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Artificial insemination service delivery by paravets of State Animal Husbandry Department (SDAH): An assessment of four states of India

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ABSTRACT

The study was conducted to assess the artificial insemination (AI) and related service delivery by the paravets of four states (Gujarat, Rajasthan, Telangana and Odisha). Forty paravets were selected from each state making the total sample size of 160. Questionnaire through e-mail and telephonic survey were the methods considered for collection of data. Various services related to AI, viz. number of AI/month, number of pregnancy diagnosis (PD)/ month, average distance travelled/day, etc. were studied along with the input availability for AI. The average AI done/month was 145 which was comparatively higher than the average number of pregnancy diagnosis/month i.e. 116.5. Significant differences were also observed among the states, in case of number of AI/month and pregnancy diagnosis. Though most of the inputs were readily available to them for AI such as cryocan, AI gun, semen straw, LN_2 and gloves but some of the critical inputs, viz. vehicles, waterbaths, thermometer, apron, gum-boots and crystoscope were inadequate. The average distance/day covered by them while providing doorstep services was 16.3 km but none of the respondents was provided vehicles for it. Regression analysis of various socio-personal variables, viz. age, gender, education, job experience, annual income and number of trainings undergone on average number of AI/ month depicted that these variables together were significantly contributing to 51.8% variability in dependent variable. From the different variables, age, annual income and number of trainings undergone were the significant contributors in average number of AI service delivery per month. By seeing the results pertaining to inputs availability, it is advisable to ensure the availability of adequate vehicles, and other inputs by State Animal Husbandry Departments and to take efforts in reducing the gap between the number of AI done and pregnancy diagnosis conducted through proper monitoring to improve the effectiveness of AI. Further refresher training of the paravets on regular basis needs to be ensured to update their knowledge and skills.

Keywords: Artificial Insemination (AI), Paravets, Pregnancy Diagnosis (PD), Service Delivery

Livestock sector, being a pivotal part of India's economy, contributes 4.1% to total GDP and 27.4% to agricultural GDP (BAHS 2019). Among the various challenges being faced by the sector, low productivity of livestock is one. Out of the total adult female bovine population in India, only 20% of the total breedable bovine population is under AI coverage (19th Livestock Census, DAHD&F). This may lead to degradation in the productivity of cattle. The livestock services encompass animal healthcare, production along with human health protection (FAO 2002). In India, the direct delivery of livestock services is being done by the government either free of cost or with subsidies. Paravets working under State Animal Husbandry Department are the major players delivering the AI services. Some studies reported that, according to livestock owners' perception, inadequate availability of professional and para professional staff acts as major constraints in effective utilization of livestock services (Ravikumar and Chander 2011). As per the information available, an AI worker only performs 1.92 AI/day in comparison to the required average i.e. 4 number of AI per day (PIB 2017, GoI). The total number of inseminations done during the year 2019 were 75,779,000 which shows a steady increase from previous year. However, the state wise AI coverage, was found to be uneven (BAHS 2019). Livestock farmers rated the delivery of breeding services, viz. artificial insemination and pregnancy diagnosis as average in terms of effectiveness (Jain 2016) and were partly satisfied with the breeding service delivery (Rathod *et al*. 2014). Government of India has announced Nationwide Artificial Insemination Program in the year 2019. This is being implemented in 2 phases i.e. phase 1 and phase 2 in 600 districts of India which were having less than 50% AI coverage (PIB 2019). Under National Livestock Policy (2013), special importance has also been given towards enhanced AI coverage which can lead to improvement of the productivity of dairy herds. Keeping these facts under consideration, the study was carried out with an objective

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to assess the actual status of AI and other related service delivery by paravets working under state animal husbandry department.

MATERIALS AND METHODS

The study was undertaken in four states, viz. Gujarat, Rajasthan, Telangana and Odisha. From each state, three districts were selected purposively, keeping in view the accessibility of researcher. The selected districts were Jaipur, Sikkar and Jhunjhunu from Rajasthan; Nabarangpur, Balasore and Dhenkanal from Odisha; Mahbubnagar, Warangal and Khammam from Telangana and Kutch, Banaskantha and Anand from Gujarat. Sample selected for the study were para-veterinary professionals/AI workers of state animal husbandry departments from the selected area. Questionnaire through e-mail and telephonic survey were the methods used to collect data. An *ex-post-facto* method was used for the study.

