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Original Article

Effect of Prostaglandin on Estrus Synchronization under Smallholder Dairy Farmers

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ABSTRACTS

This study evaluated the effect of single and double-dose injections of prostaglandin hormone in the Adaberga, Ejere, and Metarobi districts. 130 cows or heifers were injected with single and double doses of prostaglandin to evaluate the effectiveness based on estrus induction, conception rate, and number of services per conception. Cow/heifers that did not respond by a single injection were reinjected with another single dose of prostaglandin. Descriptive statistics, Frequency distribution procedures, and Chi-Square test were used. Among cows or heifers treated with a single dose of prostaglandin 43.68%, 29.23%, and 27.69% open heat, silent heat, and no response respectively. There was a significant difference between breeds in silent-responded cows/heifers and local silent-responded cows /heifers were greater than the crossed-responded cows/heifers. Estrus rate was estimated to be 61.36%, 81.82%, and 73.81% in Adaberga, Ejere, and Metarobi for a single dose of prostaglandin injection respectively. There was a significant difference between AITS on the estrus rate. The conception rate for a single dose of prostaglandin was 40.7%, 72.22%, and 64.52% in

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Adaberga, Ejere, and Metarobi whereas the number of services per conception was 2.46, 1.56 and 1.55 in Adaberga, Ejere and Metarobi respectively. The overall conception rate and number of services per conception for a single dose of prostaglandin injection was 57.44 % and 1.74 respectively. The overall estrus rate, conception rate, and number of services per conception for both single and double doses of prostaglandin injection were 83.85%, 52.29%, and 1. 91 respectively. Improvements in facilities and management should be necessary before implementing effective estrous synchronization and mass artificial insemination programs. The skill and knowledge-based training for enhancement estrus synchronization must be given to both the farmers and implementers to enhance perception and adoption of the technology. The AITS must update recent skills and knowledge. Finally, evaluating the effect of single and double doses of prostaglandin injection serves as a basis for improvement of the fertility of dairy cows in turn it will help in designing appropriate breeding strategies for dairy cattle.

Keywords: Prostaglandin, Estrus, Synchronization, Dairy

INTRODUCTION

Artificial insemination (AI) technology maximizes the use of outstanding males, disseminates superior genetic material, improves the rate and efficiency of genetic selection, introduction of new genetic material by the import of semen rather than live animals (Verma *et al*., 2012). However, it is widely believed that the AI service in Ethiopia has not been successful in improving the reproductive performance of the dairy industry (Sinishaw, 2005). AI service is getting weak and even declining due to inconsistent service in the smallholder livestock production systems of the Ethiopian highlands (Dekeba *et al*., 2006). This is because of technical inefficiency, and system-related, financial and managerial problems (Azage *et al*., 1993). This could be also related to the monitoring of heat in smallholders is quite difficult for the farmers as they are engaged in various farm activities (Woldu, *et al.*, 2011).

Reproductive performance has been declining in dairy cows with an increasing number of days open and decreasing conception rates from year to year (Getnet and Addisu, 2006, Halie *et al*., 2011). One major problem for this is the lack of accurate estrus detection. However, it is believed that most cows would benefit economically by reducing the number of days open, decreasing culling rates due to non-pregnant females, and shortening their calving intervals (Graves, 2009).

These days, there are various technology-based biological applications for manipulating the reproductive efficiency of breeding cows, like synchronization. Synchronization of estrus (heat) involves manipulating the estrous cycle of females, so they can be bred at approximately the same time (Rasby and Deutcher, 2013). For a dairy cow to produce the most offspring during her life in a herd, she should calve first at two years of age and again every 12 months until she is culled.

