

Estimation of Repeatability and Most Probable Producing Ability (MPPA) of Sapudi Sheep Based on Daily Body Weight Gain of Lambs from Birth to Pre-weaning and Weaning

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ABSTRACT

This research aimed to estimate the repeatability and MPPA values of Sapudi ewes based on the lamb's daily gain from birth to pre-weaning and weaning. Using recorded data in a pedigree of lamb, 53 data with half-sib relationship came from 14 ewes which included the record of body weight gain of Sapudi lambs from birth to pre-weaning and weaning. The data were analyzed by descriptive method with a quantitative approach. The study showed that the average daily gain of pre-weaning and weaning was 007 kg/day. The repeatability value of pre-weaning and weaning daily gain was 0.636 in the high category and 0.377 in the medium category. The MPPA daily gain values for pre-weaning and weaning ranged from -0.032 to 0.018 and -0.016 to 0.009. The research concluded that the Sapudi sheep ewes based on the MPPA daily gain pre-weaning were six heads with four rankings, while the daily weight gain weaning was ten heads with ranking of five. The highest rank of Sapudi ewes in pre-weaning and weaning daily gain was ear tag 094 with MPPA values of 0.018 and 0.009. It is recommended that further research can be conducted to estimate the repeatability value of quantitative periodically as the basis for the selection and culling of livestock.

Keywords: Ewe, local sheep, repeatability, selection.

INTRODUCTION

Sapudi sheep is a popular Indonesian lamb which is known as a meat producer. Sapudi sheep in Indonesia are spread over the area of East Java, especially Jember Regency, there is a technical implementing unit for breeding Sapudi sheep, namely in the Technical Implementation Unit for Livestock Breeding-Green Forage (UPT PT-HMT) Jember by performing their main tasks and functions as a developer of superior Sapudi sheep from terms of production and reproduction. Three important pillars in the sheep breeding business are called the golden triangle concept, namely breeding, feeding, and management. The implementation of the three pillars is that increasing livestock productivity in the field is that sheep breeding businesses must be supported by the application of feed and management followed by continuous genetic improvement (Varijakshapanicker et al., 2019; Simoes et al., 2021; Marinchenko, 2021).

Important factors in parental breeding that have a major effect on lambs consist of 2 factors, first before birth, which affects the genetics of the mother and the uterine environment, the second is postnatal factors which are influenced by milk production and quality of mother's milk during breastfeeding (Oldenbroek and Waaij, 2014). The second factor consists of the birth to pre-weaning period

and the birth to weaning period (Canul et al., 2019; Faid-Allah et al., 2016; Teklebrhan et al., 2014). To find out the advantages of parents in raising their kids from birth to pre-weaning and weaning, it can be observed through the weight gain of their children (Waheed et al., 2022; Jawashreh et al., 2018; Dafur and Mbap, 2021). The repeatability of the ewes seen from the increase in the body weight of the lambs can be estimated using the repeatability value. This replicability is one of the benchmarks needed to estimate the maximum value of heritability or inheritance. This repeatability can provide an overview of the level of adjustment between repeated and consecutive records of the same livestock so that it can describe the superiority or failure of a parent.

Repeatability can also be used to estimate the maximum ability of ewe to produce based on existing performance records so that a parent ranking can be made. Estimation of repeatability and MPPA (Adhianto et al., 2019; Sumadi et al., 2016; Awalia et al., 2019) growth properties in Sapudi sheep on a regular basis can be used as a selection benchmark for increasing the productivity. Therefore, this study aimed to estimate the repeatability and MPPA values of pre-weaning and post-weaning daily body weight gain at UPT PT-HMT Jember, East Java.

MATERIALS AND METHODS

The research was carried out from November 22 to December 22, 2021 at the Technical Implementation Unit for Livestock Breeding and Forage Feeding (UPT PT and HMT) Jember, Curah Manis, Sidomulyo, Silo District, Jember Regency, East Java. The material used in this study was data recording of Sapudi lambs with half-sibling relationships from 14 mothers including 53 data on body weight gain of Sapudi lambs from birth to pre-weaning and weaning.

