed that 70% of the respondents did not have animal health problems, and 85% of respondents said that they get veterinary service. The result of the survey indicated that, regarding disease prevalence, the major animal diseases identified in the area were anthrax, bovine pastorolosis, black leg, mastitis, and dystocia. In general, milking cow supplementation was practiced more in the study area but not for synchronized cows or heifers.

Table 2. Husbandry management of dairy cows

Variables	Machakel	Dejen	Lumame	P value
1. Feed resources	%	%	%	
Hay	67	70	68	
Natural pasture	92	95	94	
Atela	80	82	90	
Crop residue	55	60	80	0.03
All combinations	75	80	80	
2. Water source				
Pond	13	10	6	
River	85	87	92	0.06
Pipe water	2	3	2	
3. Frequency of cleaning the house of cattle				
Daily	55	60	58	
Weekly	35	28	35	0.025
Monthly	5%	2	7	
4. Getting vet. Service				
Vaccination	35	45	48	
Treatment only	45	50	45	0.045
Not get any service	20	5	7	

N=Number of households, X^2– chi square value

The majority of households get water for their cattle from distances less than 1 km, about 63% and 63.3% for the wet and dry seasons, respectively.

The housing system of dairy cattle was significantly varied (P<0.05) among the districts. The overall average percent of farmers was 92.6%, 5.7%, and 1.7% housing in separate houses, family houses, and verandas, respectively. Demeke et al. (2017) reported that in watersheds of the North Ache fer District housing system, dairy cattle owners used separate houses house (65%) and family houses (58%). On the contrary, report of Debir (2016), 90% and10% for family houses and separate houses, respectively. The result of the current study shows no dwelling of animals in the family house, and the family house and there is rearing of animals within the separate house is known.

3.5. Breeding Practice of dairy cows

The breeding practices that were reported in the study area were bull schemes, natural heat-based AI, hormone plus AI, and a mix of both bull schemes with natural heat-based AI and AI with synchronization (Fig. 3 below). In the free mating system, heat detection is carried out by the mounting of cows several times during each heat period. In Dejen, 64.3%, 12.7%, 7.1%, and 28.6% use natural mating, AI services, hormones, AI, and natural heat-based AI, respectively. In Lumame district, 60.7%, 11.4%, 7.1%, and 32.1% of the respondents practice uncontrolled natural mating, AI service, hormone and AI, and natural heat-based AI and bull, respectively. In Machakel, 43%, 25.1%, 10.5%, and 21.2% of the respondents practiced natural mating, AI service, hormone, AI, and a mix of AI and bull service, respectively. Farmers in the study areas had a relatively low level of practiced hormone and AI services. This might be due to knowledge of husbandry to help overcome the problems in managing heat detection, as their indigenous knowledge was applicable to using natural mating. Lack of formal market access, poor transportation, and communication difficulties in the areas contributed to decreasing the motivation to practice the technology.