The long postpartum anestrous period is a very common problem in cows reared in a tropical environment (Tadesse *et al*., 2011). The conception rates in Ethiopia were poor ranging from 7.14 to 40.23%. The differences in these parameters among regions were also highly significant. Oromia is one of the regional states of Ethiopia and has a low conception rate which is 34.29 % (Gebremedhin, 2009). Since West Shewa (Adaberga, Ejere, and Meta Robi) is located near Addis Ababa milk shade they demand higher milk production. The above challenges are an indicator of a very low level of fertility or AI efficiency.

Estrus (heat) detection has been cited as the most important factor affecting the reproductive success of artificial insemination programs. Besides the above, proper control of the time of estrus is difficult since peak estrus activity often occurs at night, and determination of the actual onset of standing estrus may be difficult without 24-hour observation (Aulakh, 2008). The primary goal of any estrus synchronization protocol is to induce a compact estrus response so that cows can be inseminated at a predetermined period with acceptable fertility (Noseir, 2003).

These days, prostaglandin and progesterone are used to synchronize estrus in dairy cattle operations to boost the efficiency of AI by inducing the regression of the corpus luteum (Murugavel *et al*., 2010). Prostaglandin is the first method of heat synchronization that depends on the presence of a functional CL particularly in the diestrus stage of the estrus cycle (days 6 to 16 of the cycle) (Cordova-Izquierdo *et al*., 2009).

To this effect, the benefits of using technological options and approaches to improve the supply of Diaz *et al*., 2005 desirable animal genetic material that incorporates estrus synchronization and AI can be tremendous. These systems allow producers to reach certain production or economic goals quicker than natural service and can open the doors to value-added markets. Therefore, to boost the dairy industries and to alleviate the problems of the above-mentioned gaps, evaluation of the effect of Prostaglandin on estrus synchronization of dairy cattle under small holders' conditions is indispensable. The objective of this paper is: To evaluate the effectiveness of single and double-dose injections of prostaglandin hormone in terms of estrous induction and conception to AI.

MATERIALS AND METHODS

Area Description

This study was conducted in potential areas of the Addis Ababa milk shed of West Shewa, Oromia, Ethiopia. The zone has 21 districts. The zone had a total cattle population 2,015,696 (CSA, 2013). Based on good infrastructure, increased number of dairy cows, good awareness and experience of farmers in dairying and access to the market, and the attitude of farmers to adopt market-oriented commodity development three districts, Ada Berga, Ejere, and Metarobi were selected.

