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ANALYSIS CORRELATIONS BETWEEN AGE AND SEMEN PRODUCTION OF LIMOUSIN BULL AT NATIONAL ARTIFICIAL INSEMINATION CENTER, SINGOSARI - INDONESIA

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ABSTRACT

The aim of this research was to analyze the correlation between age and semen quality. The material used is in the form of secondary data, namely data from 2012-2018 from 29 Limousin bulls which include semen quality data as much (n = 27407) ejaculation at the Center for Artificial Insemination, Singosari, East Java, Indonesia. The research method used is a case study. The variables observed were bull's age, semen volume, individual motility, and semen concentration. Data were analyzed using SPSS 21 with One-Way ANOVA method. Correlation test using Pearson correlation (r) and statistical analysis of linear regression models to estimate the quality of semen based on the age of the bulls. The results showed that the age of the bulls had a significant effect ($p < 0.05$) on the quality of semen. Age of bulls was significantly correlated ($p < 0.05$) with volume ($r = 0.43$), individual motility ($r = 0.063$) and sperm concentration ($r = 0.282$). The conclusion of the research, Age of Limuosine bull were significant difference on volume, individual motility and sprem concentration. Age has a negative correlation to sperm concentration and individual motility but is positive to semen volume.

Keywords: Correlation, age, semen quality, semen production, Limousin bull.

INTRODUCTION

People's economic growth has an impact on the demand for meat in Indonesia. The consumption of beef in Indonesia per capita is 0.469 kg (Ditjennak, 2019). Consumption of beef in Indonesia must be accompanied by the large number of slaughtered cows. The current cattle population in Indonesia has not fulfilled the needs of the community, the beef cattle population from 2017-2018 was 16.4 million head and an increase of 3.93% (Ditjennak, 2019). The population and productivity of beef cattle can be increased through livestock reproduction management in order to create competitiveness and community independence in small to medium scale beef cattle fattening by utilizing high quality semen from superior bulls, one example is Limousin cattle. One of the ways to increase the productivity and reproduction of local livestock is by using the Artificial Insemination (IB) program. The application of reproductive technology and semen cell biology requires the availability of high quality semen inseminated in female livestock Romadhoni, et al. (2015). Feradis (2010) states that each bull has different quality of semen depending on age, individual livestock, nation and environment. Age is an important reproductive parameter in calculating estimates of semen production and quality. Melita *et al.,* (2014) states that the age of bulls and the frequency of ejaculation affects the volumeof semen. Lestari, *et al.,* (2013) stated that endocrine hormones are affected by age so that they affect the development of the reproductive organs. Bulls semen production will increase with age, because age correlates with the size of the testes. The bigger the testicle size, will produce more tubuli seminiferi that it can increase the production of spermatozoa cells (Ismaya, 2014).

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Based on the information in previous studies regarding the relationship between age of bulls and quality of semen, it is necessary to conduct research to evaluate the relationship between age and quality of Limousin bull produced at BBIB Singosari.

MATERIALS AND METHODS

This research was conducted on 20 July 2019 - 20 August 2019. The research location was conducted at the Singosari Artificial Insemination Center, Malang. The material was records of 29 Limousin bulls collected from 2012-2018. The bulls were kept in individual cages by feeding them 15 kg of forage, 4 kg of concentrate, 3 kg of silage, 4 kg of hay and 0.05 kg of minerals. While drinking water was served *ad libitum*. The method of this research was observation by collecting data on age, semen volume,individual motility and sperm concentration collected from the recording data observed by BBIB Singosari. Age grouping based on the age of bulls starts from the age of 3-12 years. The number observed n = 27407 consisting of 3 years (n = 862), 4 years (n = 2345), 5years (n = 3422), 6 years (n = 3892), 7 years (n = 3979), 8 years (n = 3839), 9 years (n = 4294), 10 years (n =3103), 11 years (n = 1181) and 12 years (n = 490). The data were processed with Microsoft Excel and analyzed using SPSS 21 with the One-Way ANOVA method. If there was a significant difference then proceed with Duncan's test. The correlation between age and qualityof semen used Pearson correlation (r) and linear regression analysis was used to calculate the estimation formula between variables.