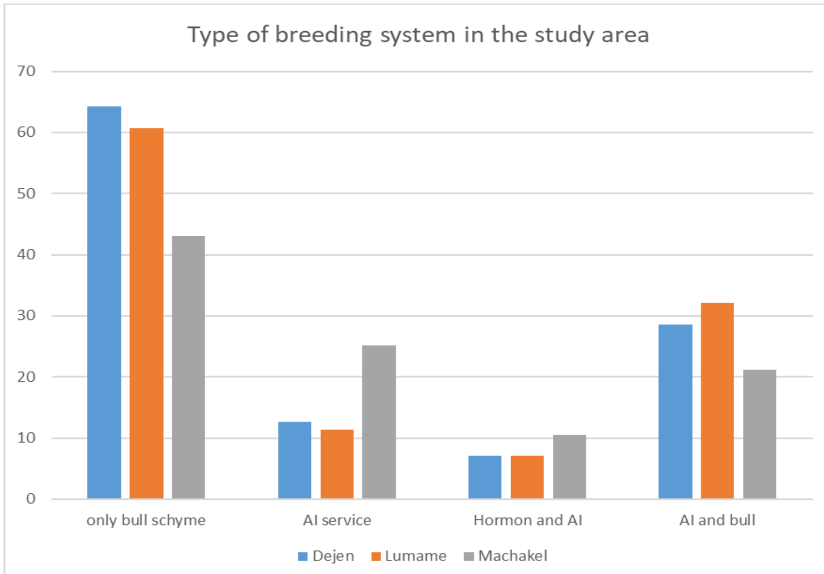


Figure 2. Type of breeding system in the area

3.6. Breeding Objective, Breed and Trait Preferences

The primary breeding objective in Dejene and Lumame was milk, while in Machakel both milk and draft power were equally important, as shown in Table 5 below. The objective of keeping livestock in Dejene, Lumame, and Machakel districts was presented. Both Dejene and Lumame districts kept their livestock for milk purposes. But in Machakel, the farmers kept their livestock primarily for both milk and draft power. Draught power, income, meat, and manure were ranked 2nd, 3rd, 4th, and 5th based on the purpose they served in Dejene, respectively. About 73.3%, 68.3%, and 50.0% of the respondents in Dejene, Lumame, and Machakel primarily kept their cattle for milk purposes, respectively. The second objective of keeping cattle was different in three districts. Trait preference, as perceived by farmers, was rated as milk yield, fertility, and body weight. This is similar to the results of a previous study by Zewdu (2004), in which milk was mentioned as one of the most important functions and primary reasons for keeping indigenous cattle.

Table 5. Breeds preference for crossbreeding using AI

Variables		Districts			
Preference of AI service in your area	Machakel	Lumame	Dejen	Overall	P value
Yes No Total	92	95.4	96	94.46	0.02
	8	4.6	4	5.53	
	100	100	100	100	
Willing to use AI in animal breeding					
Yes No	94	97.5	100	97.16	0.32

Total					
	6	2.5	-	2.83	
	100	100	100	100	
Have you ever crossed your zebu cattle					
Yes No Total	56.2	48.6	60	54.93	0.04
	43.8	52.4	40	45.4	
	100	100	100	100	
The breed considered to suitable for crossbreeding with the Zebu					
Holestein Jersey Other Total	98	98.2	94.3	96.83	0.022
	2	1.8	5.7	3.16	
	-	-	-	-	
	100	100	100	100	

Table 3. Breeding objective of keeping livestock and trait preference

District	Variables	Most important	Important	Least important	Not important	index	Order
Machakel	Milk	2.72	0.60	0	0	0 .32	1
	Meat	0	0.66	1	0.26	0.14	4
	draught power	2.68	0.70	0.02	0.04	0.31	2
	Income	0.3	2.28	0.22	0.06	0.17	3
	asset accumulation	0	0.04	0.4	0.9	0.07	6
	social and culture	0	0	0.24	0.68	0.06	7
	Manure	0.3	0.26	0.4	0.49	0.22	5
Lumame	Milk	2.67	0.62	0.2	0	0 .29	1
	Meat	0.25	0.09	0.23	0.24	0.14	4
	draught power	1.3	0.75	0.2	0.29	0.15	3
	Income	0.25	2.45	0.03	0.09	0.23	2
	asset accumulation	0	0	0.2	0.75	0.09	5
	social and culture	0	0	0.20	0.65	0.09	5
	Manure	0	0	0.30	0.65	0.08	5
Dejen	Milk	2.1	1.3	0.04	0.03	0.31	1
	Meat	0.05	0.45	1.3	0.07	0.12	3
	draught power	2.45	0.35	0.14	0.04	0.32	1

	income	0.08	2.76	0	0	0.16	2
	asset accumulation	0	0.35	1.35	0.36	0.23	4
	social and culture	0	0	0.13	0.84	0.08	6
	manure	0	0	1.35	0.37	0.3	5

3.7. Institutional Structure, Efficiency and Administration of Breeding Scheme and AI

The provision of mating services was broadly categorized into two based on the organization. practitioners. As depicted in Table 6 below, respondents reported 91.2%, 63.4%, and 55.6% of Machakel, Lumame, and Dejen got their different types of breeding schemes from the district offices of livestock agencies, respectively. In Dejen (8.8%), the highest households practice private bull service compared to Lumame (4.3%), and in Machakel, private bulls were not used by the farmers. This could be related to the inefficiency of semen (lower quality), a lack of easy access, or the or the inefficiency of technicians in the local area. It may be related to the scarce number of technicians in districts. This implies that if a lot of cows come into heat, the technicians will be constrained to address all of the cows at a time with poor infrastructure and vehicles. The overall breeding scheme provided by the district office of the livestock agency was higher, and private bull scheme practitioners held the second rank, having 70.0%, 6.8%, and 18.2%, respectively. The lowest provision of the mating system was achieved by the research center and the mix of the research center and government, which were 9.6% and 5.1%, respectively. This was due to the lowest accessibility and adoption of hormonal-based AI practices in the study area.

