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## A Study to Evaluate the Artificial Insemination (AI) Success Rate in Cattle Population Based on Three Years Record among Different Sub-centers of Chittagong and Cox's Bazar District of Bangladesh

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**Abstract:** To evaluate the success rate of artificial insemination and average service required per conception of cows inseminated in different AI points of sub centers under Chittagong and Cox's Bazar District of Bangladesh, last three years AI records were analyzed and interpreted. The lowest and highest conception rates in different points under Pahartali sub center were recorded to be 55 and 73%, respectively during 1998-1999; the same results being obtained during 1999-2001; 55 and 66%, respectively during 2000-2001. The lowest and highest average services required per conception of cows inseminated in these points was 1.3 and 1.8, respectively. On the contrary the lowest and highest conception rates were 41 and 42% during 1998-99 and the following year (1999-2000) with an improvement to 46 and 55 % during 2000- 2001 period, respectively in points under Shandip sub-center. The lowest and highest average service per conception were between 1.8 and 2.4 during the said period. The lowest and highest conception rate and average service per conception were obtained from different points of Cox's Bazar sub center where 59 and 64%, 50 and 72%, 50 and 77% conception rates; and 1.6-1.7, 1.4-2.0, 1.3-2.0 average services per conception during the period of 1998-1999, 1999-2000 and 2000-2001 were recorded, respectively. These differences were proved to be statistically significant. The difference in successful conception rates between Shandip and Pahartali Sub center; and Shandip and Cox's Bazar sub center during 1998-1999, 1999-2000, 2000-2001 period were also found statistically significant. However, as the overall (1998-2001) conception rates were compared between Shandip and Pahartali and Shandip and Cox's Bazar, there were shown statistically insignificant. The overall conception rates and average services per conception to the animal of 1998-2001 were found to be significant as well.

**Key words:** Artificial insemination, conception rate, service, pregnancy

### Introduction

Most of the cattle in Bangladesh are indigenous type (*Bos indicus*) with some cross breeds along with some pure breeds, for example Sindhi, Sahiwal, Jersey, Holstein etc. Now-a-day, cross bred number is uplifting country wide day by day with the spread of artificial insemination practices (Rahman *et al.*, 1998). Artificial insemination was thus first introduced in Bangladesh from 1959 by using liquid semen of HYV breed for cattle development. However, currently, 23 AI centers, 423 sub-centers and 554 points covering all the 64 districts of the country have been extending artificial insemination services using frozen semen. Profitable dairy farming is defined as the satisfactory reproductive performance of the cow. Productivity of cow largely depends on individual reproductive performance. The best measure for reproductive efficacy of heifers and cows include age at puberty, age at first calving, calving to first post-partum

service interval as well as the interval between calving and post-partum conception (Rahman *et al.*, 1995). In earlier large dairy herds and small hold farm level studies, it was noticed that delayed puberty, long post-partum acyclicity and gynecological problems were the major limiting factors against maintaining optimum reproductive efficiency of the indigenous Zebu cattle in Bangladesh (Shamsuddin *et al.*, 1987; Alam and Ghosh 1988; Ghosh *et al.*, 1988). Substantial declines in the reproductive performance of dairy herds worldwide noticed in several recent studies to give an example, in the USA, conception rate to first service has declined @ 0.4% per year over the period from 1973-1995 (Butler *et al.*, 1995). In the UK conception rate has declined by approximately 1% per year over the past 20 years, falling from 55.6% between 1975 and 1982 to 39.7% between 1995 and 1998 (Royal *et al.*, 2000).

The study is an epidemiological work evaluating

conception rates and average services per conception of the cows being inseminated in different points under different sub centers of Chittagong and Cox's Bazar districts of Bangladesh which perhaps is not available in Bangladesh. Therefore, the present study is undertaken as epidemiological pattern looking at the following objectives:

- I. To evaluate the AI success rate of different sub-centers of Chittagong and Cox's Bazar district of Bangladesh.
- II. To find out the variation of success rates among different sub-centers in relation to time (years)
- III. To calculate the average services required per conception of the cows inseminated among different AI points under different sub-centers.