RESULT AND DISCUSSION

Average Value of Birth Weight and Weaning Weight Average Daily Weight Gain (ADG) Preweaning and Weaning Based on the results of the analysis on the average weight gain of pre-weaning and weaning of Sapudi lambs, it showed the average weight gain of lambs from several mothers. Calculation of weight gain for pre-weaning and weaning can be seen in the

ADG can be used as a benchmark to determine the ability of livestock to convert nutrients contained in feed into the meat during pre-weaning and weaning. Lamb's ADG is used as a basic reference for the selection of superior broodstock. The body weight of the lambs was measured during the pre-weaning period (0-2 months) and before weaning (0-3 months) using standard scales in kilograms (kg). The average daily weight gain of pre-weaning and weaning of Sapudi lambs is listed in Table 1. Daily body weight gain was calculated from the recorded weights of birth weight until a certain age, while in this study using pre-weaning ADG data which was calculated by pre-weaning weight minus birth weight and divided by age, while weaning ADG was calculated from weaning weight scales minus birth weight divided by age.

The data analyzed in this study used 53 data from Sapudi lambs from 14 broods, during the maintenance period from February 2019 to May 2021. The average daily body weight gain of the lambs based on the ewes ranged from 0.03 kg to 0.09 kg and was measured at 0 to 2 months (pre-weaning) with data on actual daily body weight gain between 0.01 to 0.09 kg where a population mean value of pre-weaning body weight gain was 0.07 kg. The study showed that the average value of body weight gain was almost the same compared to Farid's (2019) study with the highest daily body weight gain at the age of 1-30 days 120 ± 19 (g/head/day), then

appendix. And the value of weight gain for weaning and weaning is presented in Table 1.

Table 1. ADG of pre-weaning and weaning

No	Parent code	ADG Pre-weaning (kg)	ADG weaning (kg)	n
1	094	0.09	0.09	3
2	28	0.08	0.07	5
3	058	0.08	0.08	4
4	11	0.07	0.08	3
5	B1	0.07	0.07	6
6	23	0.07	0.08	3
7	51	0.06	0.05	6
8	17	0.06	0.08	3
9	1530	0.06	0.08	4
10	14	0.06	0.07	3
11	A35	0.06	0.08	4
12	103	0.05	0.06	3
13	123	0.05	0.06	3
14	310	0.03	0.08	3
Average		0.07	0.07	53

sheep at the age of 31-60 days 97 ± 20 (g/head/day). The results of the study showed that the average daily body weight gain was higher than the research by Ilham (2017) with the results of the relative body weight gain of local sheep kept in pastures in the pre-weaning period (aged 1-13 weeks) in the dry season for males and females were 53.71 g/day and 61.15 g/day respectively, in the rainy season 55.71 g/day and 69.24 g/day respectively. Table 1 shows the sequence of parent that has the highest mean value, according to the results of the study, there were 3 broods with daily pre-weaning weight gain above the population average (094, 28, 058), 3 broods with an ADG value equal to the population average (11, B1, 23) and 8 other parents had a mean value below the population mean (51, 17, 1530, 14, A35, 103, 123, 310).

The high average value of daily weight gain for pre-weaning is thought to be good traditional maintenance, so that the nutritional intake for lactating cattle in UPT PT and HMT Jember is quite good, this is in accordance with the three pillars of animal husbandry, that are good feed, good seeds, and good management. The average value of daily weaning body weight gain in Table 1 shows an evenly distributed value between parents, the values ranged from 0.09kg/day and the lowest was 0.05 kg/day with data on the actual weaning weight gain of 0.05 kg/day to the highest 0, 09 kg/day was measured at the time of weaning, with a population average

value of 0.07 kg/day of weaning body weight gain. Table 1 shows 9 parents having values above the population mean with eartags (094, 058, 11, 23, 17, 1530, A35, 103, 310), three parents with values equal to the population mean value (28, B1, 14), two parents were below the population mean with eartags (51, 123). Weaning data show an increase in the value of ADG compared to the period before weaning, this is not in line with the results of Ilham's research (2017) which shows that the body weight gain of local sheep decreases gradually until the 13th week of both the dry and rainy seasons and after that, it does not show any further increase or increase. Several non-technical factors are thought to influence the level of pre-weaning and weaning ADG which is sometimes not proportional to the birth weight value.