Keeping in view, the response rate of questionnaires (40%), 100 questionnaires to each state were mailed making a total of 400 mailed questionnaire. To collect more credible data from the paravets, the veterinarians of the concerned areas were contacted through proper channel (through chief district veterinary officer). The questionnaires were filled by the paravets under respective veterinarian's guidance. Out of the 400 questionnaires, 180 filled questionnaires returned back. Telephonic survey was preferred to organise the complete data of incomplete/ partially filled questionnaires. To make the results unbiased, responses of 40 paravets were selected randomly from each state making a total sample size of 160. The paravets were asked about their service delivery pattern under certain components, viz. number of AI done per month, number of pregnancy diagnosis (PD) done per month, total number of cases attended per month, average distance covered in a day, types of species handled and fees charged from AI and PD and inputs availability for AI. The mean of all the four states were compared by one-way ANOVA. Correlation and regression analysis was done to study the factors contributing to average number of AI conducted per month. The data was analysed using SPSS software

$$\text{Mean } \bar{x} = \sum_{i=1}^{N} x_i \div N$$

Where n= total number of respondents.

RESULTS AND DISCUSSION

Average number of AI per month: The paravets were enquired about the average number of artificial inseminations (AI) they perform in a month and from the total sample size, most of the respondents i.e. 48.8% performed medium number of AI ranging from 136 to 245 AI per month (Table 1). The average number of AI performed by the respondents was found to be 145 AI/ month. While analysing, state-wise differences were found showing respondents of Odisha differed significantly from other 3 states having average number of AI 91.2 per month which is significantly lower than the average number of AI performed by the respondents of other three states ($p<0.01$). From the current study, it was clear that the average AI done/ month was 145 which fell under medium coverage. This goes in line with the previous study of Channappagouda and Sasidhar (2018) who reported that livestock service delivery was rated average indicating the scope for improvement. As per the past research by Ravikumar (2007), artificial insemination was stated to be one of the major services and provided most frequently as majority of the service providers had devoted most of their time to curative and breeding services. Saravana (2006) also reported the similar findings in Tamil Nadu.

Number of pregnancy diagnosis (PD) per month: Similarly, respondents were enquired about the number of pregnancy diagnosis (PD) performed by them in a month and the results depicted that around 56.2% of the respondents fell under first group, i.e. low with the range of 20 to 113 followed by medium group (38.3%) within a range of 114 to 207 pregnancy diagnosis per month. State-wise significant difference was observed among the four states and Rajasthan and Gujarat had almost similar results with an average of 140 number of pregnancy diagnosis/month. These two states differed significantly ($p<0.01$) with higher number of pregnancy diagnosis/ month than the other two states. The average number of pregnancy diagnosis was 116.5. A substantial gap was seen between number of AI done/month and number of pregnancy diagnosis/month. Hamdani (2013) in Uttar Pradesh. surveyed that productive services consisting of artificial insemination (AI) and pregnancy diagnosis were the major services always being delivered timely by 55.3% of para-professionals whereas Jena (2016) conducted a study in Odisha on service delivery pattern of mobile veterinary units and reported medium availability of breeding services (AI and PD), according to the service providers' view. From secondary data analysis, an overall conception rate of 35% has been reported in the country (Annual Report, DAHD&F, 2020–2021). Similarly, calving rate of 32.8% has been reported in Telangana (vahd.telangana.gov.in, 2019–2020) whereas in annual reports of BAIF (2019-2020), 42% conception rate has been reported. This clearly shows that the present conception rate/AI varies from 30 to 40%. This may be due to the gap between number of AI conducted per month and pregnancy diagnosis. Thus, the gap needs to be bridged which can help to increase the conception rate per AI.

Number of cases attended per month: The respondents were asked about the total number of cases attended by them in a month which included AI, minor healthcare (first aid), etc. The results indicated that 41.9% of the respondents attended high number of cases per month within a range of 484 to 650 cases. The average number of cases were 415.9 cases per month. There was no significant difference found among the respondents of four states.