RESULTS AND DISCUSSION

Effect of age on semen quality

Table 1. Average semen quality of Limousin cattle at different ages

Age	n (ejucalte)	Volume (ml) Mean ± sd	Individual Motility (%) Mean ± sd	Sperm Concentration (10^6) Mean ± sd
3 years	862	5,45 ± 1,51[a]	67,71 ± 8,23[f]	1418,90 ± 409,58[g]
4 years	2345	5,84 ± 1,61[c]	62,63 ± 12,17[d]	1338,03 ± 430,08[f]
5 years	3422	5,70 ± 1,79[b]	64,30 ± 11,58[e]	1245,27 ± 455,33[e]
6 years	3892	5,97 ± 1,89[d]	62,75 ± 14,85[d]	1095,86 ± 428,21[d]
7 years	3979	5,98 ± 1,91[d]	60,02 ± 15,83[a]	1035,90 ± 418,36[c]
8 years	3839	6,16 ± 1,90[e]	61,16 ± 14,16[bc]	975,87 ± 387,51[b]
9 years	4294	6,05 ± 1,90[de]	62,06 ± 12,86[cd]	967,04 ± 390,36[b]
10 years	3103	6,00 ± 1,93[d]	62,01 ± 13,88[cd]	966,65 ± 416,29[b]
11 years	1181	5,61 ± 2,19[b]	60,56 ± 15,23[ab]	1042,85 ± 441,26[c]
12 years	490	5,96 ± 2,08[d]	62,59 ± 13,29[d]	816,29 ± 353,66[a]
Total	**27407**	**5,94 ± 1,88**	**62,18 ± 13,81**	**1077,79 ± 439,14**

Note: Different superscriptions in the same column show a significant difference (p <0.05)

The results of the analysis of variance in Table 1 show that age gave a significant difference (p<0.05) on semen volume, individual motility and sperm concentration. The average volume from 3-12 years old shows a fluctuating value. 3 years old is the lowest volume with a value of 5,45 ± 1,51 ml and the highest volume is at the age of 8 years with a value of 6,16 ± 1,90 ml. The average volume of Limousin cattle based on different ages was 5,94 ± 1,88 ml. This can be said to be normal, Hartanti et al.(2012) stated that the normal range of bulls semen volume ranges from 3,2-7,3 ml and Arifiantini (2012), stated that the average volume of bull semen is 4-8 ml. The results of this study were lower than the research conducted by Denilisvanti,*et al.* (2017) that Limousin bulls aged 5-11 years have an average ejaculation volume of 7,17 ± 1,41 ml and Aerens et al. (2012) stated that the average volume of Limousin was 6.308 ± 1.386, but it was higher than the research conducted by Sumeidiana, *et al.* (2007) that Limousin bulls with ages ranging from 2-4 years have a semen volume of 5,42 ± 0,97 ml with a range of 4–7,55 ml. This shows that the older the bulls semen volume will increase, but after reaching peak productivity, the semen volume will decrease as the bulls get older. The individual motility value (p <0.05) shows a fluctuating value. The lowest individual motility was at the age of 7 years of 60,02 ± 15,83% and the highest individual motility was at the age of 3 years 67,71 ± 8,23%. The mean value of individual motility of Limousin bulls based on different ages was 62,18 ± 13,81%. The results of this study were higher than the results of research conducted by Denilisvanti, *et al.,* (2017) that Limousin bulls with an average age of 5-11 years have an average individual motility of 59,29 ± 13,87%. The individual motility value of all age groups shows a value below 70%, this is because fresh semen can be processed into frozen semen at BBIB, which has a minimum individual motility of 55% using the basic reference of SNI 4869-1 2017 that the general requirements for frozen semen come from fresh individual motility is a minimum of 70%, if the motility is below 70% for a particular male the value can be used *recovery rate* with a minimum of 50%. Nugroho, et al. (2014) stated that the percentage of individual motility in fresh semen which has a motility percentage above 70% is more resilient than if it is lower than 70%. The value of sperm concentration shows a fluctuating. Lestari et al. (2013) stated that sperm concentration is influenced by age. The lowest sperm concentration was found at the age of 12 years with a value of 816,29 ± 353,66 x 10^6/ml. The highest sperm concentration was found at the age of 3 years with a value of 1418,90 ± 409,58 x 10^6/ml. The average value of fresh sperm concentration in this study amounted to 1077,79 ± 439,14 x 10^6/ml is in accordance with the standard, which is above 1000 x 10^6/ml (Nugroho, et al. 2014). However lower than the research conducted by Sumeidiana, et al. (2007) that sperm concentration Limousin bull at the age of 2-4 years of 1451 ± 275,39 x 10^6/ml with a range of 864-1913 x 10^6/ml. Susilawati (2013) states that the sperm concentration value in beef cattle semen is1018 ± 457 x 10^6/ml.

