The exploration of genetic characteristics of Madura cattle[1]

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ABSTRACT: The research was conducted to observe the exterior characteristics and performance of Madura cattle based on qualitative and quantitative traits. This research was conducted in Pamekasan, Sumenep, and Sapudi Island, Madura, East Java province. Two groups of Sonok calf and Sonok cow in total number of 157 cattle samples were used for observation of exterior characteristics. The body measurements and performance data were obtained from 203 Madura cattle. The result showed that Sonok calf and Sonok cow have different exterior characteristics. The Sonok cows showed several changes on exterior characteristics from those of Sonok calves, such as appearing of the chest fat and back line, size of hump, the lappet size, and the colors surrounding eyes, nose and mouth. The body measurements of 2-3 y old of Sonok cattle were higher than that of Madura cattle in Sumenep and in Sapudi Island. In example, girths of chest of those cattle are 163.19 ± 9.87 cm, 138.44 ± 18.36 cm and 148.88 ± 10.18 cm, respectively. More interestingly, the Sonok cattle in the same area showed the improvement of body measurements compare with the pervious results in 1992 (girth of chest 158.19±10.88 cm). Performance of Madura cattle such as weaning age, first age of mating, first age of calving were 5.75 ± 0.78 mo, 19.571 ± 0.53 mo, and 30.00 ± 0.00 mo, respectively. The estimation of body weight in those phase were 151.58 ± 36.98 kg, 240.00 ± 45.96 kg, and 251.08 ± 68.33 kg, respectively. Based on this research, Sonok calf and Sonok cow had spesific characteristics. Generaly body measurements and performance of Sonok cattle was better than Madura cattle in general. Therefore, we suggest that the population of Sonok cattle could be improved in order to get high quality local cattle in Madura island.

Key words: exterior characteristics, body measurements, Sonok calf, Sonok cow, Madura cattle

INTRODUCTION

Madura breed of cattle is one of the local breeds of cattle in Indonesia which spread over Madura Island. The shape was uniform. It was probably the hybrid offspring of a crossed between Banteng and Zebu cattle, which most likely as Sinhala cattle brought by traders in the past (Hardjosubroto, 1994). Population of Madura cattle was estimated 900.000 heads and spread in almost parts of Indonesia such as Madura, East Java, Sumatra, Kalimantan, Sulawesi, Nusa Tenggara Barat (NTB) and Nusa Tenggara Timur (NTT) (Livestock Official of East Java, 2006). From the official data on the 2008, population of Madura cattle in Madura ranch known as much as 601.795 spread over four district : Bangkalan (142.567 heads), Sampang (123.438 heads), Pamekasan (97.899 heads), and Sumenep (237.891 heads) (Communication and Information Official of East Java, 2009).

Madura cattle have a unique physical characteristic. The color of their body was dominant in red, brick-red, and brown, white color on the belly and inner thighs with unclear white pattern on the back-bottom. Madura cattle have black fur in its tail and have no dewlap. Madura cattle back on the straight and have a hump on the bull while the cows did not seem the hump, dorsal line of brownish-colored blackness found in that cattle, whereas in the eye and ears were circle black line. Both sexes have the same color from birth to mature. The horn of the cattle was small and short with a curved semi-circular direction with the tip pointed straight ahead and the horn in females is almost invisible.

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Madura cattle is graceful animal, it can be used as working cattle, beef cattle, *karapan* (bull racing), and Sonok contest (dancing cattle). In Madura Island, the cattle generally work in pairs to cultivate the land, such as plowing, harrowing, and clearing the weeds (Gunawan, 1993). Beside as a beef cattle, Madura cattle was potential because it has high resistance against environmental stress and disease, high fertility rates, high adaptability to the low feed, and feed consumption was fewer than the hybrid or imported beef (East Java Communication and Information Official, 2009).

Madura cattle particularly males (bull), have a great ability in running differently compared to other types of cattle. The cattle run along 130-meter and the distance can be taken for 90-10 seconds, therefore Madura cattle used for *karapan sapi*. The bull was race in pairs and traditionally held since long time ago. One more thing that drives the successful of Madura cattle is that there were traditional cattle contest named 'Sonok Contest' or *Kontes Sapi Sonok* which took since a long time ago.