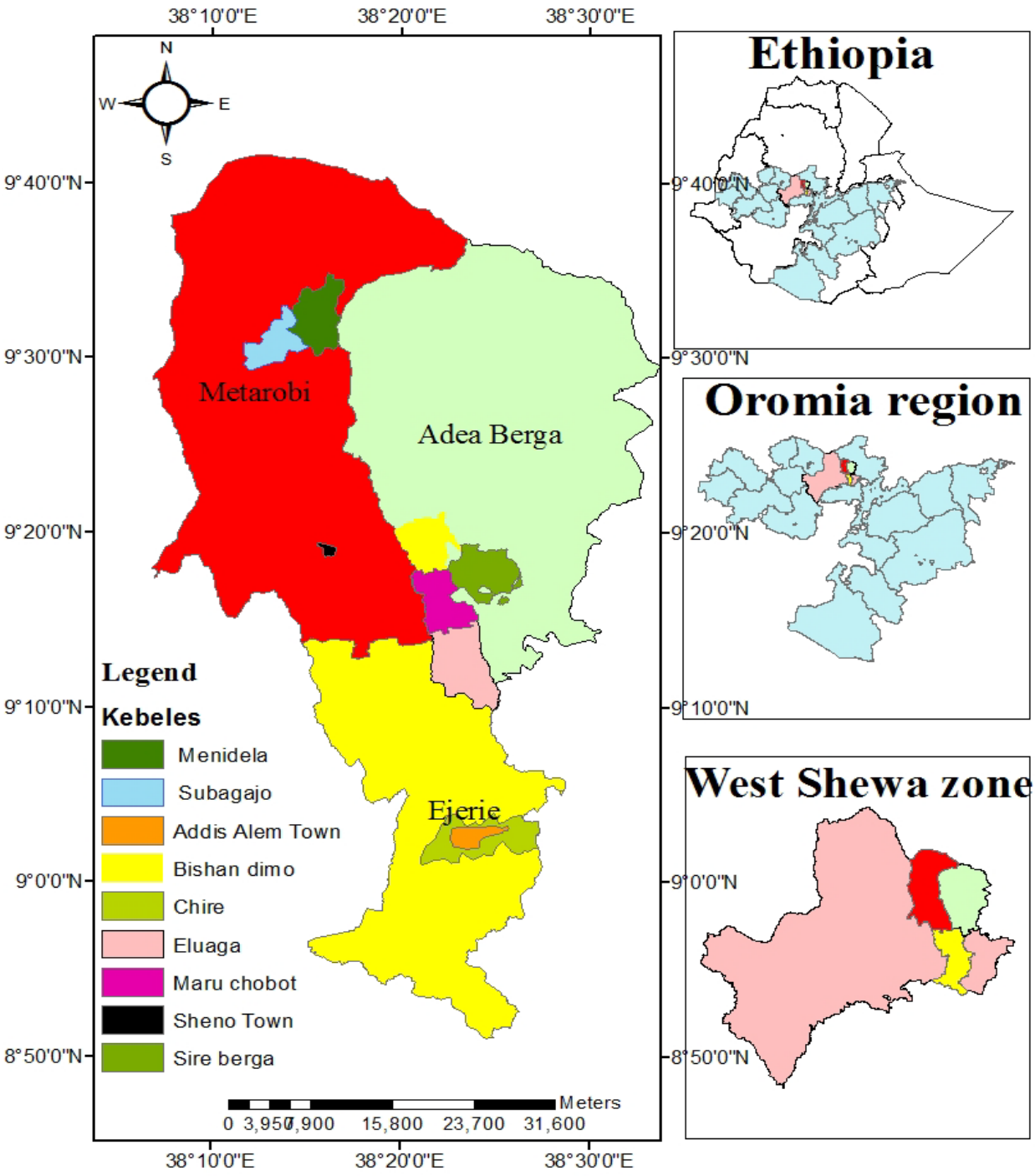

Figure 1: Map of the study Area

Materials and Chemical

Animal handling crash, cut/scissor; Prostaglandin (Lutalyse); Long sleeved gloves; Latex hand gloves, Needles (18" x 21); Drenching Gun; Syringes (5-10 ml); Sheath; Ear tag Applicator; Ear tags marker alcohol, savlon and animals were the materials used in this study.

Sampling for estrus synchronization

The experiments were conducted on farm dairy cows of smallholder farmers in 3 districts of west Shoa of Oromia region, Ethiopia. The body condition of cow/heifers selected ranged from 2 to 4 on a scale from 1 to 5. Body condition scored 1 for very thin 2 for thin 3 for moderate, 4 for optimal, and 5 for very fat. A transrectal palpation examination was performed to confirm cows/ heifers with a functional corpus luteum (CL), i.e., cyclicity. Non-pregnant heifers or cows were selected from the population purposively based on CL presence, body condition, and health from any sign of disease.

All selected cows/heifers (130) were given a single dose of intramuscular injection of $PGF_2\alpha$ (33.5 mg of dinoprost tromethamine per 5 mL of solution, equivalent to 25 mg of $PGF_2\alpha$; Lutalyse®; Pharmacia and Upjohn Company, Pfizer, New York NY USA) on day zero (beginning of the experiment). The cows /heifer that exhibited mucus discharge, mounting, and bellowing together were considered as open estrus response while those that did not show signs of estrus having loosened cervical opening through trance rectal palpation were assumed as silent heat response The cows/heifers (94) that came into heat were reported by individual farmers who owed dairy cow/heifers based on signs of heat and AIT'S were inseminated immediately after report. AI was conducted 8-12 hrs. after the first estrous behavior was detected. After all the 36 cows/heifers, which do not respond to the first injection were subjected to double injection 11 days after the first $PGF_2\alpha$ injection.