This is due to the condition of the mother who does not want to breastfeed her child, the death of the mother, and the production of milk that is not optimal so that the Sapudi lambs do not get enough nutrition for daily body weight gain at pre-weaning age. This is reinforced by Assan (2020) who argues that the principal factors that influence the growth of sheep before weaning are genetic and non-genetic factors including birth weight, mother's milk production, sex, weaning age and, the number of children born at the age of the mother. The high value of ADG during pre-weaning and before weaning was due to good management of lamb rearing at UPT PT and HMT Jember. The high ADG is influenced by the size of the livestock body including chest circumference and body length, this is as conveyed by Khoirun (2017) which states that increasing body weight is influenced by increasing body size including chest circumference, body length and shoulder height, due to growth not only fat and increased muscle structure making up the body such as bone also increases.

Estimation of Repeatability of Daily Body Weight Gain (ADG) for Pre-Weaning and Weaning

Based on the results of data analysis using the analysis of variance formula, estimation of repeatability values based on pre-weaning and lamb weaning was carried out as a benchmark for selection of broodstock with different males. The repeatability value estimation based on ADG of 53 Sapudi lambs came from 14 Sapudi mother. The ANOVA calculation can be seen in the appendix, and the

estimated value of weaning and weaning repeatability is presented in Table 2 below.

Table 2. Estimated Repeatability of Pre-weaning and Weaning ADG

Parameters	Pre-weaning	Weaning
Repeatability	0.636	0.377
Category	high	medium
Standard Error	0.135	0.179
n ()	14	14

Estimation of repeatability values based on daily body weight gain of pre-weaning and weaning calves was carried out as the basis for selection of parents with different males. Estimation of the repeatability value of body weight gain of 53 Sapudi lambs from 14 Sapudi lambs. The estimation of the repeatability value in this study was needed to calculate the MPPA value of the Sapudi ewes based on the results of the average daily weight gain of pre-weaning and weaning cubs. Repeatability is useful as an estimate of the maximum value that can be obtained for heritability and as an estimate of production power during the life of an animal (Suprpto et al., 2018). Traits that can be measured for their repeatability appear more than once in an individual livestock, for example in milk reproduction, egg production, daily body weight gain, calf weaning weight, child birth weight, and wool production (Mudawamah, 2017). The results showed that the repeatability value of pre-weaning lamb's ADG was 0.636 which was obtained from parents with different males where the repeatability of the characteristics of the Sapodilla sheep based on body weight gain of 63.6% was influenced by the genotype and permanent environment, and the remaining 36.4% was influenced by the temporary environmental phenotype.

This is in accordance with Mudawamah (2017), the repeatability value is closer to 0.0 if the temporary environmental diversity increases. On the other hand, the higher value is closer to 1.0 if the diversity of traits is largely controlled by genetic and permanent environmental factors. The repeatability value of pre-weaning ADG in this study was included in the high category. It was thought that the observed broodstock had high production repeatability in producing superior Sapudi lambs. This was presumably because the broodstock had the same high repeatability to produce daily pre-weaning weight growth, and were categorized based on

three groups, namely low, medium, and high according to Mudawamah's (2017) statement that the repeatability value could be grouped into three categories, namely low if it has a value of 0.0 to 0.2; medium if the value is 0.2-0.4; and high if the value is more than 0.4. Calculation of the estimated repeatability value of weaning ADG is 0.377 obtained from selected lambs from different mothers and males. This indicates that the repeatability of the characteristics of the Sapudi sheep based on ADG is 37.7% which is influenced by the genotype and the permanent environment and the remaining 62.3% is influenced by the phenotype including the temporary environment which greatly affects the growth of the Sapudi lamb.

This is in accordance with the research of Saputra et al. (2021) weaning weight is influenced by various maternal parts of the environment that affect growth performance at weaning. Temporary environmental diversity also greatly affects maternal environmental variability due to feed and environmental conditions directly affecting the parental phenotype. The estimated value of weaning ADG repeatability in the study was in the high category. This is in accordance with Mudawamah's opinion (2017) that the repeatability value standard is between 0 (0%) to 1 (100%) which can be grouped into three categories, namely low (0.00-0.20); medium (0.20-0.40) and high if the value is more than 0.4. Warwick et al. (1990) stated that high repeatability values will indicate the ability of the mother to reproduce on her production to produce lambs with a certain weaning weight. The difference in the value of the results of the study is thought to be due to differences in the genetic abilities of the observed parental individuals, weaning weight, the results of the repeatability of weaning weights in this study according to Wolf et al., (2008), the repeatability varies depending on different locations, the number of different records, the use of methods, treatment, time, and place of research are different.

