(RESEARCH ARTICLE)

The role of inseminators in the success of artificial insemination beef cattle in Gorontalo district

Asrieana Suprianti Dunggio *, Mohamad Ikbal Bahua and Safriyanto Dako

Pascasarjana, Universitas Negeri Gorontalo, Indonesia.

Abstract

The research was conducted using survey method with the aim to analyze the relationship between variables of characteristics, knowledge and skills of inseminators that affect their performance in supporting the success of artificial insemination of beef cattle in Gorontalo District and the variables that play the most role in the performance of successful implementation of artificial insemination in beef cattle. This research is a qualitative and quantitative research. The subjects in this study were 26 inseminators. The source of data is primary data through questionnaires. Data analysis was done descriptively and Multiple Linear Regression Analysis. The results of the study inseminator performance together significantly influenced ($P < 0.05$) by age factor ($P < 0.05$).0.05) by age (X_1), length of service (X_2), characteristics (X_4) and knowledge (X_5) and significantly influenced the success of artificial insemination with the equation $Y = 2.3358 + 0.0196X_1 - 0.0369X_3 + 0.1623X_4 - 0.4542X_5$ ($P < 0.05$) with $R^2 = 0.0358 + 0.0196X_1 - 0.0369X_3 + 0.1623X_4 - 0.4542X_5$ ($P < 0.05$).0.05) with $R^2 = 0.5258$ and p-value=0.03459.

Keywords: Inseminator; Artificial Insemination; Artificial Insemination Success; Linear Regression Analysis

1. Introduction

Efforts to encourage increased domestic production can be made through improved production technology to increase productivity through optimization of artificial insemination. Artificial insemination technology has been applied in Indonesia since 1952. Intensive field application began at the beginning of 1973 using frozen semen from various imported cattle breeds. Artificial insemination is one of the technologies in beef cattle farming to increase population and genetic quality of livestock.

Artificial insemination is the insertion of semen/cement into the genitals of healthy female animals using insemination tools so that the animal becomes pregnant. It is expected that the optimization of artificial insemination technology will shorten births so that it will encourage an increase in beef cattle production. The success of artificial insemination is influenced by three main factors, namely livestock, semen, and humans. Ardhani *et al*. (2020) stated that the success of artificial insemination is influenced by three main factors, namely livestock, semen and humans. The role of the inseminator in the successful implementation of artificial insemination is certainly influenced by the expertise and skills of the inseminator in the introduction of lambing, tool sanitation, handling frozen semen, correct thawing, and the ability to perform artificial insemination.

Gorontalo Regency with 19 sub-districts consisting of 14 urban villages and 191 villages, has 31 active inseminators who have acceptors spread across Gorontalo Regency. As a beef cattle breeding area with the largest population in Gorontalo Province, 101,733 heads (2022 Beef Cattle Population Data), artificial insemination is one of the steps that can support the achievement of an increase in beef cattle population. The advantages of artificial insemination in cattle in Indonesia include faster genetic quality improvement because it uses semen from superior males, can save the cost

* Corresponding author: Asrieana Suprianti Dunggio

of maintaining other males, and transmission of venereal diseases from inseminated cattle can be limited or prevented (Setiawan, 2018).

2. Research methods

This research was conducted at the Livestock and Animal Health Service Office of Gorontalo District from January to March 2024. This research is a survey study consisting of primary and secondary data surveys. Primary data was obtained from interviews with inseminators in Gorontalo district using questionnaires. Secondary data were obtained from the Livestock and Animal Health Service Office of Gorontalo District in the form of data on the implementation of artificial insemination of inseminators and the number of pregnancies per mating (S/C). The population of this study were 26 inseminators.

