

Conference Paper

Genetic Evaluation of Body Weight and Body Measurements in Madura Cattle at Weaning Age

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Abstract.

Body weight and body measurements at weaning age are important traits representing growth in beef cattle. This research was conducted at the Technical Unit of Madura Cattle and Forage for Animal Feed, Pamekasan, Madura, Indonesia. Eighty-six data points of performance of Madura cattle at weaning age, born in 2014-2019 were used to evaluate the performance and estimate the heritability for weaning weight (WW) and body measurement (chest girth (CG), body length (BL) and wither height (WH)) at weaning age. Weaning age was corrected to 205 days. Estimation of variance components was performed using restricted maximum likelihood applying genetic models of Genstat version 18. The mean of WW, CG, BL and WH for female were 83.82 +17.91 kg; 100.87 +7.80 cm; 87.66 +8.96 cm; and 93.04 +5.49 cm, respectively. The mean of WW, CG, BL and WH for male were 81.02 +20.52 kg; 100.12 +9.82 cm; 85.94 +9.54 cm; and 92.69 +7.46 cm, respectively. There were significant difference for WW, CG, BL and WH between year of calf birth. The number of sires used each year varied between 1 to 7 sires. The heritability values for WW, CG, BL and WH were 0.60, 0.43, 0.48 and 0.44, respectively.

Keywords: body length, chest girth, heritability, weaning weight, wither height

1. Introduction

Madura cattle as local cattle breed of Indonesia has the superiorities for low feed intake, high genetic resistance to hot climate and high adaptability to low quality feed. Madura cattle has also high carcass percentage with good meat quality [6]. This beef cattle plays an important role as source of meat, especially in East Java. Indonesian National Standard (SNI / *Standar Nasional Indonesia*) of Madura cattle is used to maintain the quality of Madura cattle performance. There are three body measurements involved in SNI: Chest Girth (CG), Body Length (BL) and Wither Height (WH). Body measurement at weaning age are of critical importance in the beef breeding program. Performance at weaning age represents the survival ability of a kid and milk producing ability of dam.

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Body weight and body measurement at weaning age are economically important traits, that are easily measured and should be genetically improved.

Heritability for a certain trait is the most important genetic parameters for designing and predicting outcomes of breeding programs. Selection should be based on the traits with moderate to high heritability to enhance the genetic improvement of Madura cattle. The mean for corrected weaning weight of Madura cattle in four districts of Madura island (Bangkalan, Sampang, Pamekasan and Sumenep) in 2019 was 93.96 ± 6.21 kg [7]. Performance at weaning age of Madura cattle were 81.74 kg, 99.9 cm, 85.75 cm and 102.46 cm for weaning weight, chest girth, body length and wither height, respectively [4]. Heritability estimates from birth to 600 days of age in Brahman cattle ranged from 0.28 ± 0.01 to 0.50 ± 0.06 for body weight, 0.27 ± 0.01 to 0.43 ± 0.09 for chest girth, 0.28 ± 0.01 to 0.58 ± 0.08 for hip height and 0.34 ± 0.01 to 0.51 ± 0.08 for body length using univariate analysis [2]. Heritability for weaning weight, chest girth, body length and wither height of Madura cattle in Pamekasan, Madura were 0.33, 0.35, 0.66 and 0.53, respectively [4].

Technical Unit of Madura Cattle and Forage for Animal Feed, Pamekasan Madura, belong to East Java Livestock Services has the responsibility to conserve and improve the quality of Madura cattle. The genetic evaluation of sire based on the performance of offspring at weaning age is important for designing breeding program to improve Madura cattle. This study aimed to evaluate the weaning performance and estimate the heritability value for body weight and body measurement at weaning age of Madura cattle in Technical Unit of Madura Cattle and Forage for Animal Feed, Pamekasan, Madura.

2. Materials and Methods

The material used were Madura cattle in Technical Unit of Madura Cattle and Forage for Animal Feed, Pamekasan, Madura, which born in 2014 to 2019. Weaning Weight (WW), Chest Girth (CG), Body Length (BL) and Wither Height (WH) at weaning age were measured and recorded. Body measurement at weaning was corrected to 205 days of age using the formula:

$$WW_{205} = \left(\frac{WW - BW}{age} \times 205 \right) + BW [1]$$

in which: WW_{205} = corrected weaning weight (kg); WW = weaning weight at the day of measurement (kg); BW = birth weight (kg); age = age at the time of weaned (days). Estimation of variance components was performed using restricted maximum likelihood

applying genetic models of Genstat version 18 [8]. The heritability for the traits were calculated using sire model. The formula of sire model is as follows:

$$y_{ij} = \mu + s_i + e_{ij}[3]$$

in which: y_i = performance of offspring j from sire i;

μ = population mean; s_i = random effect of sire i; e_{ij} = random error.

3. Results and Discussion

Means of BW, CG, BL and WH for female Madura cattle at 205 days of age were shown in Table 1. Statistical analysis showed that there were no significant different between male and female performances. The performance of female Madura cattle during 2014 to 2019 varied significantly. The highest weaning weight (96.63 kg) was found in year of 2017. The highest value for body measurement was found in 2016 with 106.17 cm, 95.4 cm and 96.4 cm for CG, BL and WH, respectively. The results were higher than study done in Pamekasan which reported the value of WW, CG, BL and WH were 81.74 kg, 99.90 cm, 85.75 cm and 102.46 cm, respectively [4].