### Materials and Methods

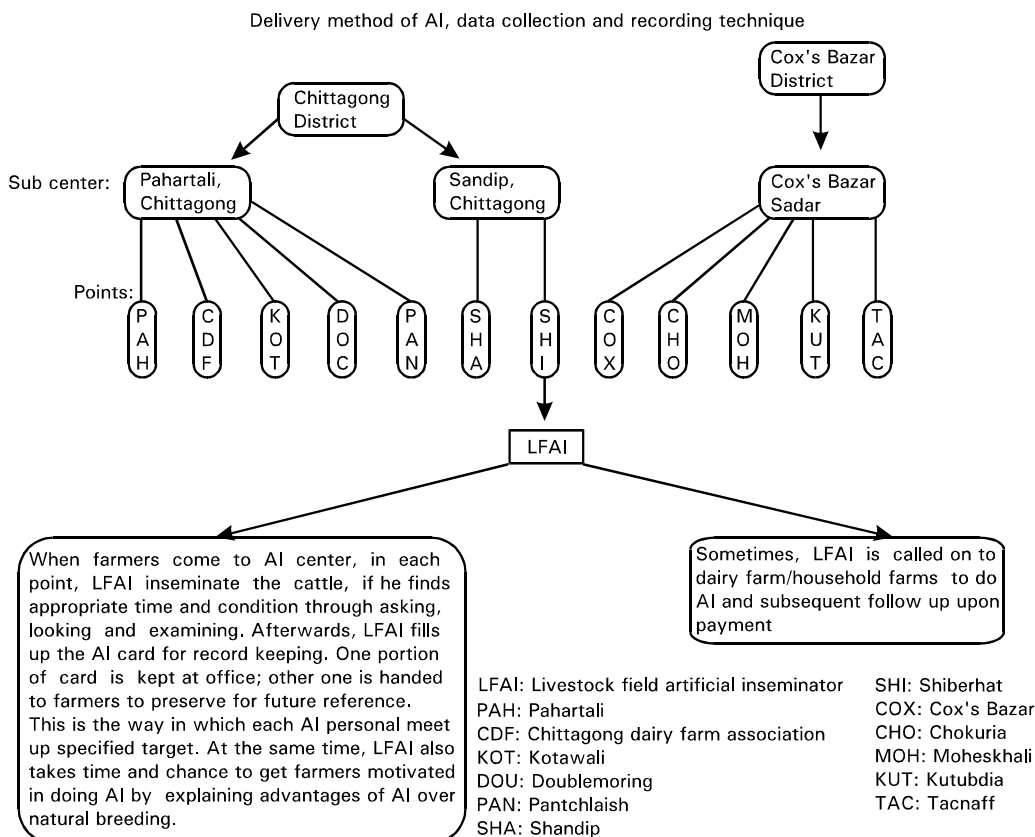
As per existing standard method in this country, the operation of artificial insemination service at field level is being directed under a separate wing of Directorate of Livestock Services (DLS). The delivery of service at very field level to the owner/farmer provided while cows or heifer recognized in heat brought to the different AI

points working under the Sub-centres of the District Artificial Insemination Centres. The service however also been extended in the form of on-call to the farm upon payment. The detail methodology of AI service provided at sub-centers and their subsequent record keeping and trace back system has explained in the following diagram as accorded and standardized by the Directorate of Livestock Services and National Breeding Policy of Bangladesh.

### Conception rate calculation/estimating success rate of AI:

Conception rates (CR) are estimated from the proportion of pregnancies confirmed by rectal examination of the genital tract at day 60 of post-insemination among the total number of cows/heifer inseminated artificially with frozen semen in a specified period of time. The pregnancy confirmation is done in 20% animals of the total inseminated cows/heifers following a systemic random sampling (i.e., every five of the total inseminated animals). The results obtained from this manner are generalized to the target population.

$$\text{Conception rate (CR)} = \frac{\text{No. of cows/heifer pregnant}}{\text{No. of cows/heifer inseminated}} \times 100$$



A descriptive form of report has to make by LFAI of each point monthly to be forwarded to controlling Upazila Livestock Office (ULO). ULO puts forward the report to AI sub-center. This is the hierarchy of information exchange and storage about evaluating the success rate for a given period of time as per the target of achievement set respectively.