The data generated from this study were analyzed descriptively and to identify the role of inseminators on the success of artificial insemination using multiple linear regression analysis. Multiple linear regression analysis is performed to determine the direction and how much influence the independent variable has on the dependent variable (Ghozali, 2018) with the equation:

$$Y = a + b_1X_1 + b_2X_2 + \ldots + b_nX_n$$

Where:

Y	: Independent variable (Artificial Insemination Success)
a	: Constant
b	: Slope or Coefficient Estimate
$X_1..X_n$	: Independent variable (Role of Inseminator)

3. Research results

Qualitative analysis of inseminator profiles in the form of age, education and length of service is described as follows:

3.1. Age category of inseminators

Table 1 Age Category of Inseminators

No.	Age Category (years)	Number of Inseminators (people)	Average Average Number of IBs (head)	Average Average Number of CLA (head)
1	20-30	4	421	301
2	31-40	7	371	274
3	41-50	8	682	553
4	51-60	6	495	442
5	61-70	1	103	80

Source Primary Data Processing, 2024

A total of 30.8% of inseminators were in the 41-50 year age group. While for the age group 20-30 years as much as 15.4%, 31-40 years as much as 26.9%, 51-60 years as much as 23.1% and in the age group 61-70 years as much as 3.8%. Razak *et al*., 2021 mentioned that age can be used as a benchmark in seeing a person's activity at work, with age conditions that are still productive, it is likely that someone can work well and optimally.

Jihadi Asraf, R *et al*., 2023 in his research said that there is a relationship between age and experience or flight hours of inseminators so that the success rate of artificial insemination produced is better. In the table, the average number of artificial inseminations and most pregnancies were in the 41-50 year age group. From the age category, inseminators in Gorontalo Regency are in the age range of 15-65 years, where the age range is included in the productive age range. As argued by Ardhani *et al*., 2020 that the age range of 15-65 years is included in the productive age category. The younger a person is, generally the curiosity about something is higher and the interest in adopting technology is also higher. Meanwhile, the effect of age on the total success of artificial insemination is shown in the following table:

Table 2 Data of Inseminator Age on Total Success of Artificial Insemination

Age	Frequency	Total Success (Total S/C)
20-29	3	3.79
30-39	8	10.69
40-49	8	10.63
50-59	5	8.06
60-69	2	2.72

Source Primary Data Processing, 2024

The highest total success of artificial insemination is found in the age group of 30-39 years and 40-49 years, namely 10.69 and 10.63. When viewed in the table, the S/C value ranges from 1.2-1.6, as stated by Feradis (2014) that a good S/C is 1.6-2.0 times the service. In the age group of 20-29 years, the success rate reached 10.56% with an S/C value of 1.2, in the age group of 30-39 years the success rate was 29.78% with an S/C value of 1.3, in the age group of 40-49 years the success rate reached 29.62% with an S/C value of 1.3, in the age group of 50-59 years the success rate reached 22.46% with an S/C value of 1.6 and in the age group of 60-69 years the success rate reached 7.58% with an S/C value of 1.3.

3.2. Inseminator Education Category

Inseminator education categories can be seen in the following table:

Table 3 Education category of inseminators

No.	Education Category	Number of Inseminators (people)	Average number of IBs (head)	Average number of PKB (head)
1	HIGH SCHOOL	20	506	403
2	Diploma	1	567	451
3	Bachelor	5	422	298

Source Primary Data Processing, 2024

From the table of inseminator education categories, the data showed that 76.923% of inseminators had a high school education, 19.231% had a bachelor's degree and 3.846% had a diploma. Dawit *et al*., 2021 said that a person's education will have an impact on knowledge and broad insight, so there is a tendency to respond or adopt an innovation more easily. Suyanto, B. (2023) in his research illustrates that East Lampung has inseminators with good education, most of which are high school, and interestingly there are inseminators with diploma, undergraduate and even postgraduate education.

Education is an indicator of whether or not individuals are able to accept innovations or knowledge, especially about animal husbandry. The total success of artificial insemination in the education category is presented in the following table:

Table 4 Data on Education to Total Success of Artificial Insemination

Education	Frequency	Total success (total S/C)
HIGH SCHOOL	16	21.70
SMEA	1	1.41
SMK	3	3.93
D3	1	1.76
Bachelor	5	7.10

Source Primary Data Processing, 2024

Inseminators in the high school education group showed the highest frequency of 16 people. That in the high school education group the success reached 60.44%, in the SMEA education group the success reached 3.93%, in the SMK education group the success reached 10.95%, in the diploma group the success reached 4.90%, and in the undergraduate group the success achieved was 19.78%. The S/C as a parameter of success in the implementation of artificial insemination is in the range of 1.3-1.7 (good). Ardhani *et al.*, 2020 said that education affects the learning process, the higher a person's education, the easier it is for that person to receive information, the more information received, the more knowledge gained about animal husbandry, especially artificial insemination (IB).