Estimated Value of MPPA ADG Prewaning and ADG Weaning

Based on the results of the pre-weaning MPPA ADG analysis, there are 5 ranks with several ranks with the same value in several parents. The highest rank is with the parent eartag 094 with an MPPA value of 0.018 and the lowest is the parent eartag with an eartag of 310

with an MPPA value of -0.032. The calculation can be seen in the MPPA value is presented in Table 3.

Table 3. Value of MPPA ADG preweaning

No	Parent code	MPPA	ADG Pre-weaning (kg)	Ranking
1	094	0.018	0.09	1
2	058	0.015	0.08	2
3	28	0.015	0.08	2
4	B1	0.008	0.07	3
5	11	0.001	0.07	4
6	23	0.001	0.07	4
7	51	-0.002	0.06	5
8	A35	-0.002	0.06	5
9	17	-0.004	0.06	6
10	1530	-0.007	0.06	7
11	14	-0.007	0.06	7
12	103	-0.010	0.05	8
13	123	-0.010	0.05	8
14	310	-0.032	0.05	9
Mean		-0.001		

ADG Weaning

Based on the results of the MPPA ADG weaning analysis, there are 14 parent ranks, there are parents with eartag 094; 0.009 and the lowest rating of the parent with the eartag 51; -0.016. calculations are in the appendix and the values are presented in full in Table 4.

Table 4. Value of MPPA ADG weaning

No	Parent code	MPPA	ADG weaning (kg)	Ranking
1	094	0.009	0.09	1
2	058	0.007	0.08	2
3	A35	0.004	0.08	3
4	1530	0.004	0.08	3
5	11	0.003	0.08	4
6	17	0.003	0.08	4
7	103	0.003	0.08	4
8	310	0.003	0.08	4
9	23	0.003	0.08	4
10	28	0.001	0.07	5
11	14	-0.001	0.07	6
12	B1	-0.006	0.07	7
13	123	-0.006	0.06	7
14	51	-0.016	0.05	8
Mean		0.001		

In this study, it is hoped that the MPPA ranking of the observed broodstock has a high

reproducibility to produce superior Sapudi lambs. The way to estimate the production ability of a ram is by calculating the MPPA value. Therefore, an evaluation of broodstock productivity at UPT PT HMT Jember is needed to increase the productivity of Sapudi sheep. The data used in calculating the MPPA value in this study is based on the data on the average daily weight gain of pre-weaning and weaning children. From the results of the MPPA estimation based on the estimated repeatability of weaning, the MPPA population average value of -0.001, 6 broods with MPPA values above the population average, and the top 3 ranks in the broods 094, 058, 28. While the average value of the MPAA weaning population is 0.001, 9 broods have an MPPA value above the population average, with the top 3 rankings in the parent 094, 058, and A35 from the calculation results, the mean population value of MPPA weaning is higher than that of pre-weaning. This is presumably because weaning weight is influenced by environmental diversity which affects growth performance in the period before weaning.

Temporary environmental diversity of broodstock is directly influenced by feed quality and environmental conditions which directly affect the parent phenotype (Saputra et al., 2021). The estimated value of the pre-weaning and weaning MPPA of the three parents is comparable to the high average value of the pre-weaning and weaning ADG, it is expected that the MPPA value is related to the repeatability value for these traits and the number of existing records. Based on the MPPA formula, high repeatability values of pre-weaning and weaning ADG can result in high estimates of MPPA values (Tribudi et al., 2020). Selection based on the estimation of MPPA values can be applied to livestock to maintain broodstock that has high production values. The estimation of MPPA value as the basis for selection reference was also reported by Tribudi et al. (2020) who argue that broodstock with MPPA values above the population average is maintained for development and can be used as a benchmark for sorting broodstock in the Madura cattle population at the UPT Madura Cattle Breeding and Animal Health Pemekasan. the selection will be prioritized as superior broodstock in order to achieve the goal of improving Sapudi sheep's superior seeds at UPT PT HMT Jember.

CONCLUSION

The repeatability of pre-weaning and weaning of Sapudi lamb's ADG was 0.636 and 0.377 with high and medium categories. The ranking of the Sapudi ewes above the MPPA ADG pre-weaning is 6 heads with 4 rankings, while based on ADG weaning as many as 10 tails with 5 rankings. The highest rank of Sapudi ewes in pre-weaning and weaning ADG was eartag 094 with MPPA values of 0.018 and 0.009.

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