Cows that returned to estrus before pregnancy diagnosis were re-inseminated upon estrus detection and considered to be non-pregnant from previous AI. In general, the number of services per conception was calculated by the total number of services/ inseminated per total number of cows conceived, and conception rate was calculated by total number of pregnant cows per total number of cows inseminated multiplied by 100 (Khatun *et al*., 2014). This is shown below.

$$\textbf{Conception rate} = \frac{\text{No. of cows/heifers pregnant}}{\text{No. of cows/heifers inseminated}} \times 100$$

$$\textbf{Number of services per conception} = \frac{\text{Total number of services}}{\text{Total number of cows conceived}}$$

$$\textbf{Estrous rate} = \frac{\text{Number of cows showed estrous}}{\text{Number of cows treated}}$$

RESULT AND DISCUSSION

Affects of Single Injection Prostaglandin on Estrus Response

The estrus response for prostaglandin Treatment is presented in Table 1. A total of 130 cattle composed of 21 heifers and 109 cows were treated with prostaglandin hormone. There is no. significant difference in response to prostaglandin treatment between districts. From the total of prostaglandin-treated cows/heifers 41.07 % and 34.21% of cow/heifers show open heat and silent heat respectively.

There is no significant difference in open heat response between breeds. On the other side, the lower number of crossed cows/heifers (31.58%) showed silent heat than locals (68.42%). The silent responded local cows/heifers were significantly different from crossed cows/heifers. This might be due to physiologically local cows having shorter, less intense estrous cycles. Besides the above cross breeds can give better milk yield than the local cow. So, the handling of farmers in the management and feeding of the cross-breed cows was better than locals. This discriminatory nutritional and managemental handling might cause lower manifestations of estrus signs. The response recorded by body condition scored 3 and 4 comparably equal. However, slightly lower responses were recorded by those cow/heifers' body condition scored 2. Similarly, both open heat and silent heat responses were higher in cows/heifers' body condition 3 and 4 whereas slightly lower responses were observed in those cows/heifers' body condition scored 2.

There was a significant difference across the parties of silently responded cows/heifers. The highest numbers of cows that show silent heat response were recorded in parity 1 and 3. The lower number of cows that show silent heat responses were observed in heifers and parity 4 and above. However, the cows with parity 2 showed lower silent heat responses than parity 1.

The overall response to a single injection was 72.3%. This figure was lower than the report of Tegegne (2012) from the Hawassa-Dale milk shade area (97.7%) and Adigrat- Mekelle milk shade (100%) areas. Similarly, it was lower than the report in Adebabay (2013) which was 89.2%. This difference can be attributed to feed shortage, inefficient determination of corpus luthum, and managemental stresses. But it was similar to the report of Islam M. R. (2013) in Bangladesh (75%).

The factors affecting the estrus rate of single-shot prostaglandin

The estrus rate of a single-dose injection of prostaglandin is presented in Table 2. Estrus rate was not statistically significant, between Ejere (81.82 %), Metarobi (73.81%), and Adaberga (61.36%).

The estrus rate of cows in general to $PGF_2\alpha$ is 73.40% while the estrus rate of heifers was 66.67%. Among the cows primiparous cows had the highest estrus rate followed by cows with parity 3 and then cows that gave birth 4 and above were recorded. The

cows that gave two births had the lowest estrus rate. The differences in estrus rate within cows of different parity were slight.