3.3. Length of Service Category

Length of service is one of the inseminator profile data analyzed to see inseminator performance, as shown in the following table:

Table 5 Category of Length of Service as an Inseminator (length of service)

No.	Category Length of Service (years)	Number of Inseminators (people)	Average number of IBs (head)	Average number of PKB (head)
1	1-5	4	338	214
2	6-10	10	518	399
3	11-20	10	575	474
4	21-30	2	271	209

Source Primary Data Processing, 2024

Inseminators with the highest length of service are those with 6-10 years and 11-20 years of service, namely 38.462%, 15.384% for the 1-5 years group, and 7.692% for the 21-30 years group. Amedia *et al.*, 2021 said that extensive inseminator experience requires a long enough working period, where increasing work experience, inseminators will further improve the quality of performance. Inseminators in Gorontalo Regency on average have been in the profession as inseminators for 10.34 years.

From the table above, it is explained that there is an increase in the average number of artificial inseminations and pregnancies along with the increase in the length of service of inseminators, then it will tend to decrease in the working period of 21-30 years. Arianti *et al.*, 2020 added that the high level of work experience of a person in carrying out their duties will lead to high knowledge and skills in performing artificial insemination. The effect of length of service on the success of artificial insemination is presented in the table below:

Table 6 Data on tenure and total success of artificial insemination

Length of service	Frequency	Total Success (Total S/C)
1-10	14	18.75
11-20	10	14.42
21-30	2	2.72

Source Primary Data Processing, 2024

In the working period of 1-10 years, the total success of artificial insemination was 18.75, so that in the working period group the success of artificial insemination reached 52.24% with an S/C value of 1.3. For the 11-20 year tenure group the total success of artificial insemination amounted to 14.42, with success reaching 40.18% and an S/C value of 1.4 while in the 21-30 year tenure group the total success of artificial insemination amounted to 2.72 in the sense that the success achieved was 7.58% and the S/C value was 1.3.

3.4. Characteristics

The average characteristic <3 has a percentage of success of 16.16%, for an average of 3.0-3.9 the success reached 43.62% and on average ≥4 the success reached 40.22%. In the characteristic variable, the S/C value is 1.3-14 (good). Characteristics in this case are experience in line with the length of service of the inseminator, where the inseminator characteristics factor is one of several factors determining the success of artificial insemination. The results of the study

obtained inseminators have an average length of time as an inseminator is 10.34 years. This shows that inseminators have been doing artificial insemination activities for a long time, so it can be said that they have sufficient experience in carrying out artificial insemination. Amidia *et al.*, 2021 said that the extensive experience of inseminators requires a long working period, the increasing work experience of inseminators will further improve the quality of performance.

Table 7 Data of Characteristics on Total Success of Artificial Insemination

Characteristics (average)	Frequency	Total success (S/C)
<3	4	5.80
3,0-3,9	12	15.66
≥ 4	10	14.44

Source Primary Data Processing, 2024

3.5. Knowledge

Table 8 Data on Knowledge towards Total Success of Artificial Insemination

Knowledge	Frequency	Total success (S/C)
4.0-4.5	8	11.58
4.6-5.0	18	24.32

Source Primary Data Processing, 2024

From the table above, divided into average groups 4.0-4.5 and 4.6-5.0 where the total success of artificial insemination is 11.58 and 24.32 respectively. At an average of 4.0-4.5 the success achieved was 32.26% while at an average of 4.6-5.0 the success reached 67.74 with S/C at 1.3-1.4 (good).