The Sonok contest usually held before bull racing "karapan". In the Sonok contest, cow were assessed and judged in overall shape, the beauty between pairing of cows, beautiful dress, beautiful hair and skin color, beauty, agility cows walked that accompanied by traditional music "gamelan" and the skill of cows were being able to stop with front foot stepping on the finish line in a few minutes after they reach the gate which equipped with a mirror. The success of ornamental Sonok cows be a winner regardless of the election contest is not like the color of the body, hump, back line, color around the eyes and mouth, ass and other colors. Such criteria are also important for the selection of Sonok cows competed in the contest which will be due to one Sonok cow assessment criteria in the competition is overall body shape. The existence of those standard criteria for both exterior and body size Sonok cow for small and big Sonok selection is crucial for the implementation of cow's selection in beauty and quality. Therefore the aims of this research are to identify constraints and criteria for small and big Sonok cattle. Hopefully the result of this research will form an exterior characteristic standard for both small and big Sonok cattle.

An exterior characteristic like quantitative traits such as body size is closely related to growth factors, cattle which well in growth can be ascertained that its body size as well too. In this study, in addition to exterior characteristic were also observed in Sumenep and Sapudi Island grouping by age. The observations obtained by the standard body size during the growth phase (2-3 y) for Madura cows and Sonok cows.

MATERIALS AND METHODS

This study used case study approach conducted in some district of Madura Island such as: Pamekasan, Sumenep, and Sapudi. The parameters were observed in this study are the exterior characteristics and comparison of body size and performance in Madura beef cattle and Madura Sonok cattle at the age around 2-3 y.

Exterior Characteristics

The data of exterior characteristics were obtained from 157 Sonok cattle (small and big) which joined the Sonok contest, held at 15 and 16 August 2009 in Waru sub-district, Pamekasan District, Madura. The data were taken by direct observation and the result was shown in Table 1.

Table 1. Qualitative traits on Sonok calf and Sonok cow

	Score				
Item	0	1	2	3	4
Color of body	-	dark red	red	yellow	
Chest fat	none	present			
Dewlap	none	small	medium	big	
Backline	none	present			
Hump	none	small	medium	big	
Color around eye, mouth, hoof and leg	-	the same as color of body	creamy	white	gray

Body Size

Body size obtained from 203 female Madura cows as sample. The cattle body size was measured using a tape FH brand with 1 cm precision figures and the measuring ruler FHK brand with 0.2 cm accuracy. Cattle body size data including: girth of chest, height of withers, length of the body, height at hip, length of head, width of head, and head index. Length of the body (absolute) is the straight distance that measured between *Tuberculum lateralis* to *Tuberculum ischiadicum*. Girth of chest is the length of the circular (the circumference) as measured on chest that right in the back of withers (on the rib (costae) 3-4. Height of withers is straight distance from the plane to the highest point in withers. Height at hip was obtained by measuring the distance from the plane until the highest point of the hip. Head index is the ratio between length of head and width of head. Width of head was measured from the widest part of the head. Length of head was measured from tip of snout to mid-point of the antlers. Data of body measurement was taken with parallelogram position of the livestock. Body weight estimation of Sonok cattle was calculated using body weight estimation scale on the measuring tape brand of FHK. Age estimation was done with direct interview or direct showed of the tooth growth.

Vital Data Comparison of Sonok Cattle and Madura Cattle

Vital data observed in Madura cattle and Sonok cattle were girth of chest, height of withers, length of the body, height at hip, length of head, width of head, head index, body weight estimation at the age around 2-3 y.

Performance of Female Sonok Cattle

Performances observed such as weaning age, first age of mating, first age of calving were based on result of the Mahardika's research (2009).

Data Analysis

Analysis of the data used for exterior data in analysis by calculating the percentages, while quantitative data (body measurement and performance of cow) were analyzed descriptively by calculating the means and standard of error.