#### Quality assurance of semen

- I. Collection of semen from a bull of known genetic merit, which shows the best performance with the local condition.
- II. To maintain the quality, semen is preserved in liquid nitrogen at  $-196^{\circ}\text{C}$  temperature.
- III. To do viability test sperm of some sub centers

**Data acquisition, sorting, entry and analysis:** For the present study, last three years AI data were collected from different AI points delivering services of AI under different sub-centers of two Eastern district Chittagong and Cox's Bazar. The data were duly screened for missing information and duplications and entered into Epidemiological data base (Epi-info-6.4 and STATA-7.3) for further sorting and analysis. Descriptive statistics were carried out to estimate the conception rate and services required per conception and were expressed in percentage with the level of confidence (95%). Difference in conception rate between different points and sub-centers were tested for significance using "z" test as the sample size is good enough for the mentioned test.

#### Results and Discussion

The lowest conception rate 55% was found in Pahartali and Kotwali center, followed by 59 and 60% in Doublemoring and Pantchlaish points respectively where as the highest rate was recorded to be 73% in CTG Dairy Farm Association points of Pahartali sub-center during 1998-1999. The overall conception rate was calculated to be 59% in this sub-center. The results were statistically significant for all points and sub-centers. However, average service required per conception was ranged between 1.3-1.8 with an overall 1.7 during this period for Pahartali sub-centers (Table 1).

The CR for the successive year (1999-2000) remained almost similar apart from Doublemoring, which increased to 73% than its previous year 59 and 60% in CTG, a bit less than that of 73% of previous year (1998-1999) which also was statistically significant. Nothing was changed in the average figure of conception rate in this sub-center for subsequent year. The overall average service required per conception remains unaltered for the successive years in this sub-center (Table 1).

Earlier worker reported a bit more or less similar conception rate (57.04) in first service (Ghosh *et al.*, 1992).

It was indicated in the previous work that 65% first service conception rate in first service in farms animals might have achieved provided with good nutrition and body weight at the time of estrous (Mostafa *et al.*, 1986; Dobson and Alam, 1987). The result of average services per conception to the animal in some points in the present study has been coincided with other study where it was 1.68 (Ghosh *et al.*, 1992). Number of services per conception for local-Friesian (1.68) and cross (1.79) as reported earlier is almost similar with the present study (Sultan and Bhuiyan, 1997). The present study also got some extent of similar figures of average services per conception (1.30 and 1.35) in indigenous and crossbred cows respectively (Rahman *et al.*, 1998; Halim, 1992). Highest and lowest conception rate 42 and 41% in the points of Shandip sub-center were observed during 1998-1999 and 1999-2000, which were slightly increased (55 and 46%) in the following year (Table 2). The required average service per conception was 2.4 at 1999 and 2000 in compare to 1.8-2.2 in the last year (2001). However, the overall conception rate and average service per conception during 1998-2001 were 44 and 2.3% respectively (Table 2). Relatively poor conception rate of Shandip AI sub-center might be attributed to the poor nutritional status of cows that might have resulted from scarcity or seasonal unavailability of fodder, which agree with earlier works (Leaver, 1977). The average number of services required is in close agreement with the findings of earlier researchers (Bhuiyan, 1999; Busch *et al.*, 1996). They reported that the average number of services per conception is 1.87. They also have interpreted that lower than expected level of conception rate and service per conception might be associated with disease or other factors intervening reproductive efficiency of herd, inseminator and time of insemination. The results of average services per conception found in this study was the same with previous report (Singh *et al.*, 1990) where they reported 2.61, 1.98 and 2.03 for Sahiwal, Jersey x Sahiwal and Red Dane x Sahiwal respectively. The variable average conception rates 76.61 and 73.96% were recorded in indigenous and crossbred cows respectively (Rahman *et al.*, 1998) where as in the same species, it has been found 74.47 and 77.65% respectively (Halim, 1992) that some extend agrees with the present study. Although the artificial insemination performances influenced on climatical factors (maximum temperature day after insemination, rainfall day of insemination, minimum temperature day of insemination, solar radiation day of insemination, and minimum temperature day after insemination etc) were not taken into account in this study, these factors had potential influence on performance rates. They recorded that warmer months were closely associated with lower conception rates than cooler months (33.7

**Table 1: Number of inseminated animals (1st AI) and their conception rate in different points under Pahartali AI sub-center, Chittagong district**