Table 1: Heat response of cows/heifers for a single dose of prostaglandin injection

Variables	Open heat		Silent heat		None response (closed)	
	N	%	N	%	N	%
Location						
Adaberga	18	32.14	9	23.68	17	47.22
Ejere	23	41.07	13	34.21	8	22.22
Metarobi	15	26.79	16	42.11	11	30.56
X^2-value		1.75		1.95		3.50
significance		Ns		Ns		Ns
Breed						
Local	27	48.21	26	68.42	24	66.67
Cross	29	51.79	12	31.58	12	33.33
X^2-value		0.071		5.1579		4.00
significance		Ns		*		*
Parities						
0	11	19.64	3	7.89	7	19.44
1	10	17.86	14	36.84	5	13.89
2	13	23.21	6	15.79	12	33.33
3	8	14.29	12	31.58	6	16.67
4& above	14	25.00	3	7.89	6	16.67
X^2-value		2.036		13.84		4.27
significance		Ns		*		Ns
BCS						
2	12	21.43	13	34.21	13	36.11
3	26	46.43	15	39.47	13	36.11
4	18	32.14	10	26.32	10	27.78
X2-value		5.2857		1.00		0.50
significance		Ns		Ns		Ns
Total	56	100	38	100	36	100
Overall	56	43.6	38	29.23	36	27.69

* Show significance difference at ($p<0.05$) level

X^2=chi-square value

Ns = non-significant

There was great variation in terms of skill of technicians with the highest degree of estrus rate which implies that the skill and experiences on palpation of corpus luteumof cycling cows. On this matter T_3 and T_4 had the highest skill and experience having 87.5% and 84.62% of estrus rate followed by T_1 i.e., 66.67%. The lowest number of services per conception was recorded by T_2 and T_5.

Table 2: Estrus rate for single dose injection of prostaglandin

Variables	Cows receiving TRT	№ of cows responded for TRT	Estrus Rate	X^2	P-value
Location					
Adaberga	44	27	61.36	1.3	0.23
Ejere	44	36	81.82		
Metarobi	42	31	73.81		
Total	130	94	72.31		
Breed					
Local	77	53	68.83	1.53	0.23
Cross	53	41	77.36		
Total	130	94	72.31		
Parities					
0	21	14	66.67	2.92	0.57
1	29	24	82.76		
2	31	19	61.29		
3	26	20	76.92		
4& above	23	17	73.91		
Total	130	94	72.31		
BCS					
2	38	25	65.79	4.62	0.09
3	54	41	75.93		
4	38	28	73.68		
Total	130	94	72.31		
AITS'					
T1	18	12	66.67	36.96	0.0001
T2	52	32	61.54		
T3	16	14	87.50		
T4	39	33	84.62		
T5	5	3	60.00		
Total	130	94	72.31		
Overall total		94	72.31		

AITS=Artificial Insemination Technicians; BCS= Body Condition Score, X^2=Chi-Square value, P = probability, TRT=Treatment

The factors affecting the number of services per conception rate and conception rate of single-shot prostaglandin

The conception rate and number of services per conception of single-dose injection of prostaglandin are presented in Table 3. The services per conception are about 2.46, 1.55, and 1.56 in Adaberga, Metarobi, and Ejere respectively. As indicated in Table 3 about 72.22%, 64.52%, and 40.74% of conception rate was recorded in Ejere, Metarobi, and Adaberga respectively.

There are many factors affecting the number of services per conception and conception rate. The number of services per conception rate of cross-breed cows /heifers is statistically similar to that of local breeds of cows /heifers i.e.,1.78 and 1.71 respectively. Similarly, the conception rate of crossed cow/heifers and local cows/heifers were found the same.

The overall number of services per conception rate of cows in general to $PGF_2\alpha$ is 1.54 to 1.70 while the number of services per conception rate of heifers was 2. The average rate of conception of cows in general and heifers in the study districts was 59.25% and 50%, respectively. Among the primiparous cows, all parity of dam had a relatively similar number of services per conception rate. About 65%, 63.18%, 58.82%, and 50% of conception rate cows had recorded parity 3, 2, 4,1and 0 of dams respectively. There is no significant difference between body condition groups of services per conception and conception rate.