Distance covered per day: When the respondents were questioned about the distance covered by them in a day, the results depicted that maximum number of respondents (85.6%) were covering 5 to 20 km in a day. The average

Table 1. Distribution of respondents according to the AI and related service delivery

AI Service Delivery	Gujarat (n=40)	Rajasthan (n=40)	Odisha (n=40)	Telangana (n=40)	Pooled (N=160)
Average no. of AI/month					
Low (30-135)	9 (22.5)	9 (22.5)	32 (80.0)	16 (40.0)	66 (41.2)
Medium (136-245)	25 (62.5)	26 (65.0)	8 (20.0)	19 (47.5)	78 (48.8)
High (246-350)	6 (15.0)	5 (12.5)	0 (0.0)	5 (12.5)	16 (10.0)
Mean±SE	170±11.9^{b}	172±11.6^{b}	91.2±6.6^{a}	149±12.04^{b}	145±5.9
F value 12.19**					
Average no. of pregnancy diagnosis/month					
Low (20-113)	11 (27.5)	14 (35.0)	37 (92.5)	28 (70.0)	90 (56.2)
Medium (114-207)	26 (65.0)	22 (55.0)	3 (7.5)	11 (27.5)	62 (38.8)
High (208-300)	3 (7.5)	4 (10.0)	0 (0.0)	1 (2.5)	8 (5.0)
Mean±SE	140.5±9.10^{c}	140.1±10.0^{c}	79.5±5.7^{a}	106±7.8^{b}	116.5±4.6
F value 12.5**					
Average no. of cases/month					
Low (150-316)	11 (27.5)	14 (35.0)	19 (47.5)	8 (20.0)	52 (32.5)
Medium (317-483)	10 (25.0)	4 (10.0)	15 (37.5)	12 (30.0)	41 (25.6)
High (484-650)	19 (47.5)	22 (55.0)	6 (15.0)	20 (50.0)	67 (41.9)
Mean±SE	435±21.8	430±24.2	353.7±16.9	445±17.4	415.9±10.4
F value 4.25^{NS}					
Average distance covered/day (Kilometres)					
5-20 Kilometres	34 (85.0)	33 (82.5)	34 (85.0)	36 (90.0)	137 (85.6)
21-35Kilometres	2 (5.00)	1 (2.50)	2 (5.00)	4 (10.0)	9 (5.6)
36-50 Kilometres	4 (10.0)	6 (15.0)	4 (10.0)	0 (0.0)	14 (8.8)
Mean±SE	16.6±1.9	18.5±2.3	16.9±1.9	13.3±1.02	16.3±0.9
F value 1.36^{NS}					
Types of species handled					
Two types (Cattle and buffalo)	21 (52.5)	16 (40.0)	21 (52.5)	28 (70.0)	86 (53.8)
Three types (Cattle, Buffalo and Goat)	15 (37.5)	19 (47.5)	6 (15.0)	1 (2.5)	41 (25.6)
Four types (Cattle, Buffalo, Sheep and Goat)	4 (10.0)	5 (12.5)	13 (32.5)	11 (27.5)	33 (20.6)
Fee charged for delivering AI and pregnancy diagnosis services (in Rupees)					
AI at centre	10	30	40	40	30
AI doorstep	63.7±3.5	123.3±3.1	102.75±2.2	102.5±1.7	98.06±2.2
PD at centre	0	0	0	0	0
PD doorstep	45.25±0.8	47.5±0.8	47.0±0.8	48.5±0.9	47.06±0.4

Note: Artificial Insemination (AI), Pregnancy Diagnosis (PD); Standard Error (SE); Figures in parenthesis shows percentage; * significant at 5% level, ** significant at 1% level.

distance covered by the respondents was 16.3 km. No significant difference was found among the respondents of the four states. Distance plays a major limiting factor in smoother AI service delivery. As per the previous research by Basunathe *et al.* (2010), the major reasons behind the non-adoption or discontinuation of AI were: non-availability of service and lack of awareness among farmers. Gowda and Samanta (2002) also conducted a study in Kerala and stated that distantly located AI centers was found to be one of the major hindrances in artificial insemination system.