3.6. Skills

Table 9 Data on Skills and Total Success of Artificial Insemination

Skills	Frequency	Total success (S/C)
<4,0	1	1.26
4,0-4,5	6	8.58
4,6-5,0	19	26.05

Source Primary Data Processing, 2024

In the inseminator skills table, the average groups <4, 4.0-4.5 and 4.6-5.0 were obtained. For the average <4 the success reached 3.51%, for the average 4.0-4.5 the success of artificial insemination reached 23.91% and on average 4.6-5.0 the success of artificial insemination reached 72.58%. The S/C value was 1.2-1.4 (good).

3.7. Artificial Insemination Success Rate

To determine the extent of the role of inseminators on the success rate of artificial insemination in beef cattle in the district, several factors were analyzed, namely age (X_1), education (X_2), length of service (X_3), characteristics (X_4), knowledge (X_5) and skills (X_6), each of which is referred to as an independent variable. The results of multiple linear regression analysis of the dependent and independent variables in this study are shown in Table 10:

Table 10 Regression Coefficient Values Between Performance and Independent Variables

Regression coefficient	Value	Pr(>|t|)
Constant	2.3358	0.000778***
X_1 (age)	0.0196	0.004058**
X_2 (Education)	0.0378	0.196828
X_3 (Length of service)	0.0369	0.007086**
X_4 (Characteristics)	0.1623	0.024329*
X_5 (Knowledge)	0.4542	0.009574**
X_6 (Skills)	0.0182	0.888439

Source Primary Data Processing, 2024

Based on the results of data processing above, it can be seen in the Pr(>|t|) section, some variables do not have a significant effect because the resulting value is more than $\alpha = 0.05$. The variables that significantly affect the success of artificial insemination (Y) are Age (X_1), Tenure (X_3), Characteristics (X_4) and Knowledge (X_5) so that the model obtained is as follows:

$$Y = 2.3358 + 0.0196X_1 - 0.0369X_3 + 0.1623X_4 - 0.4542X_5$$

The model above shows how the relationship between X_1, X_3, X_4 and X_5 to Y. If all X variables are 0, the value of Y will be 2.3358 as a constant value. It can also be seen in the model above, the regression coefficient of X_1 is 0.0196 which indicates that the Y variable will increase by 0.0196% if X_1 increases by 1%. The regression coefficient of X_3 is 0.0369 which indicates that variable Y will increase by 0.0369% if X_3 increases by 1%. Then for the X_4 regression coefficient it is 0.1623 which indicates that the Y variable will increase by 0.1623% if X_4 increases by 1%.

Similarly, the regression coefficient of X_5 is 0.4542 which indicates that variable Y will increase by 0.4542% if X_5 increases by 1%.

Based on table 10, the significant value of Pr(>|t|) on the age variable (X_1) is 0.004058 smaller than 0.05, so it can be said that the age variable has a significant effect on the success of artificial insemination in Gorontalo Regency. According to Saragih (2000) in general, age has an influence on work productivity, more on jobs that rely on physical strength. Inseminators in Gorontalo Regency are in the productive age range of 15-65 years so that they are able to carry out tasks in the field, as there is a relationship between age and work experience or flying hours of inseminators so that the success rate of artificial insemination produced is better. At productive age, it is possible for inseminators to be alert in serving acceptors from one place to another so that the possibility of delays in insemination time is small, thus greatly supporting the success of artificial insemination.

The length of service variable (X_3) obtained a significant value of 0.007086 (<0.05) so that the length of service significantly affects the success of artificial insemination in Gorontalo Regency. New inseminators have different experience from inseminators who already have a long working period. Experience in the field will be obtained if the inseminator's flying hours are high so as to gain insight and skills. The longer the inseminator's working period, the more experience they have.

For the characteristics variable (X_4), a significant value of 0.024329 (<0.05) was obtained, which means that characteristics significantly affect the success of artificial insemination in Gorontalo Regency. Experience inseminator's experience depends on the experience in inseminating livestock, as well as technical trainings related to insemination that have been attended. Inseminators who have been in the profession for a long time are certainly full of experience, while new inseminators must gain more experience and hone their skills.