There was great variation in terms of skill of technicians with the highest degree of number of services per conception which implies that the skill and experience in deposition of semen and semen handling of estrous cows. On this matter T_1, T_3, and T_4 had the highest skill and experience having 1.5, 1.5, and 1.62 of number of services per conception. The highest number of services per conception was recorded by T_2. Fortunately, T_5 was successful 100% but the observation is very small and could not simply to said highest. Similarly, there was great variation in terms of skill of technicians with the highest degree of conception rate success T_1 (66.67%) and T_3 (64.29) followed by T_4 (63.64%). The lowest conception was achieved by T_2 (43.75%).

In general, the overall number of services per conception of single-dose prostaglandin injection was 1.74 whereas the conception rate was 57.44 in this study area. The conception rate of this study was higher than the national rate of conception (27%) reported by Desalegn *et al*. (2009) and the conception rate (13.1%) reported by Kebede (2013) in the Bahirdar milk shade area. The result was also similar to the preliminary results of mass synchronization in SNNPR (63%) and Tigray (62%) reported by (IPMS, 2011). The rate of pregnancy was also greater than the rate of pregnancy reported by Tadesse (2011) (47.5%). The effect of single-shot prostaglandin was optimal that it was expected.

Table 3. Effect of district, breed, parity, body condition, AITS, and Bull ID for conception rate and NSC of experimental study for a single dose of $PGF_{2}\alpha$

Variables	N	PPT	NPT	CR	X2	P-value	NSC
Location							
Adaberga	27	11	16	40.74	4.33	0.12	2.46
Ejere	36	23	13	72.22			1.56
Metarobi	31	20	11	64.52			1.55
Breed							
Local	53	31	21	58.49	1.19	0.28	1.71
Cross	41	23	19	56.10			1.78
Parity							
0	14	7	7	50.00	2.11	0.71	2
1	24	12	12	50			2
2	19	12	7	63.18			1.58
3	20	13	7	65			1.54
4& above	17	10	7	58.82			1.7
BCS							
2	25	16	9	64	1.33	0.51	1.56
3	41	22	19	53.66			1.86
4	28	16	12	57.8			1.75
AITS'							
T1	12	8	4	66.67	15.44	0.0039	1.5
T2	32	14	18	43.75			2
T3	14	9	5	64.29			2.29
T4	33	21	13	63.64			1.61
T5	3	2	1	66.67			1
Overall	94	54	40	57.44			1.74

AITS= Artificial insemination technicians, BCS= Body condition score, PPT= Positive pregnancy test, NPT=Negative pregnancy test, CR=Conception rate, NSC= Number of services per conception, N=Number of observations, X^2-Chi-square value

Effect of double shot prostaglandin on estrus response

In this study, 36 cows/heifers that could not respond to a single injection were treated with the second injection of prostaglandin. Estrous cyclic females at days 0 (estrus) to 6 and those from days 17 to 21 of their cycles were without functional CLs and did not respond to injections. As explained by Diskin *et al*., (2002) it has also been suggested that the lower fertility in prostaglandin-treated cows may be because a high proportion of cows might have been inseminated after having a short luteal phase. Animals injected with prostaglandin at the late stage of the luteal phase have both a

greater estrous response and a higher conception rate than animals treated in the early and or mid-luteal stages (Nebel, 1998; Diskin *et al*., 2002)

The onset of estrus after treatment with $PGF_2\alpha$ is variable and dependent on the stage of the follicular development of the animal when they are treated with $PGF_2\alpha$. After the first $PGF_2\alpha$ injection, those cows that did not come into estrus might have resulted due to inappropriate timing to inject when palpating corpus luteum (might be day 0 to 6 or day 17 to21) and also might be due to the nature of estrus cycle physiology of the cow.