Types of species handled: The respondents were asked about the types of animal species they handle in their field job. From the results it was clear that most of the respondents (53.8%) were handling two types of species i.e. cattle and buffaloes followed by 25.6% handling three types (including goat) and 20.6% handling four types of species i.e. cattle, buffalo, goat and sheep.

Fee charged for delivering AI and Pregnancy diagnosis (PD): The information about amount of money charged for AI and pregnancy diagnosis (PD) both at centre and doorstep was assessed from the respondents whose results showed that there was fixed price of AI at centre which was different for each state, viz. ₹10 for Gujarat, ₹ 30 for Rajasthan and ₹ 40 for both Odisha and Telangana. While delivering AI at doorstep, the respondents charged on an average ₹ 98.06. In case of pregnancy diagnosis, the charge was nil at the centre whereas at doorstep the respondents charged on an average ₹ 47.06. Yadav and Chnadel (2014) also reported that the AI charge was ₹ 30 (at door step) and ₹ 10 (at centre) in Gujarat. The results justify the previous study of Rathod *et al.* (2014) who reported that as per the

opinion of 31.3% of the respondents, breeding services were freely available whereas 44.6% respondents reported to avail these at nominal rates. On the contrary, Gowda and Samanta (2002) conducted a study in Kerala and reported that high cost of insemination was found to be one of the constraints in artificial insemination system. To enhance the coverage, a substantial initiative has been undertaken by government by introducing NAIP phase 1 and phase 2 under which the doorstep delivery of AI has been made available free of cost targeting an overall AI coverage of 50%.

Inputs availability for AI: The information about inputs available to them for smooth conduction of AI and related services was assessed. The iputs were categorised into five groups, viz. AI equipment, thawing essentials, heat detection equipment, transportation facilities and basic sanitary measure. From the results given in Table 2, it is evident that cent percent of respondents had availability of the various AI equipment like cryocan, AI gun, semen straw and LN_2 . While taking into account the essentials needed during thawing, 91.9% of the respondents mentioned regarding availability of thermometer whereas only 25.0% had waterbath. Only 2.5% of the respondents had Crystoscope which is an equipment used for heat detection. In case of transportation facilities, none of the respondents reported the availability of vehicle for doorstep delivery of AI. In case of availability of basic sanitary measures, 80% of the paravets had apron, 55.6% of respondents had gum-boots whereas cent per cent reported availability of gloves. It has also been reported in the same study that a gap of 30.6% was seen in adoption of basic sanitary measures while performing AI, viz. wearing of protective clothing like apron, gloves and gum-boots during AI (Panda *et al*. 2021). This may be due to the inadequacy of basic inputs available. This supports the study of Meena *et al*. (2015) who have also thrown light upon inadequacy of equipment as well as insufficient number of paravets as serious hindrances. Biradar (2009) in a study in Karnataka reported that majority of the vets reported the main constraints faced by them in delivering breeding services are lack of transport facilities followed by lack of skilled subordinate staff whereas constraint faced by farmers was non-availability of AI at doorstep. Distantly located AI centers was one of the major constraints in artificial insemination system as reported by Gowda and Samanta (2002). Similar results were reported by Rashmi *et al*. (2020) and Rajput (2006). Turkson (2003) in Ghana also stated that the perceived hindrance in delivery of animal health services was mainly due to lack of transport facilities along with inadequate supply of medicines and equipment.

Factors affecting the AI service delivery: To assess the factors that are associated with and contributing to the AI service delivery by the paravets, a correlation and multiple regression analysis was done in which the dependent variable was average number of AI per month and independent variables were various socio-personal variables, viz. age, gender, education, job experience, annual income and number of AI trainings undergone. Age, gender job experience and annual income had negative and significant correlation with average number of AI delivered per month (Table 3). This explains that those from young age group, male and having less job experience were conducting more number of AI per month. A positive association with education, annual income and number of trainings undergone depicts that the respondent having higher educational qualification were performing better in delivery AI services. Similarly, those who have undergone more number of trainings were delivering better service than those having undergone lesser number of trainings.