Relationship between age and quality of semen

The results of observations on the estimation of the relationship between reproductive variables are used to anticipate, manipulate one of the roles of the variable in order to increase the role of other correlated variables. The correlation value between age and quality of fresh semen from Limousin cattle is shown in Table 2.

Tabel 2. Correlation between Age and Semen Quality of Limousin Bull in 2012 - 2018

Correlation	R	r^2	Y	P Value
Age-SV	0,043	0,002	y = 5,667 + 0,037x	0,000
Age-IM	0,063	0,004	y = 65,091 – 0.400x	0,000
Age-SC	0,282	0,08	y = 1.491,280 – 56,794x	0,000

Information: SV = Semen Volume; IM = Individual Motility; SC = Sperm Concentration

The results of the analysis showed that age correlated with volume, individual motility, and sperm concentration ($p < 0.05$). The highest correlation value was found in the relationship between age and concentration ($r = 0.282$) while the lowest was on volume ($r = 0.043$). Age can be used to estimate the volume in Limousin cattle with the regression equation $y = 5.667 + 0.037x$, the regression equation $y = 65.091 - 0.400x$ to estimate individual motility and the regression equation $y = 1,491,280 - 56,794x$ to estimate the sperm concentration. Table 2 shows the volume determination coefficient value of 0.2%, individual motility 0.4%, and sperm concentration of 8% explained by age. The greater the coefficient of determination (r2), the greater the accuracy of the regression line (Lestari, et al. 2013). The results of the study show differences with the research of Kumar and Srivastava (2017) which states that the coefficient of determination of age on motility(r2 = 81%) and sperm concentration (r2 = 41%) in Murrah cattle. The relationship between age and semen volume has a positive value. This shows that getting older of bulls semen volume will increase. This is in accordance with the opinion Ismaya (2014) states that the older bull semen production will increase, because age is correlated with the size of the testes. The bigger the testicles, will produce more tubuli seminiferi, spermatozoa cell production will increase. Paldusova's research results et al. (2014) states that the age group > 5 years shows optimal results and those aged < 2 years show the lowest results. The relationship between age and individual motility has a negative value. This shows that getting older of bulls individual motility will decrease. This is consistent with research conducted by Lestari et al. (2013) stated that the results of the regression line equation between age and the percentage of individual motility showed a slow decline after 100 weeks of age and increased again at over 300 weeks of age (5-7 years). Another result is shown in a study conducted by Brito et al. (2002) states that increasing age has a significant effect on the percentage of spermatozoa motility ($P < 0.01$) and the increase in abnormal spermatozoa ($P < 0.01$). The relationship between age and sperm concentration has a negative value. This shows that getting older of bulls sperm concentration will decrease. This is in accordance with the research of Lestari et al. (2013) which states that age affects spermatozoa concentration ($P < 0.01$).

CONCLUSION

The overall results showed that the age of the bulls had an effect on the quality of semen including semen volume, individual motility, and sperm concentration. Age has a negative correlation to sperm concentration and individual motility but is positive to semen volume. Thus the advice that researchers can give to BBIB in selecting superior bulls by considering age the bulls in semen production.

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