So, to detect the cyclic cows in the single injection, which failed to respond due to an inappropriate stage of corpus luteumdevelopment, the second injection of $PGF_2\alpha$ was conducted. Thus after 11 days of the first injection, the second $PGF_2\alpha$ was given to those cows that did not respond to the first (Lauderdale, 2005). In Adaberga the highest number of cows returned to response to $PGF_2\alpha$. In the same study site, about 29.41 %(N=5) and 17.65% (N=3) of the total cows injected with the second $PGF_2\alpha$ showed silent and open heat response. Similarly, 37.5 % and 36.36% of double-injected cows in Ejere and Metarobi had come into estrus respectively. From the total number of cows/heifers' the highest number of local cattle was responded and that might be due to the short luteal phase of local cow /heifers. In general, the overall 41.67% of the total double-injected cow/heifers had come into the onset of estrus.

The overall effect of single and double injection prostaglandin on estrous rate

The overall effect of single and double prostaglandin on estrus rate is presented in Table 5. The percentage of cows and heifers detected in estrus after the first and second $PGF_2\alpha$ injections was not significantly influenced by breed, body condition scoring, and parity. The estrus rate had a slight difference between Adaberga and the rest of the two other districts. Relatively Metarobi (85.7%) and Ejere (88.64%) had similar Estrus rates. The lowest Estrus rate had been observed in Adaberga which is 77.27%.

The overall estrus rate across districts was found as 83.85%. Relatively cows with parity 2(87.5%) and 3(88%) had higher estrus rates than heifers, parity 1 and parity 4 and above. A slight difference in estrus response at the first injection and second injection was obtained in crossed cow/heifers. An estrus response rate of cross cow/heifers (87.04%) was found lower than that of local cow/heifers (81.58%).

The estrus rate ($p<0.0001$) of cows /heifers had a highly significant variation between AI technicians. There was variation in terms of the skill of technicians with the highest degree of influence on the Estrus rate. On this matter T_4 and T_3 had the highest skill and experience having 92.3% and 87.5% of Estrus rates followed by T_2 (85.1%) and then by T_1 i.e.,69.57 %. The lowest Estrus rate was recorded by T_5 (60%).

Table 4. Effect of double injection prostaglandin on estrus responses

Variables	Heat response					
	Open heat		Silent heat		No response	
	N	%	N	%	N	%
Location						
Adaberga	3	17.65	5	29.41	9	52.94
Ejere	2	25.00	1	12.50	5	62.50
Metarobi	1	9.09	3	27.27	7	63.64
X2		1	0.5	0.5	1.4	1.4
P-value		0.61	0.48	0.48	0.57	0.57
Significance level						
Parity						
0	2	28.57	1	14.29	4	57.14
1	1	20.00	1	20.00	3	60.00
2	2	16.67	5	41.67	5	41.67
3	-	-	2	33.33	4	66.67
4& above	1	16.67	-	-	5	83.33
X2	0.67		3.25			0.67
P-value	0.88		0.20			0.9
Significance level						
BCS						
2	-	-	4	30.77	9	69.23
3	4	30.77	3	23.08	6	46.15
4	2	20.00	2	20.00	6	60.00
X^2		0.67		0.25		0.86
P-value		0.41		0.88		0.65
Significance level						
AITS'						
T1	1	11.11	3	33.33	5	55.56
T2	3	16.67	5	27.78	10	55.56
T3	-	-	-	-	2	100.0
T4	2	28.57	1	14.29	4	57.14
T5	-	-	-	-	-	-
X2		1		0.61		6.62
P-value		0.61		0.48		0.09
Significance level						
Overall response	6	16.67	9	25.00	21	58.33

TRT=treatment, BCS= Body condition score, AITS=Artificial insemination technicians= number of observations

Table 5: Effect of single and double dose prostaglandin injection on estrus rate of cows/heifers