In line with the views of Yuliandri and Rahman, (2021) that the relationship between inseminator characteristics and the results of artificial insemination shows a relationship in the meaningful category and there is a significant relationship, meaning that it can be known that the relationship between inseminator characteristics shows a real relationship to the results of artificial insemination and has a positive relationship direction, meaning that the higher the quality of inseminator characteristics, the quality of artificial insemination success will increase.

For the knowledge variable (X_5), a significant value of 0.009574 (<0.05) was obtained, which means that knowledge significantly affects the success of artificial insemination in Gorontalo Regency. According to Yuliandr *et al.* 2021*,* respondents who have received formal education and have attended various trainings have a high knowledge response to counseling. Although with an average high school education, the attitudes and views of inseminators can be better, because they learn from experience so that they are able to make good and careful decisions. Training is a very important activity and must be followed by inseminators, where through this activity inseminators can improve inseminators' knowledge, skills, and understanding of artificial insemination, so that it will improve inseminators' performance. Inseminators who have attended the training are expected to have knowledge of reproductive anatomy, female reproductive organs, semen deposition, and the lambing cycle of female cattle.

For the coefficient of determination (R^2) = 0.5258 which shows how much the role of changes in the dependent variable is caused or caused by changes in the independent variable. While the p-value obtained sig value = 0.03459, where the significance value (0.03459) <0.05, it means that the variables of age, education, length of service, characteristics, knowledge and skills simultaneously affect the success of artificial insemination of beef cattle in Gorontalo Regency.

The interpretation of the coefficient of determination R^2 = 0.5258 is quite strong (0.40-0.599), which means that the influence of the independent variable X on the independent variable Y is quite strong. If the coefficient of determination (R^2) value is getting closer to 1, the influence of the independent variable X on the independent variable Y is getting bigger. R Square of 0.5258 or 52.58% means that the variables of age (X_1), education (X_2), length of service (X_3), characteristics (X_4), knowledge (X_5) and skills (X_6) simultaneously (together) affect the success of artificial insemination (Y) by 52.58%, so it can be said that the effect of the relationship is quite strong. While the remaining 47.42% can be explained by other factors or variables not examined in this study,

4. Conclusions

From the results and discussion, it can be concluded as follows:

- Through multiple linear regression analysis, there is a significant relationship between age, length of service, characteristics and knowledge to the success of artificial insemination of beef cattle in Gorontalo Regency with the equation model $Y=2.3358+0.0196X_1-0.0369X_3+0.1623X_4-0.4542X_5$ with the coefficient of determination (R^2) = 0.5258 and p-value obtained sig = 0.03459 (<0.05), meaning that the variables of age, education, length of service, characteristics, knowledge and skills simultaneously affect the success of artificial insemination of beef cattle in Gorontalo Regency. 0.05), it means that the variables of age, education, length of service, characteristics, knowledge and skills simultaneously affect the success of artificial insemination of beef cattle in Gorontalo Regency. The coefficient of determination (R^2) = 0.5258 means that the effect of independent variable X on independent variable Y is quite strong.

- R Square of 0.5258 or 52.58% means that the variables of age (X_1), education (X_2), length of service (X_3), characteristics (X_4), knowledge (X_5) and skills (X_6) simultaneously (together) affect the success of artificial insemination (Y) by 52.58%, it can be said that the effect of the relationship is quite strong on the success of artificial insemination of beef cattle in Gorontalo Regency. While the remaining 47.42% can be explained by other factors or variables not examined in this study.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclsoed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1]   Pa et al. (2023). Evaluation of the Success of Artificial Insemination Program in Female Local Beef Cattle in Kuala District, Langkat Regency, North Sumatra Province.*Scientific Journal of Agricultural Students.*8 (1). E-ISSN: 2614-6053.

[2]   Aprisal et al. (2023), Characteristics of Inseminator Relationships on the Success of Artificial Insemination (IB) of Cattle in Sawahlunto City. *Wahana Peternakan*, 7 (2), 95-106.

[3]   Kuswanto (2023). Analysis of the Success Rate of Artificial Insemination (IB) Based on Conception Rate (CR) in Productive Female Beef Cattle in Tarano District, Sumbawa Regency, NTB.*Mandalika Veterinary Journal.* 3 (1), 1-6.