Sub-Center	Target Year	Points	Total cows/heifer inseminated (1st AI)	PD 20%	CN	CR/year (%)±SE	95% CI	Av. S/C		
Pahartali, Chittagong District										
Pahartali, Chittagong District	1998-1999	Pahartali	2199	440	242	55±.02	50-60	1.8		
		CTG Dairy Farm Association	731	146	107	73±.04	66-80	1.3		
		Association								
		Kotwali	1283	257	141	55±.03	49-61	1.8		
		Doublemoring	1305	261	154	59±.03	53-65	1.7		
	1999-2000	1999-2000	Pantchlaish	1318	264	158	60±.03	54-66	1.7	
				6836	1368	802	59±.01	56-62	1.7	
			Pahartali	2011	402	221	55±.02	50-60	1.8	
			CTG Dairy Farm Association	897	179	107	60±.04	53-67	1.7	
			Association							
		2000-2001	2000-2001	Kotwali	941	188	107	57±.04	50-64	1.8
				Doublemoring	998	200	146	73±.03	67-79	1.3
				Pantchlaish	1139	228	132	58±.03	52-64	1.7
					5986	1197	713	60±.01	57-63	1.7
Pahartali, sub-center	1998-2001	Pahartali	2694	539	296	55±.02	51-59	1.8		
		CTG Dairy Farm Association	1173	235	139	59±.03	53-60	1.7		
		Kotwali	1004	201	119	59±.03	52-66	1.7		
		Doublemoring	1085	217	143	66±.03	60-72	1.5		
		Pantchlaish	1285	257	141	55±.03	49-61	1.8		
			7241	1449	838	58±.01	55-61	1.7		
Total	20063	4013	2353	59±.007	57-61	1.7				

**Table 2: Number of inseminated animals (1st AI) with their conception rate in different points under Shandip AI sub-center, Chittagong district**

Sub-Center	Target Year	Points	Total cows/heifer inseminated (1st AI)	PD 20%	CN	CR/year (%)±SE	95% CI	Av. S/c	
Shandip AI sub-center, Chittagong district									
Shandip sub-center	1998-1999	Shandip	738	148	61	41±.04	33-49	2.4	
		Shiberhat	000	000	000	00	00	00.0	
			738	148	61	41±.04	33-49	2.4	
	1999-2000	1999-2000	Shandip	853	171	72	42±.04	35-49	2.4
			Shiberhat	99	20	00	00	00	00.0
				951	191	72	42±.04	35-49	2.4
				856	171	79	46±.04	39-53	2.2
	2001-2001	2001-2001	Shandip	427	85	47	55±.05	44-66	1.8
			Shiberhat	1283	256	126	49±.04	43-55	2.0
				2973	595	259	44±.02	40-48	2.3

**Table 3: Number of inseminated animals (1st AI) with their conception rate in different points under Cox's Bazar AI sub-center, Chittagong district**

Sub-Center	Target Year	Points	Total cows/heifer inseminated (1st AI)	PD 20%	CN	CR/year (%)±SE	95% CI	Av. S/c	
Cox's Bazar AI sub-center, Chittagong district									
Cox's Bazar	1998-1999	Cox's Bazar	756	151	97	64±.04	56-71	1.6	
		Chokuria	1069	214	126	59±.03	52-66	1.7	
		Moheshkhali	97	19	12	63±.11	41-85	1.6	
		Kutubdia	630	126	77	61±.04	52-70	1.6	
		Tacknough	000	000	00	00	00	00	
	1999-2000	1999-2000		2552	510	312	61±.02	57-65	1.6
			Cox's Bazar	585	117	84	72±.04	64-80	1.4
			Chokuria	570	114	71	62±.05	53-71	1.6
			Moheshkhali	49	10	5	50±.16	19-81	2.0
			Kutubdia	699	140	94	67±.04	59-75	1.5
			Tacknough	00	00	00	00	00	00
				1903	471	254	54±.02	50-59	1.9
	2000-2001	2000-2001	Cox's Bazar	620	124	95	77±.04	70-84	1.3
			Chokuria	671	134	83	62±.04	54-70	1.6
			Moheshkhali	89	18	9	50±.12	27-73	2.0
			Kutubdia	856	171	123	72±.03	65-79	1.4
			Tacknough	48	10	00	00	00	00
	1998-2001	1998-2001		2284	457	210	53±.03	48-58	1.6
			Total	6739	1348	876	65±.01	62-68	1.7