RESULTS AND DISCUSSION

Madura cattle population growth data in the Pamekasan District, noted by the Pamekasan Animal Husbandry Department from 2004 to 2008 was presented in Figure 1.

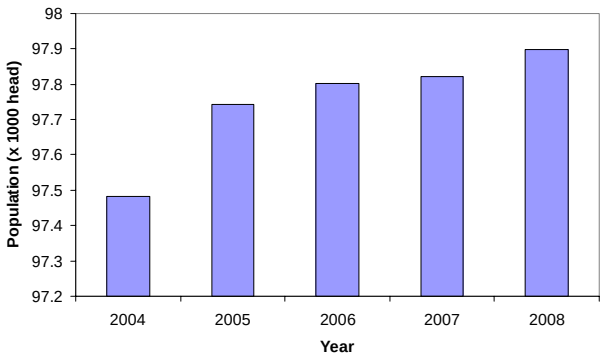

Figure 1. Madura cattle population in Pamekasan (Source: Animal Husbandry Office of Pamekasan District, 2009)

Madura cattle population in Pamekasan District from 2004 until 2008 has increased. In 2004, the population of Madura cattle reached 97,482 cattle and in 2008, the population reached 97,889 cattle. Madura cattle population increase year by year. It has a positive value for the development of Madura cattle. The increase of Madura cattle population is expected to increase the number of population that has a good exterior characteristic (qualitative and quantitative).

Exterior Characteristic of Madura Cattle

Exterior characteristic should be known for the introduction of cattle breed were body's color, tail's hair, shape of horns, hump, dewlap, specific colors on the body, characteristic of the head, ears and neck (Supiyono, 1998). Percentage of the dominant exterior characteristic of Sonok calves and cow based on result of the observation in cattle contest (Sonok Calf) on August 15th 2009 and Sonok cow contest on August 16th 2009 can be seen on Table 2, while the exterior characteristic can be seen on Table 3.

Table 2. Percentage of dominant characteristics in Sonok calves and cows

	Sonok calf (n = 72)				Sonok cow (n = 85)			
Criteria	0	1	2	3	0	1	2	3
Color of body		56.944	25	18.056	-	67.059	22.353	10.588
Chest fat	56.944	43.056	-	-	17.647	82.353	-	-
dewlap	8.333	90.278	1.389	-	1.176	45.882	52.941	-
Back line	51.389	48.611	-	-	58.824	41.476	-	-
Hump	1.389	98.6111	-	-	1.176	29.412	48.837	
Color arround eye	-	48.6111	51.389	-	-	57.647	42.353	20.00
Color arround mouth	-	41.667	52.78	5.556	-	57.647	42.353	
Color of hoof and foot	-	19.444	75	5.556	-	44.706	47.059	8.235

Table 3. Exterior characteristic of Sonok Calf and Sonok Cow

Item	Sonok calf (n=72)	Sonok cow (n=85)
Age, mo		
Minimum	5.0	12.0
Maximum	24.0	96.0
Average	11.7	34.9
Exterior characteristics		
Color of body	dark red	dark red
Chest fat	none	present
Dewlap	small	medium
Hump	small	medium
Back line	none	present
Color around eye	creamy	dark red
Color around mouth	creamy	dark red
Hoof and foot	creamy	creamy

The exterior characteristic of Madura cattle (Sonok calf) with a range of ages approximately 5 to 24 m based on Table 2 were a dark red of body colors, haven't chest fat, small dewlap, haven't back lines, small hump, have a beige color on the around of eyes and mouth also hoof and legs. While Sonok cows with aged range of 12 to 48 m had different exterior characteristic compared to with Sonok calves (Table 2). Sonok cow had chest fat, size of dewlap increased become medium size, looking the back line, size of hump become medium size, and the ground colors of the eyes and mouths change become dark red (same with body color).