[4]   Kusuma et al. (2021). Evaluation of the Success Rate of Double Dose Artificial Insemination (2nd and 8th Hours) on the Quality of Mating in Ongole Crossbred Cattle.*Journal of Animal Science, Padjadjaran University.* 21 (2), 94-101.

[5]   Amidia et al. (2021). Analysis of the Success of Artificial Insemination (IB) of Cattle Based on Inseminator Characteristics in Kerinci Regency.*Scientific Journal of Batanghari University Jambi*, 21(2), 467-476.

[6]   Marianus et al. (2021). Evaluation of Artificial Insemination (IB) of Upsus Siwab Program in Berau Regency.*Journal of Tropical Environmental Animal Husbandry.*4 (1). E-ISSN: 2654-2501.

[7]   Mahyun et al. (2021). The success rate of artificial insemination (AI) based on the Mandatory Breeding Cow Program (SIWAB) in Sangkub District.*Zootec.*41 (1), 122-130.

[8]   Benedikta et al. (2021). Analysis of Artificial Insemination Success Factors in Bali Cattle in South Atambua sub-district, Belu Regency.*Journal of Animal Science.* 6 (4), 72-75.

[9]   IG et al. (2020). Identification of Factors Affecting the Performance of Inseminators in Supporting the Success of Artificial Insemination in the UPSUS SIWAB Program in Bali. 23(2).

[10]   Pasino et al. (2020). Increasing the productivity of female cattle through artificial insemination with rectovaginal method. *Journal of Local Animal* Husbandry, 2(2).ISSN 2685-7588.

[11]   Deviana et al. (2020). Factors Affecting the Success of Artificial Insemination in Cattle in Asahan District, North Sumatra.*Scientific Journal of Integrated Animal* Husbandry.8 (3). P-ISSN: 2303-1956.

[12]   Ardhani et al. (2020). The Role of Farmer and Inseminator Factors on the Success of Artificial Insemination in Beef Cattle in Kota Bangun Subdistrict. *Journal of Tropical Environmental Animal Husbandry.*3(1).15-22.

[13]   Fania et al. (2020). Success of Artificial Insemiansi (IB) in Bali Cattle in Mengwi District, Badung, Bali.*Indonesia Medicus Veterinus.* 9 (2), 177-186.

[14]   Poli et al. (2020). Implementation of Artificial Insemination Program to Encourage Beef Cattle Development in North Bolaang Mongondow District.*Proceedings of the VII Seminar on Animal Husbandry Technology and Agribusiness- Webinar: Prospects for Animal Husbandry in the New Normal Era Post Covid 19 Pandemic, Faculty of Animal Husbandry, Universitas Jenderal Sudirman.*

[15]   Kastalani et al. (2019). The Success Rate of Artificial Insemination (IB) in Beef Cattle Farming in Kalampangan Village, Sabangau Subdistrict, Palangka Raya City.*Journal of Tropical Animal Science*, 8(2), ISSN: 2301-7783.

[16]   Anari et al. (2018). Beef Cattle Development Strategy to Increase Farmers' Income in Manokwari Regency, West Papua.*SME Management.* 13 (2).ISSN 2085-8418.

[17]   Supriyanto (2016). Factors Affecting the Success of Artificial Insemination (IB) Program in Beef Cattle.*Triton Journal.* 7 (2).ISSN: 2085-3828.

[18]   Purwantini, Tri Bastuti. 2015. Optimization of Artificial Insemination (Ib) Supporting the Acceleration of Beef Production and Self-Sufficiency. *Proceedings of the National Seminar on Food Self-Sufficiency of Lampung State Polytechnic.* 2(1), 602-609.

[19]   Tati et al. (2012). The Role of Inseminators in the Success of Artificial Insemination in Dairy Cows.*Agricultural Informatics*, 21(2), 77-82.

[20]   Jihadi Asyraf, Rifqi et al. (2023). The effect of age and inseminator experience on the success of artificial insemination in dairy cows in the working area of the North Bandung Cattle Breeders Cooperative (KPSBU) Lembang.Journal of Agricultural and Animal Sciences.11(2).