Reproductive performance of peranakan ongole (PO) bull at different altitudes areas in Lampung province

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Abstract. Peranakan Ongole (PO) cattle are famous for their bulls and known for their toughness, rapid growth and natural tolerance to tropical heat and disease resistance. This study was conducted to determine the reproductive performance of PO bull in some altitude in Lampung Province. A total of PO bulls used were 48 heads, with age three to four years. The variables observed were volume, consistency, pH, semen colour, concentration, mass movement, motility, percentage of living spermatozoa and abnormality. Data were collected during the rainy season and dry season, calculated with the average and standard deviation and then analyzed descriptively. Based on the macroscopic examination, Peranakan Ongole bull living in low temperature place had a normal semen volume, the consistency mostly watery to moderate, fresh semen pH is in the normal range and the color of semen are all normal both in the rainy and dry seasons. The results of microscopic examination showed that PO cattle had a good reproduction conditions at all three

Keywords: altitude, macroscopic, microscopic, PO cattle

1. Introduction
Some of the foods we eat come from animal and plant. Animal serves a source of nutrients, especially protein and fat. One source of protein from animal that is increased every year is beef. Provision of a local beef is fulfilled around 65.24% from the total of national demands, and other demand is imported from other country. The effort to increase the meat production has been done through empowerment people to increase population of cattle.

The increasing of cattle population can be attained by various ways such as improving genetic quality and reproductive efficiency through the program Artificial Insemination (AI). The AI program is one of the most successful reproductive technologies and has successfully improved the genetic quality of livestock, so that in a short time it can produce a good quality calf in large quantities by using semen from superior bull [1].

Many factors affect the success of AI programs including: (a) the quality of frozen sperm; (b) the knowledge, understanding and awareness of farmers to heat detection; (c) body condition score (BCS); (d) health and nutritional management; (e) and inseminator skills [2,3]. Feradis [4] stated that every
bull has a different quality of sperm that is depended on the age, condition of livestock, libido and races. The most influencing factor on variation in semen quality are breed and environment, whether it is temporary or permanent.

Indonesia has many breed for local beef cattle such as Peranakan Ongole (PO). The PO cattle has a high adaptability to traditional livestock conditions. The biological potential and productivity of PO cattle are widely and highly responsive to environmental change and improvement. In order to improve the productivity of PO cattle in livestock farms, improving the reproduction and feed management can be done immediately. The reproductive performance of PO cattle was more efficient when the cattle reared in the lowland area than those in the highland area according to the days open (DO) and calving interval (CI) periods. The great environmental influence in exposing the genetic potential of the reproduction is justification for this research so the purpose of this study is to evaluate the condition of the reproduction of PO cattle at different altitudes.

2. Methodology
The study was conducted in three districts in Lampung province from December 2013-December 2014, December 2013-February 2014 was the rainy season and July-September 2014 was the dry season. Those three districts were Central Lampung district (lowland about 0-100 m above sea level), Pesawaran districts (medium land about 100-250 m above sea level) and West Lampung (highland > 400 m above sea level). Central Lampung average temperature 29.45 C, humidity 78.60%, THI 80.82, Pesawaran average temperature 27.27 C, humidity 81.43%, THI 78.60, and West Lampung average temperature 23.18 C, humidity 81.18%, THI 71.94.

A total of PO bulls used were 48 heads, with age three to four years. The variables observed were volume, consistency, pH, semen colour, concentration, mass movement, motility, percentage of living spermatozoa and abnormality. Data was collected during the rainy season and dry season, calculated with the average and standard deviation and then analyzed descriptively.

3. Result and Discussion
Examination of semen quality can be performed using macroscopic and microscopic examination. The macroscopic examination includes volume, consistency, pH, colour and smell. While microscopic examination includes concentration, motility, viability, and abnormality. However, [13] said that the aspects that is determined the quality of semen are the motility, concentration and morphology of spermatozoa (abnormality).

3.1 Macroscopic Quality
3.1.1 Fresh Semen Volume. The volume of semen is the number of millilitres of semen per ejaculation [5]. The volume of semen volume in the rainy season is varied from 2.17 ± 1.61 ml to 6.00 ± 0.50 ml and in the dry season is varied from 2.70 ± 1.75 ml to 5.20 ± 2.38 ml. The volume of PO cattle at the third altitude in both seasons is in the normal range, according to [6] between 1-15 ml. However, [4] stated that the range of volume is 5-8 ml and there is an PO cattle in Central Lampung during the rainy season and PO cattle in West Lampung in the dry season.

The highest semen volume is from cattle that are kept in Central Lampung (6.00 ± 0.50 ml). The volume difference is probably caused by the amount of nutrients that is given when the bull is in puberty, although the amount of feed given is does not differ significantly. Number of feeding of PO cattle in Central Lampung is 60.63 kg / bull, Pesawaran is 44.19 kg / bull and West Lampung is 65.35 kg / bull [7]. It is supported by the opinion of Nuryadi [8], he stated that firstly spermatogenesis process is taken place when the age of bull around 10-12 months. At this time, the nutrition is used optimally for the formation of sex cells, include the sperm production. Furthermore, at the age of 2-3 years, the bull has an adult body so most of the nutrients that is absorbed in the body is used for the body cells growth. Beside the age and quality of feed, the differences in semen volume are caused by body size, breed, shelter frequency [5], temperature, aged sex of a male [9] and environmental stress [10].
Table 1. Macroscopic quality of PO bull’s fresh semen in rainy and dry season.