Madura cattle was suspected as a result of crossbred between Bali cattle (*Bos javanicus*) and zebu cattle (*Bos indicus*) (Gunawan, 1993; Nijman *et al*., 2003; Hartatik *et al*., 2009), therefore the exterior characteristic of Madura cattle between Bali cattle and Zebu cattle. In addition, Pritchard *et al*., 2000 in Kusdiantoro *et al*. (2009) Madura cattle based on mt- DNA has Zebu and Banteng blood, and based on Y-chromosome analysis, Madura cattle contain Zebu cattle blood and taurine (from Taurus blood).

While based on the microsatellite analysis, the blood of Madura cattle contains Zebu cattle and Banteng. Added by Cahyadi *et al*. (2009) Madura cattle have haplotype A, which Madura cattle shows a relationship with Banteng (*Bos javanicus*).

From this research, Sonok calves and Cow had dark red of body color and black color of back lines. It was characteristics of Bali cattle (Hardjosubroto, 1994) and Java cattle (Susilawati *et al*., 2002 in Cahyadi, 2009). Horn shapes of Madura cattle were similar to those of Bali cattle, up circle (Williamson and Payne, 1993). Hump and dewlap in Sonok cattle was feature from Zebu cattle. According to Pukite (1993) in Abdurahman (2006), *Bos indicus* cattle have a broad hump above the shoulders and neck also width of dewlap.

The hump and dewlap of Sonok cattle was developed well. It can be seen from the development of hump's size and dewlap's size from Sonok Calf and Sonok Cow. Size development is caused by growth period of cattle. When the growth of cattle has passed the growth of meat and muscle, so fat will develop in growth. The fat will form part of hump and dewlap and also fat chest in Madura cattle. According to Hammond (1933) in Soeparno (2009), body tissue reached maximum growth, started from neuro tissue, bone, muscle and fat. Carcass component growth pattern begin with rapid bone growth, then. After reaching puberty, the growth of muscle will decrease and fat deposition will increase (Soeparno, 2009).

Measurement Exterior Characteristic of Sonok Cattle and Madura Cattle

Vital data of Madura cattle in Sumenep district, including Sapudi Island, and also Sonok cattle, can be seen in Table 4.

Table 4. Vital data of 2-3-yr old Sonok Madura cattle

Data vital	Madura Cattle		Sonok cattle (n =47)
	Sumenep (n = 18)	Sapudi Island (n =17)	
Age, mo	31.33 ± 2.57	30.85 ± 3.197	29.32 ± 5.95
Girth of chest, cm	138.44 ± 18.36[a]	148.88 ± 10.18[b]	163.19 ± 9.87[c]
Height of the withers, cm	116.56 ± 7.52[a]	114.12 ± 4.84[a]	122.704 ± 5.79[b]
Length of body, cm	114.17 ± 9.24[a]	113.94 ± 4.51[b]	106.42 ± 9.12[b]
Height of hip, cm	115.78 ± 8.00 [a]	113.24 ± 3.401[a]	124.29 ± 10.94[b]
Length of head, cm	41.78 ± 3.90	43.06 ± 2.63	43.64 ± 3.59
Width of head, cm	18.61 ± 1.72[a]	18.56 ± 1.43[a]	21.40 ± 1.66[b]
Head Index, cm	44.66 ± 3.49[a]	43.12 ± 2.45[a]	49.31 ± 5.06[b]
Estimation of body weight, kg	226.56 ± 80.10[a]	276.00 ± 46.89[b]	338.84 ± 58.55[c]

[abc] Within a row, means without common superscript differ (P<0.05)

At the same average of age, there are significant differences on girth of chest, height at the withers, length of body, height of the hip, head index, and body weight estimation on Madura cattle in Sumenep and Sapudi Island and also Sonok cattle. Sonok cattle have bigger body size and body weight estimation than Madura cattle in general. The result is consistent with Widi and Hartatik (2009) that resulted Sonok cattle's body size is bigger than Karapan cattle. Mudhita (1992) said that female Madura cattle at 3 y old had girth of chest, body length, and body weight estimation were 140.83 cm; 177.77 cm; and 198.38 kg, the size on the vital data is almost same with the result of the research. The differences of vital data on Madura cattle in Sumenep and Sapudi Island with Sonok cattle are caused by several things such as management and selection by the farmer. While body size of Sonok cattle in this study (Table 4), higher than the previous study done by Rasyid and Umiyasih (1992), which is Sonok cattle age 2 to 2.5 y had girth of chest 158.19 ± 10.88 cm and body length 127.16 ± 8.28 cm. Based on Hermanto et al (1992), Sonok cattle with age 2-3 of y, had girth of chest 161 ± 9.61 cm.

