

## Estimation of Repeatability and the Most Probable Producing Ability (MPPA) Based on Birth Weight and Weaning Weight for Ranking of Sapudi Sheep

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### ABSTRACT

This study was conducted to estimate the repeatability and MPPA values of Sapudi ewe based on birth weight and weaning weight. Samples used 93 Sapudi lambs from 26 ewes that lambed three times, and the observed variables were lambing weight and weaning weight. Collected data were analyzed quantitatively. Estimating repeatability by analyzing the variance of the relationship between sibling and parental rank was based on the relative MPPA formula. The results showed that the average lambing and weaning weights were  $2.789 \pm 0.206$  kg and  $10.058 \pm 1.470$  kg. The repeatability of lambing and weaning weight were  $0.108 \pm 0.119$ , and  $0.565 \pm 0.104$  belonged to the low and high categories. The average MPPA of lambing and weaning weight were 0.001 and 0.087. MPPA values of lambing and weaning weight range from -0.087 to 0.075 and -1.721 to 2.713. The highest ranking of the Sapudi ewe in lambing and weaning weight is ear tag 103 and ear tag 27 with MPPA 0.075 and 2.713. It can be concluded that there were 11 ewes with MPPA lambing and weaning weight above the average MPPA population that should be maintained in the population.

**Key words:** Ewe, genetic parameter, quantitative traits

### INTRODUCTION

Livestock is an excellent source of animal protein. One of such animals is small ruminant local livestock i.e., sheep (Al-Khafaji et al., 2015; Haslin et al., 2021; Nasich et al., 2021; Mudawamah et al., 2021). Based on the data from the Directorate General of Livestock and Animal Health (2020), the sheep population in Indonesia in 2018 was 17,611,392 heads. In 2019 there was an increase of 17,833,732 heads. In the following year, 2020, the sheep population decreased to 17,769,084 heads. Indonesia has various local sheep, such as Sapudi sheep or Fat-Tailed Sheep (DEG). The Sapudi sheep have qualitative characteristics, the head and body are white, the front line is convex, the hair is not thick, the ears are quite wide and erect, the tail is fat for males, the back of the back is raised with a concave curve on the backline, the tail is triangular to sigmoid in shape, long, wide and thick. At the same time, their behavior is calm and not aggressive (Susilorini and Kuswati, 2019). Sapudi sheep have distinctive characteristics: a long, large, and wide tail with fat deposits at the base of the tail, while the tip of the small tail is not fatty (Santosa, 2021).

In breeding, Sapudi sheep need to be selected for broodstock with certain advantages that affect livestock productivity, including the nature of birth weight and weaning weight. Birth weight is the weight that was weighed when the

cattle was born, and high birth weight will tend to produce high weaning weight and weaning growth (Haslin et al., 2021). Weaning weight results from weighing the lamb when it is separated from its mother. To measure the mother's superiority from birth weight and the weaning weight of the resulting offspring, one of them is by estimating repeatability and ranking each parent based on the MPPA value.

Repeatability is a concept related to heritability and is useful for traits that repeatedly appear in an individual (Irawan, 2019). The relationship between repeatability and heritability is due to part of the phenotypic diversity caused by additive genetic diversity but to repeatability coupled with dominant genetic diversity, epistasis, and permanent environmental diversity (Suprptono et al., 2018). Repeatability can describe the degree of adjustment between successive repeated records of the same livestock.

The MPPA value is a maximum estimate of the production ability of female livestock, which is calculated or suspected based on existing performance records (Rahmawati et al., 2019). The estimated MPPA value is used to select female cattle bred in the population. The selection of meat-type sheep aims to increase the growth of the next generation of offspring (Saputra et al., 2021).

This study intends to estimate the repeatability and MPPA for the ranking of

Sapudi heifers based on birth weight and weaning weight.

## MATERIALS AND METHODS

It was data recording of birth weight and weaning weight on 93 Sapudi lambs with a half-parent relationship from 26 Sapudi lambs that have given birth three times at UPT PT and HMT Jember, during the maintenance period from February 2019 to May 2021 with concentrate feed and forage. The sheep breeding system uses a natural mating system; according to Mudawamah et al. (2019), the matings of small ruminants in Indonesia use a natural mating system or artificial insemination. The method used is a descriptive method with a quantitative approach. This method is considered appropriate to reveal the data and characteristics found in Sapudi sheep. Variables observed in this study were as follows: birth weight (weighing results when the Sapudi sheep were born, expressed in kilograms) and weaning weight (weaning results when weaning began or separated from the mother, expressed in kilograms). To determine the weaning weight, the weaning weight is corrected using the following formula:

$$BSt = BLN + \left( \frac{BSN - BLN}{Weaning\ age} \right) \times 90\ days$$

Description:

BSt : Corrected Weaning Weight  
BLN : Real Birth Weight  
BSN : Real Weaning Weight

Analysis of the data for the estimation of repeatability using the analysis of the variance of the sibling relationship, the estimation of the MPPA value using the following relative formula:

$$MPPA = \frac{nr}{1 + (n - 1)r} (\bar{P} - \bar{\bar{P}})$$

Description:

MPPA: *Most Probable Producing Ability*

n : observation frequency  
r : observed performance reproducibility  
 $\bar{P}$  : average performance per female cattle  
 $\bar{\bar{P}}$  : average observed population performance

## RESULTS AND DISCUSSION

### Average Birth Weight and Weaning Weight

Based on the results of this study, the birth weight of baby lamb ranged from 2.3 to 3.2

kg, the average birth weight was 2.6 to 3.0 kg, the average birth weight of Sapudi lambs was  $2.789 \pm 0.206$  kg, this value is higher than the results of the previous studies in the same place by Sumadi et al. (2014) which showed that the average birth weight in DEG was  $2.45 \pm 0.58$  kg. Of the 26 parents with average birth weight, 17 had an average birth weight above the population average, i.e., 17 or 65.38%, and the remaining 9 or 34.62% were below the average birth weight production.