TABLE 1: Mean of body weight (BW), chest girth (CG), body length (BL), wither height (WH) at weaning age of female Madura cattle borned in 2014 to 2019.

Year of Birth	N	BW (kg)	CG (cm)	BL (cm)	WH (cm)
		Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
2014	7	75.46 \pm 17.32	96.92 \pm 6.67	83.61 \pm 6.16	91.66 \pm 4.92
2015	8	70.47 \pm 10.86	96.52 \pm 6.18	81.76 \pm 6.98	89.97 \pm 5.59
2016	10	96.45 \pm 18.18	106.17 \pm 9.37	95.40 \pm 8.66	96.40 \pm 5.61
2017	6	96.63 \pm 9.40	104.75 \pm 4.41	93.51 \pm 5.06	96.27 \pm 4.44
2018	3	83.74 \pm 11.32	100.00 \pm 1.25	85.05 \pm 4.35	91.50 \pm 0.59
2019	3	75.75 \pm 17.09	98.51 \pm 7.73	79.87 \pm 6.14	89.31 \pm 2.65
Total	37	83.82 \pm 17.91	100.87 \pm 7.80	87.66 \pm 8.96	93.04 \pm 5.49

Table 2 presented the performance of male Madura cattle at weaning age during 2014 to 2019. The highest performance of WW, CG, BL and WH was in year 2017 and the lowest performance was in 2015. The mean of weaning age performance were lower compared to the performance of Madura cattle reported in 2017 which were 97 kg, 113 cm, 96 cm and 103 cm, respectively [5].

The following Table 3 showed the distribution of sire that produced offspring born in 2014 to 2019. The number of sire used in breeding program was 14 heads, in which showed high variation in distribution of sire between year. The lowest number of sire used was in 2017, which was only 1 sire and produced 10 offsprings. While in 2015,

TABLE 2: Mean of body weight (BW), chest girth (CG), body length (BL), wither height (WH) at weaning age of male Madura cattle borned in 2014 to 2019.

Year Birth	of N	BW (kg)	CG (cm)	BL (cm)	WH (cm)
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
2014	10	82.02±14.08	100.56±5.40	86.94±5.43	95.11±5.61
2015	11	75.71±20.05	98.66±9.33	82.71±7.81	90.93±5.78
2016	5	87.94±13.95	104.02±8.07	94.42±5.37	95.69±5.77
2017	4	93.36±7.15	102.13±2.17	94.09±5.16	96.96±5.77
2018	6	80.43±17.38	98.66±8.03	85.28±9.77	91.03±7.05
2019	11	78.60±31.42	99.61±16.05	82.08±13.18	90.38±10.95
Total	47	81.02±20.52	100.12±9.82	85.94±9.54	92.69±7.46

there were 7 sires used for producing offspring. The sire of E occupied the highest percentage of offspring with 17.44% of the total number of offspring during 2014-2019, in which 66.67% was in 2017. Based on Table 1 and 2, it could be seen that 2017 showed the best performance, which was the contribution of sire E to produce offspring with better performance at weaning age. The variation in using sire with different number per year was due to the availability of semen or sire at that year. Hence, it was not based on its breeding value.

TABLE 3: The distribution of sire producing offspring borned in 2014 – 2019.

SIRE	2014	2015	2016	2017	2018	2019	Total Offspring per sire
A					3		3
B	8	3					11
C	2	11					13
D			9				9
E	4		1	10			15
F			4				4
G	3	2					5
H					6	7	13
I		2					2
J		1					1
K		1					1
L		1					1
M			1				1
N						7	7
Total Offspring per year	17	21	15	10	9	14	86
Total sire per year	4	7	4	1	2	2	

The heritability for weaning weight, chest girth, body length and body height were presented in Table 4. The heritability estimate for weaning weight was categorized high with the value of 0.60. This value was in line with the research of Madura cattle in four districts in Madura island with the value of 0.64 [7]. The heritability estimates for body measurement were categorized as medium value. The heritability for chest girth was higher than the value (0.35) found in Madura cattle in Pamekasan [4]. The moderate to high value of heritability indicates that the selection based on these traits will give significant impact on the improvement of genetic and performance of Madura cattle.

TABLE 4: Component of variance of Sire (σ_s^2), residual (σ_w^2) and Heritability for chest girth (CG), body length (BL), wither height (WH) at 205 days of age in Madura cattle using Sire model.

Trait	Component of Variance		Heritability
	σ_s^2	σ_w^2	
WW	20.10	113.11	0.60
CG	3.69	27.12	0.48
BL	5.95	50.03	0.43
WH	3.03	24.23	0.44

4. Conclusions

The high genetic potency of Madura cattle could be improved by applying proper breeding program. Selection based on performance of weaning age could improve the genetic and performance of Madura cattle due to high to moderate heritability value. Due to high variation of offsprings performance at weaning age between sires and year of birth, selection of sire using in breeding program should be based on its breeding value for weaning performance of its offspring.

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