Sonok cattle's farmers always do the selection to young Madura cattle which will become a candidate of Sonok cattle. The selection includes qualitative exterior performance such as skin color, hump, bottom color, horn and other. Besides the selection of exterior performance, good management also affects body size of Sonok cattle. The selection and management of Sonok cattle were not done

in Sumenep and Sapudi Island. The daily management is traditional and less improved, so that Madura cattle's body size in these areas were relatively smaller than those in Sonok areas.

Performance of Sonok Cattle

Performance data such as weaning, first age of mating, first age of calving, and yearling in Madura cattle can be seen on Table 5.

Table 5. Performance data of Sonok cattle.

	Performance			
Vital data	Weaning age (n = 24)	Age of 1st mating (n = 7)	Age of 1st calving (n = 25)	Yearling (n = 11)
Age, mo	5.75 ± 0.78	19.57 ± 0.53	30.00 ± 0	12.00 ± 0
Girth of chest, cm	120.63 ± 10.04	143.29 ± 10.03	144.92 ± 16.23	146.27 ± 7.02
Height at the withers, cm	105.49 ± 5.31	117.44 ± 2.57	115.60 ± 6.14	120.21 ±12.97
Length of Body, cm	80.47 ± 7.65	93.77 ± 4.99	112.36 ± 8.97	98.48 ± 9.79
Height at the hip, cm	108.17 ± 5.41	119.73 ± 2.49	114.13 ±5.72	119.79 ± 4.13
Length of head, cm	35.75 ± 2.89	41.57 ± 2.07	42.36 ± 3.62	41.55 ± 3.33
Width of head, cm	16.60 ± 1.14	18.50± 1.04	18.62 ± 1.64	19.50 ± 1.96
Head Index, cm	46.54 ± 2.42	44.55 ± 2.55	44.05 ± 3.28	47.13 ± 5.35
Estimation of body wt, kg	151.58 ± 36.98	240.00 ± 45.96	251.08 ± 68.33	247.55 ± 40.48

The age of weaning, first mating, and first calving based on Mahardika research (2009) were 4,81 ± 2.25 m, 19.85 ± 0.81 m and 29.96±0.81 m, respectively. In this research, the age of weaning, first mating and first calving in Madura cattle were 5.75 ± 0.7802 m; 19.571 ± 0.532 m; 30.00±0 m, respectively. Size of girth of chest, height of withers, body length, height of hips, head length, head width, head index and body weight estimation were presented in Table 5.

Angkasari (2009) found that in Sapudi Island, weaning age of Madura cattle ranged of 4.67 ± 0.087 m. It is because the farmer let the calves suckled on their mother until weaning. Estimated body weight was 151.583 ± 36.978 kg.

In this research, Madura cattle had earlier first age mating than Madura cattle in Sapudi island 22.66 ±0.66 m. The first age mating depends on puberty achievement. Based on Tomaszawska *et al* (1991), that the achievement of puberty for each animal is different, because sexual maturity is affected by several factors such as heredity or genetic, climate, and nutrition. While, first age of calving in this research is earlier than the result of Zahri (2002) *cit* Mahardika (2009), which the age of first calving reached 36.6 m of Madura cattle in Bangkalan District. While Gunawan (2003) said that average of Madura cattle's age of calving was 41 m. The first age of calving is affected by first age of mating and estrus detection by farmer.

CONCLUSIONS

Sonok Calves and Cows had different characteristics on hump type, dewlap, chest fat, colors around eyes and mouth. The body size and performance of Sonok cattle in this research were better than those of Sonok cattle at previous research. The quantity and quality of Sonok cattle needs to be improved. As they have a good potential chance for genetic improvement and animal genetic resource conservation and use.

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