Significant at P<0.001

PD: Pregnancy Diagnosis; CR: Conception rate; Av S/C: Average services required per Conception ; SE: Standard Error; CI: Confidence Interval; Int: Interpretation; HS: Highly Significant  
CTG: Chittagong

Table 4: Conception rate difference between sub-center in Chittagong and Cox's Bazar district of different years

Year	Difference between Sub-center	CR/year (%)	DCR/year(%) ± SE	95% CI	P-value
1998-1999	S & P	P <sub>1</sub> =41 P <sub>2</sub> =58	17±.4	9-26	>0.001
	S & C	P <sub>1</sub> =41 P <sub>2</sub> =61	20±.05	11-29	>0.001
1999-2000	S & P	P <sub>1</sub> =38 P <sub>2</sub> =60	22±.04	14-30	>0.001
	S & C	P <sub>1</sub> =38 P <sub>2</sub> =54	16±.04	8-25	>0.001
2000-2001	S & P	P <sub>1</sub> =49 P <sub>2</sub> =58	9±.03	2-15	>0.001
	S & C	P <sub>1</sub> =49 P <sub>2</sub> =46	3±.04	-4-10	0.4

Table 5: Over all conception rates of 3 years period in different sub-center

Target year	Sub-center	Total cows/heifer inseminated (1st AI)	20% Preg	CN	CR/year (%) ±SE	95% CI	Av S/con
1998-2001	Pahartali	20063	4013	2353	59±.007	57-61	1.7
	Shandip	1283	595	259	44±.02	40-48	2.3
	Cox's Bazar	6739	1348	876	65±.01	62-68	1.5

Table 6: Conception rate difference between sub-center in Chittagong and Cox's Bazar district of over the 3 years period

Year	Difference between Sub-center	CR/year (%)	DCR/year (%)± SE	95% CI	P-value
1998-2001	S & P	P <sub>1</sub> =20.2 P <sub>2</sub> =20.0	0.2±.01	-0.2-0.3	0.8
	S & C	P <sub>1</sub> =20.2 P <sub>2</sub> =20.0	0.2±.01	-0.2-0.3	0.8

Significant at P<0.001

AV Serv/Con: Average services per Conception to the animal; PD: Pregnancy Diagnosis; CR: Conception rate; DCR: Difference Conception rate; SE: Standard Error; CI: Confidence Interval; S: Shandip; P: Pahartali; C: Cox's Bazar; P<sub>1</sub>: Percentage CR of Shandip; P<sub>2</sub>: Percentage CR of Pahartali; Int: Interpretation

compared to 40.1%). They also counted that rates declined with age: heifers, 47.6%; young cows, 42.7%; older cows, 31.9%. "Conception rate was 2.9% higher in stanchion than loose housed herds and 2.3% higher in grade than registered cows; conception rate also decreased for semen by bulls 8 years and older" that were not followed in this study (Taylor *et al.*, 1985). Clear mucus in half of the females upon cervical manipulation at insemination was led to know the performance parameters that were closely associated with higher conception (Stevenson *et al.*, 1983).

The lowest and highest conception rate ranged between 59-64% in different points of Cox's Bazar sub-center during the period of 1998-1999 with an overall CR of 61% (Table 3). However, a wide range of variation (72-50%) between highest and lowest CR was evidenced during 1999-2000, with a decreased overall CR (54%) than preceding year. This trend of wide variation in lowest and highest conception rate (50-77%) in different sub-centers of Cox's Bazar continues for the 2000-2001 to make a drop the overall average down to 53%. The average service per conception required to the cows and heifers was ranged between 1.6-1.7 during 1998-1999, 1.4-2.0 during 1999-2000, and 1.3-2.0 during 2000-2001 of different points with an overall services required per conception during 1999, 2000 and 2001 was 1.6, 1.9 and 1.6 respectively (Table 3). Conception rate often gets affected due to delayed involution and persistent or residual infection in the uterus following calving. It has been reported that first