The weaning weight of the Sapudi lambs in this study ranged from 7.6-13.8 kg, with each child's average corrected weaning weight of 8.12-13.47 kg; the average corrected weaning weight of Sapudi lambs was  $10.058 \pm 1.470$  kg. The average corrected weaning weight was higher than that of Sumadi et al. (2014), which shows the average corrected weaning weight is  $9.80 \pm 1.61$  kg.

### Estimated Repeatability of Birth Weight and Weaning Weight

Repeatability is a constant showing quantitative traits in livestock that appear several times during individual livestock's life (Mudawamah, 2017). The study's results found that the repeatability value for birth weight was 0.108, with a low category obtained from Sapudi lambs selected based on the half-sibling relationship. Genetic and environmental factors influence birth weight characteristics of Sapudi lambs; permanent factors constitute 10.8%, while temporary environmental factors constitute 89.2%. The repeatability value of birth weight obtained from the results of this study is almost the same (low category) when compared to that reported in lambs, namely 0.118 (Piwczyński et al., 2011), 0.13 (Ozturk et al., 2018), and 0, 19 (Yafarivard et al., 2015) but lower than the Iranian lamb of 0.27 including the medium category (Baneh et al., 2019).

The estimated repeatability value of the weaning weight of the Sapudi lamb was 0.565 which was included in the high category. This means that the repeatability of Sapudi sheep based on weaning weight is 56.5% influenced by genotype and permanent environment, and 43.5% is phenotypic factors including temporary environment. This value is higher than the study on Iranian sheep, which is 0.16 (Yafarivard et al., 2015).

### Estimated Most Probable Producing Ability (MPPA) Birth Weight

The MPPA value and parental ranking based on birth weight can be seen in table 1 below.

Table 1. MPPA value and ranking based on birth weight

No	Cattle code	MPPA	Ranking
1	103	0.075	1
2	23	0.056	2
3	80	0.047	3
4	11	0.047	3
5	17	0.038	4
6	906	0.030	5
7	216	0.021	6
8	094	0.021	6
9	901	0.021	6
10	058	0.020	7
11	27	0.003	8
12	073	0.003	8
13	126	0.003	8
14	902	0.003	8
15	855	-0.006	9
16	1530	-0.013	10
17	A35	-0.013	10
18	128	-0.015	11
19	74	-0.015	11
20	310	-0.021	12
21	B1	-0.024	13
22	13	-0.024	13
23	28	-0.049	14
24	14	-0.051	15
25	123	-0.051	15
26	51	-0.087	16
Average		0.001	

Based on Table 1, the average MPPA value in Sapudi sheep is 0.001. The ranking of Sapudi ewes based on MPPA birth weight is 16 ranks because several MPPA values are the same between parents. The results of the 3rd highest ranking of mothers based on MPPA birth weight were ear tag 103 with a value of 0.075; ear tag 23 with a value of 0.056; ear tags 80 and 11 with a value of 0.047. The highest rank of Sapudi ewes with an ear tag of 103 compared to other mothers. Based on Table 1, from a sample of 26 sheep, only 24 had MPPA, a birth weight exceeding the population's birth weight with a rank of 8 or 53.84% and 12 sheep or 46.16% which were below the average population mean birth weight.

### Estimated Most Probable Producing Ability (MPPA) Weaning Weight

MPPA values and ranking of mothers based on birth weight are presented in table 2 below.

Table 2. MPPA value and ranking based on weaning weight

No	Cattle code	MPPA	Ranking
1	27	2.713	1
2	80	1.254	2
3	128	1.095	3
4	902	0.936	4
5	906	0.776	5
6	103	0.702	6
7	74	0.564	7
8	901	0.458	8
9	216	0.431	9
10	13	0.431	9
11	094	0.405	10
12	073	0.378	11
13	126	0.378	11
14	058	0.203	12
15	310	0.119	13
16	11	0.007	14
17	23	-0.152	15
18	17	-0.179	16
19	A35	-0.216	17
20	1530	-0.300	18
21	28	-0.796	19
22	14	-1.108	20
23	B1	-1.233	21
24	123	-1.346	22
25	855	-1.532	23
26	51	-1.721	24
Average		0.087	

Table 2 shows that this study's average corrected weaning weight MPPA value was 0.087. From the weaning weight of the lambs from 26 parent sheep. The MPPA value of the sheep population, which was more than the average weaning weight, was 15 with 13 ranks or 57.69%. The remaining 11 heads, or 42.31%, were below the average weaning weight of the population.

Ranking in MPPA uses the relative MPPA formula. From this study, the MPPA ranking of Sapudi ewes based on weaning weight was 24 because several MPPA values were the same between sheep. The results of the third-highest ranking sheep population based on MPPA weaning weight were ear tag 27 with a value of 2.713; ear tag 80 with a value of 1,254, and ear tag 128 with a value of 1,095. This indicates that the highest rank based on MPPA

weaning weight trait in Sapudi ewes, namely eartag 27, was higher than the other broods.

## CONCLUSION

The research concludes that the repeatability values of birth weight and weaning weight of Sapudi ewes were 0.108 and 0.565 including low and high categories. MPPA of Sapudi sheep based on birth weight and weaning weight had negative to positive values ranging from -0.087 to 0.075 and -1.721 to 2.713. The highest rank of Sapudi ewes in terms of birth weight was eartag 103 with an MPPA value of 0.075 and on weaning weight trait was ear tag 27 with a value of 2.713. Further research is needed on estimating genetic parameters of other quantitative traits in broodstock as a basis for selection.

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