As it was mentioned above, the breeding services of natural heat-based AI, bull service, and hormonal heat-based AI were exercised as mating systems in the study area. Overall, 75.23%, 16.48%, 4.3%, 2.5%, and 4.3% of the respondents reported that the breeding schemes administered by government AI technicians, private bull owners, RC, the mix of RC, AITS,AITS and bull owners, and private vet assistants, respectively, 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 and improper timing of insemination (Azage*et al*., 1995).

Table 4. Breeding scheme and offering organization

Variables	Machakel	Lumame	Dejen	Overall	P value
Organization offering the Breeding schemes Govt/livestock agency Private Practitioner RC RC and Govt/livestock agency					0.03
	55.6	63.4	91.2	70.06	
	35.8	10.2	8.6	18.2	
	3.2	25.7	-	9.6	
	5.4	9.7	0.2	5.1	
The breeding scheme administered Government AI technician Private Vet assistant Private bull owner RC private bull owner & RC Government AITS, Private bull owner &RC					0.43
	59.2	80	80	75.23	
	-	4.3	8.8	4.3	
	30.5	6.7	5.9	16.48	
	-	-	-		
	-	6.8	5.3	4.03	
	5.3	2.2	-	2.5	

RC=research center, Govt=government, AITS = Artificial Insemination

As reported by the respondents in 3 districts, regular provision AI was not available all the time. About 83.5%, 85%, and 80.2% of the respondents in Machakel, Lumame, and Dejene, respectively, did not get AI regularly, as shown in Table 7 below. The reason for the inconsistent AI provision was the unavailability of the service on weekends and holidays, the shortage of AITS, the shortage of inputs, and the combination of all the above, which constitute 8.5%, 10.5%, 7.8%, and 73.2% in Dejene, respectively. Similarly, about 2.5%, 8%, 2.5%, and 87% reported the reasons as unavailability of the service on weekends and holidays, shortage of AITS, shortage of inputs, and the combination of all the above in Lumame, respectively. In different districts, 5%, 10%, and 80% of respondents to Machakel reported that the reason for the provision of AI was the combination of the unavailability of the service on weekends and inconsistent holidays, the shortage of AITS, the shortage of inputs, and the combination of all the above. This might be related to poor infrastructure, poor road access, and insufficient vehicles.

The overall inconsistency in AI provision, which is 80.06%, was due to the combined effect of a shortage of AITS, a shortage of inputs, and the unavailability of AI services on weekends and holidays. As depicted in Table 7, about 95% of the respondents in Lumame and Machakel cannot get the AI service on weekends and holidays. In Dejene, 80.5% of households did not get the service on holidays and weekends. Overall, 95% of the respondents in the study area did not get regular AI service on weekends and holidays. As reported in the table below 68.2%, 72.3% and 43.6% of respondents in Dejene, Lumame and Machakel districts had passed the breeding date without breeding their breeding cow due to the absence of AI service in holiday and weekends waiting until the next 21 days breeding time respectively. The implications in the above figure show that passing the breeding date increases the calving interval within breeding cows. The remaining 31.8%, 27.7%, and 56.4% of respondents in Dejene, Lumame, and Machakel use natural mating for their breeding cows as an alternative in the absence of AI service.

From the respondents in Dejene, 4%, 60.6%, and 35.4% of AITs visit daily; they call the AITs when they need him, and they take their cows to the AI station, respectively. About 3.6%, 44.5%, and 51.9% of the respondents AITs visit daily; they call to AITs when they need him, and they take their cows to the AI station, respectively, in Lumame. About 3%, 4.5%, and 92.5% of the respondents in Machakel AITs visit daily; they call the AITs when they need them, and they take their cows to the AI station, respectively.

The overall respondents in the study area reported that 61.36% had passed the breeding time by waiting for the next breeding time, and 38.64% used natural mating as an alternative in the absence of AI service. If the cow does not conceive after repeated insemination, 40%, 40%, and 33.3% of respondents in Dejen, Lumame, and Machakel practiced AI again and again after a 21-day interval of estrus, hoping to get a chance of success. They took a measure of natural mating when repeated insemination was not fruitful.