service conception rate considerably drop before 5 week after calving. However, improved CR were reported on week 8 and week 9 post-calving (38.1 and 38.8% respectively) compared to weeks 5 and 6 (14.3 and 24.5%, respectively; P<0.001) (Mayne *et al.*, 2002). The results obtained from the earlier work might be indicative to possible contributing factors in making the disparity in range of CR as found in the present study but difficult to compare since the information required interpreting the possibility was missing. On the other hand, variable conception rate was found considering month of first insemination after calving (31.3 and 44.4%) that also was not comparable because of the same reason explained above (Mayne *et al.*, 2002). However in some instances, almost similar conception rate (44.4%) was calculated. Although the seasons were not considered as an influencing factor on conception rate, some studies overlooked changes in CR convincing of seasonal effect. The average conception rate in November was 31.1% that was significantly lower than in December (44.4%) where as it was higher in April than in May (42.9 and 32.0%), respectively, which was supported by significant P-value (P<0.05) (Mayne *et al.*, 2002). Environmental temperature could be an influencing factor for the performance of artificial insemination. "Increased maximum temperature from 29.7°C during April to 33.9°C during July was associated with a decrease in conception rate on first service from 25 to 7% (Cavestany *et al.*, 1985). Air temperature on day after insemination exceeded 30°C was

influenced to decrease conception rate sharply in cows where rate did not decline in heifers until 35°C. It was found that Virgin heifers had higher conception rates for all services (50%) than lactating cows (34%). “Jerseys had higher conception rates (45%) than Holstein (39%) and Brown Swiss (41%). However the effect of breed on the conception rate has not been attempted to evaluate in the present study. Conception rate also varies between different age and production status of cows. Heifers required 1.5 services per conception compared with 2.3 for lactating cows. Services per conception also vary between breeds and recorded to be 1.7, 2.0, and 1.9 in Jerseys, Holstein and Brown Swiss respectively. However animal level factors like age, breed and production status were not possible to include as influencing factors in the present study to draw any interpretation. However apart from animal level factors some of the technical error of the inseminator and managerial error can also significantly affect the success of AI. Site of semen placement in the reproductive tract, sire, and environmental temperature the day after insemination, service number, and time of day at which insemination occurred; inseminator had also strong effects on conception rates (Gwazdauskas *et al.*, 1981).

Statistically significant ( $P < 0.001$ ) difference in conception rate (DCR) observed between Shandip and Pahartali and Shandip and Cox’s Bazar sub-center during the period 1999 and 2000. However, the difference in conception rate between Shandip and Cox’s Bazar AI sub-centers were not found statistically significant ( $P = 0.4$ ) during 2000-2001 (Table 4). These differences as evidenced between two sub-centers might have been attributed to their location, communication, number of staffs and their skillness, viability and transport of semen etc. The relatively lower conception rate as recorded in Shandip and Cox’s Bazar sub-center in comparison to Pahartali sub center could be due to their difficulties in communication for the clients to come to AI center; Insufficient number of staffs so that they might not cover the area for insemination; less skilled staff might not have detected the actual time for insemination and omitted taking valuable information from farmers; possibility of erroneous diagnosis and in worst cases the LFAI might not be able to place semen in appropriate location. Moreover the quality assessment of Semen could be a great factor for unsuccessful result because it is likely that provision for conducting of semen viability test in these sub-centers were limited.

Although variable conception rates were shown among different sub-centers during 1998-2001, the same significant statistical result ( $P < 0.001$ ) was calculated in

each point. The conception rates and average services per conception were pretty good except Shidip sub center because there might be same reasons mentioned before (Table 5).

Statistical analysis showed that there were no differences in conception rate between Shandip and Pahartali and Shandip and Cox’s Bazar during 1998-2001 (Table 6). Comparative cumulative results between different sub-centers were shown non significant variation which was not comparable with other works because of having unavailability of literatures.

#### Limitation

- I. This might be some extent manipulating type’s data because sometimes in analysis, it was found excellent results, which were not revealed even in controlled study. This could be the way how relevant personnel at each place had to show a good performance showing a good AI success rates, average services per conception, otherwise that would be questionable about their activities..
- II. The system followed to collect information might not be strictly supervised.

Obviously these were the valuable findings what there were analyzed in this study would be help to conduct very control study including many other variables such as, breed, age, rearing status, season, environmental temperature, temperature at the day of insemination, day after insemination, days of insemination after previous calving etc. However, the results could not be generalized because of not very controlled work and only 20% animals were undergone pregnancy diagnosis.

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