Further regression analysis of these variables together on average AI/ month was calculated and these variables together were significantly ($p<0.01$) contributing to 51.8% variability in dependent variable (Table 4). From the different variables, age ($p<0.05$), annual income ($p<0.01$) and number of trainings undergone ($p<0.01$) were the significant contributors in average number of AI service delivery per month.

The results showed significant differences among four states in terms of number of AI/month and pregnancy

Table 2. Distribution of respondents according to the availability of inputs for AI

Inputs availability		Gujarat n=40	Rajasthan n=40	Odisha n=40	Telangana n=40	Pooled N=160
AI Equipment	Cryocan	(100)	(100)	(100)	(100)	(100)
	AI gun	(100)	(100)	(100)	(100)	(100)
	Semen straw	(100)	(100)	(100)	(100)	(100)
	LN_2	(100)	(100)	(100)	(100)	(100)
Thawing essentials	Waterbath	(52.5)	(22.5)	(0.0)	(25.0)	(25.0)
	Thermometer	(100)	(95.0)	(87.5)	(100.0)	(91.9)
Heat detection equipment	Crystoscope	(7.5)	(0.0)	(0.0)	(0.0)	(2.5)
Transportation facilities	Vehicle	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Basic sanitary measures	Gum-boots	(100)	(2.5)	(0.0)	(7.5)	(55.6)
	Apron	(100)	(75.0)	(75.0)	(70.0)	(80.0)
	Gloves	(100)	(100)	(100)	(100)	(100)

Figures in parenthesis shows percentage.

Table 3. Correlation of various independent variables with average number of AI/month

Independent variables	Correlation with average number of AI/month
Age	-0.332**
Gender	-0.209**
Education	0.255**
Job experience	-0.172*
Annual income	-0.310**
Number of trainings	0.585**

*, Significant at 5% level; **, Significant at 1% level.

diagnosis (PD)/month. As the breedable bovine population of the mentioned states vary, the number of AI and pregnancy diagnosis performed is expected to be dependent on the total number of breedable population of that area along with their target of AI coverage. The average PD/month was 116 which is quite less than the average AI performed/ month (145). The gap needs to be narrowed down to improve the effectiveness of AI and conception rate. Strict monitoring of pregnancy diagnosis after AI should be made mandatory. The paravets should be trained regarding effective conduction of AI as well as pregnancy diagnosis. The government has already taken a great step towards this by bringing out digital real time recording of AI and pregnancy diagnosis by INAPH platform under Nationwide Artificial Insemination Program. More number of paravets need to be recruited and trained for effective conduction of the very program of NAIP. Inputs availability for AI in field among the paravets reveals lack of vehicle, followed by crystoscope, water bath and gum-boots among majority of respondents. In addition to this, some of respondents also reported inadequate availability of thermometer and apron. The state animal husbandry department needs to improve the input availability especially suitable vehicles for vets and paravets for improving the efficiency of the AI service delivery. Further, necessary measures for critical inputs such as waterbath, gum-boots, thermometer and apron are to be undertaken along with provision of crystoscope for effective heat detection. The correlation and regression analysis shows that young paravets were performing better than those of old generation whereas the performance of male paravets were higher than those of female paravets. This may be due to various other factors responsible which needs further study. Education plays an important role as it builds up a person's knowledge base and analytical power. Hence, educated respondents were performing better. As training plays a crucial role in effective AI service delivery, those who were having higher number of trainings were delivering higher number of AI. Keeping this in view, refresher course on AI should be conducted efficiently without fail to update the knowledge and skills of the inseminators.

Table 4. Regression analysis of independent variables on average number fo AI delivered per month

Independent variables	Regression of independent variables on average number of AI/Month		
	B	T value	Sig.
Age	-1.797	-2.212	0.02*
Gender	-38.966	-1.829	0.069
Education	1.761	0.224	0.823
Job experience	1.389	1.311	0.192
Annual income	-21.255	-4.201	0.000**
Number of trainings	45.614	8.402	0.000**
R^2	0.518**		
F Value	23.32**		

*, Significant at 5% level; **, Significant at 1% level.

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