Table 5. AI Service administration

Variables	**Districts**				
Regular provision of AI	Dejen	Lumame	Machakel	Overall	Pvalue
Yes (%)	12.3	5	10	8.8	0.55
No (%)	80. 2	85.0	83.5	82.86	
No practice/no idea (%)	7.5	10.0	6.5	8.03	
Reason for inconsistancy of AI					0.01
Unavailability on weekends & holidays (%)	8.5	2.5	5	4.66	
Shortage of AITs (%)	10.5	8	5	4.5	
Shortage of inputs (%)	7.8	2.5	10	7.43	
All of the above (%)	73.2	87	80	80.06	
Availability of AI on weekends and holiday					0.011
Yes	19.5	5	5	6.3	
No	80.5	95	95	93.6	
Total	100	100	100	100	

Fate of breeding cows on weekends and holiday in the absence of AI					0.006
Pass the date without breeding the cow (%)	68.2	72.3	43.6	61.36	
Use Natural mating (NM) (%)	31.8	27.7	56.4	38.64	
Means to communicate with AI technicians					0.34
AITs visit us daily (%)	4	3.6	3	3.2	
We call AITs when we need them (%)	60.6	44.5	4.5	38.6	
We take our cows to the AI station (%)	35.4	51.9	92.5	59.9	
Total	100	100	100	100	
Male animals go along with the herd					
Yes (%)	55.0	50.0	84.3	63.1	0.25
No (%)	45.0	50.0	13.7	36.9	
If your cows do not conceive with repeated					
Use AI again and again (%)	40.0	40	33.3	37.7	
Use NM (%)	55.0	55.6	66.7	59.1	
Sale for beef (%)	5.0	4.4	-	3.13	

Table 6. service offering institution and choice of breeding program of AI and estrus synchronization

Variables	Districts			
Have estrus synchronization service in your area	Dejen	Lumame	Machakel	Overall
Yes (%)	62.5	57.0	35	51.5
No (%)	47.5	43.0	65.0	51.8
Total (%)	100.0	100.0	100.0	100.0
Providerof estrus synchronization				
Government/livestock Agency/ (%)	90	60	55.7	68.5
Research center (%)	10.0	40	44.3	31.4
Total (%)	100.0	100.	100	100.0
Which breeding program do you think better		Sw		
AI with synchronization (%)	46.5	56.8	20.0	30.0
AI only (%)	48.5	33.1	70.0	60.5
Natural mating (%)	5	10.1	10.0	9.5
Total (%)	100	100	100	100

AI=Artificial Insemination

Conclusions

The current study was conducted to evaluate the efficiency of artificial insemination followed by estrus synchronization in three districts of East Gojjam Zone. The results of the survey indicated that the mean herd size of cattle per household was 7.43 + 0.30, 6.20 ± 0.58, and 6.25 ± 0.69 in Dejene, Lumame, and Machakel districts, respectively. About 12.7%, 11.4%, and 25.1% of the respondents practiced AI technology in Dejene, Lumame, and Machakel, respectively, while 3.3% of the respondent's practiced hormone plus AI technology only in Dejene and Lumame. On the contrary, about 7.1%, 7.1%, and 10.5% practiced hormones with AI in Dejene, Lumame, and Machkel, respectively. The primary objective of keeping their livestock was milk in all the districts. About 66.7%, 61.7%, and 1.7% had a low perception concerning estrus synchronization practiced in the area. The majority of respondents have a negative perception of estrus synchronization. This happened due to the inaccessibility of estrus synchronization at all times in natural heat-based AI.

The number of services per conception and conception rate was significantly affected by AITS. This implies that the skill and experience of differences in semen handling, site semen deposition, and thawing were variable across AITS. Milk production was the primary objective for all three (Dejene Lumame Machakel) districts. Even it was equally important, with draft power as the first priority in Machakel. Because of the low conception rate and higher number of services per conception, the majority of the farmers perceive low synchronization and AI. The low adoption of technology, together with the technical failure of the implementers, had aggravated the negative perception of farmers. The major factors for the conception rate were body condition score, parity, time of insemination, and the skill of AI technicians. Even though all the above factors affect estrus rate and conception rate in the three districts, Dejene was the better one.

Recommendations

Future breeding activities should consider the knowledge and perception of farmers to improve the breeding practices of dairy cattle in the area. Improvements in facilities and management should be necessary before implementing an effective estrous synchronization and mass artificial insemination program. The skill- and knowledge-based training for enhancement of estrus synchronization must be given to both farmers and implementers to enhance perception, adoption of the technology, and management practices, including heat detection.

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