Variables	Cows receiving TRT	№ of cows responded for TRT	Estrus Rate	X^2-value
Location				
Adaberga	44	35	77.27(34/44)	2.21 ns
Ejere	44	39	88.64(39/44)	
Metarobi	42	35	85.71(36/42)	
Total	130	109	83.85(109/130)	
Breed				
Local	77	62	81.58(62/76)	1.42 ns
Cross	53	47	87.04(47/54)	
Total	130	109	83.85(109/130)	
Parities				
0	21	17	80.95(17/21)	1.87 ns
1	29	24	82.28(24/29)	
2	32	28	87.50(28/32)	
3	25	22	88(22/25)	
4& above	23	18	78.26(18/23)	
Total	130	109	83.85(109/130)	
BCS				
2	38	29	76.32(29/38)	3.89 ns
3	54	48	92.31(48/54)	
4	38	32	84.21(32/38)	
AITS'				
T1	23	16	69.57(16/23)	36.58***
T2	47	40	85.10(40/47)	
T3	16	14	87.5(14/16)	
T4	39	36	92.3(36/39)	
T5	5	3	60(3/5)	
Total	130	109	83.85(109/130)	
Overall total	130	109	83.85(109/130)	

RT=treatment, BCS= Body condition score, AITS=Artificial insemination technicians, N= number of observations

The interval from the PGF_2 α injection to the onset of the heat varies depending on the stage of the cycle when $PGF_2\alpha$ is administered. Therefore, the age of the CL and the status of the developing follicle determine the time to the onset of the heat after $PGF_2\alpha$ injection (Lopez, 2000 Macmillan and Peterson, 1993).

The slightly longer means of interval between prostaglandin injection and the onset of estrus was recorded by local cow/heifers than cross cows/heifers. The mean estrus

interval after treatment for local cows/heifers was 46.52 hr while 43.79 hr was recorded for cross cows/heifers. The mean estrus interval after treatment across parities is relatively similar on heifers, parity one, three, and four and above. Exceptionally parity 2 showed a slight difference from the other parities. Similarly, the mean estrus interval after treatment of prostaglandin was shorter in cow's body conditioned scores 3 and 4 than in the cow/heifer body condition score 2. The mean estrus interval of 44.94 hr and 44.44 hr were recorded for cow/heifers' body conditions 3 and 4 respectively while 47 hr estrus interval after treatment was recorded for body condition score2

The overall mean estrus interval after treatment of prostaglandin for this study was recorded as 45.35hr. A slightly higher result was reported by (Kebede, 2013; Tadesse, 2011). In contrast, the estrus interval of cows/heifers found in this study (45.34 hr) was lower for Boran (70.67 hr) and its Holstein Frisian crossbred (54.58hr) cattle in prostaglandin synchronization with a protocol based on estradiol benzoate or gonadotropin-releasing hormone

Table 7: Mean estrus interval after treatment and interval between estrus and AI

Variables	Mean Treatment and estrus interval (hr.)
Location	
Adaberga	46.26
Ejere	45.12
Metarobi	44.71
Total	45.34
Breed	
Local	46.52
Cross	43.79
Total	45.34
Parities	
0	45.10
1	45.83
2	47.54
3	44.11
4& above	43.02
Total	45.34
BCS	
2	47.00
3	44.94
4	44.44
Total	45.34

AI=Artificial Insemination, BCS= Body Condition Score, hr= hour

CONCLUSION

The study area was categorized under the Addis Ababa milk shade area. The estrus rate of the cows/heifers treated with single-dose injection was 72.3% in the study area. Besides the above single dose of prostaglandin injection was brought more than half of the cows/heifers were treated and inseminated to become pregnant.

The number of services per conception and conception rate were significantly affected by AITS. This implies that the skill and experience of difference, in semen handling, the site semen deposition, and thawing were variable across AITS. In general, the overall estrus rate for single and double doses of prostaglandin injection is 83.85%. Similar to that of single injection the overall injection (for single and double injection) of the number of services per conception and conception rate was significantly affected by AITS. The conception rate and the number of services per conception for overall injection (for both single and double doses of injection) were 52.29% and 1.91 respectively.

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