| Parameter       | Center Lampung | Pesawaran     | West Lampung |
|-----------------|----------------|--------------|--------------|
| Rainy season    |                |              |              |
| Volume (ml)     | 6.00±0.50      | 3.77±1.54    | 2.17±1.61    |
| Consistency     | watery, medium | watery, medium, thick | watery, medium |
| pH              | 7.00±0.00      | 7.00±0.00    | 7.00±0.00    |
| Colour          | white milk     | white milk   | white milk   |
| Dry season      |                |              |              |
| Volume (ml)     | 4.83±2.25      | 2.70±1.75    | 5.20±2.38    |
| Consistency     | watery, medium | watery, medium, thick | medium     |
| pH              | 6.73±0.46      | 7.00±0.00    | 6.67±0.58    |
| Colour          | white milk     | clear, white milk | white milk |

3.1.2 Fresh Semen Consistency. Consistency or degree of viscosity is examined by shaking the tube that contains the semen slowly. The results showed that the consistency of bull’s semen in the farms both in the rainy and dry season is mostly watery to medium. On the other hand, the bull’s semen in Pesawaran is consistently thick. Consistency during the rainy season is mostly watery, while the research of [11] showed that the consistency of PO cattle in lowland rainy season is moderate. In spite of this, the result from [11] research showed that consistency of PO cattle in lowland rainy season is watery. Also, [12] reported that the consistency of PO cattle’s semen in both the rainy and dry seasons is watery, with a consistent percentage of 64%, it means the result of this study lower than Aeren’s result. This difference could be happened because different management of farming system. The cattle’s semen as samples in this study is the cattle that is managed by farmers, while the research of [12] cattle’s semen is obtained from the bull that has been selected in Sigosari National Artificial Insemination.

3.1.3 The pH of Fresh Semen. The average pH of fresh semen of PO cattle in the dry and rainy seasons at three altitudes is ranged from 6.67-7.00. The fresh semen’s pH at all altitudes is still in the normal range according to [14] is around 6.4--7.8.

The pH of PO cattle’s fresh semen at livestock farms in Lampung during the rainy season has a high score is about 7.00. While during the dry season, only bulls in Pesawaran have pH 7.00 for fresh semen. The pH of semen is 7.0 or higher due to the number of dead spermatozoa [5].

3.1.4 Fresh Semen Color. The color of fresh semen PO cattle at farms is normal in the rainy season at all three altitudes. While the colour of fresh PO cattle that are all normal in the dry season is in Central Lampung and West Lampung. According to Feradis [4], the normal colour of fresh semen is white milk or whitish and whitish cream. The color is caused by riboflavin pigments that is carried by an autosomal recessive gene but does not affect the fertility. The requirement that is established by Lembang Artificial Insemination Centre, based on SOP [2] about the minimum criterion of semen that could be used in the manufacture of frozen semen is the colour should be normal. Therefore, the bulls in Pesawaran must have rigorous testing if they want to be used as semen source.

3.2 Microscopic Quality

3.2.1 Mass Movement of Fresh Semen. Spermatozoa in a group tend to move together in one direction seem like thick and thin waves. The speed of the movement depends on the viability. Observations of mass movement indicate that during the wet season PO cattle at all altitude have mass movement ≥ 2+. While in the dry season only PO cattle in Central Lampung has mass movement 2+. These results showed only PO cattle in Central Lampung that can be used as a source of fresh semen. According to [15], the requirement for the manufacture of liquid semen is the mass movement of 2+ to 3+. Moreover, based on the SOP of frozen semen manufacture from [2], there is no bull is required for the source of semen because the minimum requirement for the manufacture of frozen semen is 3+.
The movement average of PO cattle is 2.11 (rainy season) and 1.78 (dry season). This result is better than the mass movement of Limousin cross/Simental cross that is 1.33 (rainy season) and 1.33 (dry season) [16]. However, this result is similar with the research of [17] that is conducted on cattle from livestock managed by common people, the mass movement of PO cattle (2.81) higher than the mass movement of limpo cattle (2.00) and simpo cattle (1.90). It indicates that all PO cattle have better adaptation than imported cattle [18, 19].

**Table 2.** Microscopic quality of PO bull’s fresh semen in rainy and dry season.

| Parameter               | Center Lampung         | Pesawaran            | West Lampung          |
|-------------------------|------------------------|----------------------|-----------------------|
| Rainy season            |                        |                      |                       |
| Mass Movement           | 2.00±0.00              | 2.00±0.00            | 2.33±0.58             |
| Concentration (million/ml) | 1528.33±412.94     | 1314.33±289.79       | 837.00±170.71         |
| Motility (%)            | 56.67±11.55            | 46.67±5.77           | 56.67±11.55           |
| Living spermatozoa (%)  | 73.33±5.77             | 50.00±0.00           | 70.00±17.32           |
| Abnormality (%)         | 1.85±1.09              | 18.34±9.79           | 5.98±3.31             |
| Dry season              |                        |                      |                       |
| Mass Movement           | 2.00±0.00              | 1.67±1.53            | 1.67±0.58             |
| Concentration (million/ml) | 1491.67±396.32    | 833.33±544.94        | 1007.33±325.47        |
| Motility (%)            | 53.33±5.77             | 53.33±5.77           | 43.33±20.82           |
| Living spermatozoa (%)  | 63.33±5.77             | 56.67±35.12          | 53.33±20.82           |
| Abnormality (%)         | 4.40±1.27              | 6.04±0.77            | 7.87±1.67             |

3.2.2 The concentration of Fresh Semen. The concentration of semen is the amount of spermatozoa contained in one ml of ejaculation. Concentration examination is one of the necessary conditions to know the quantity of fresh semen after shelter. The concentration of PO cattle’s fresh semen in this study both in rainy and dry season is required for the criteria as a source of semen. [20] stated that the minimum standard for a semen source is 800 million/ml, whereas according to [15] the concentration could be required for the manufacture of liquid semen if the concentration is bigger than 750 million/ml.

3.2.3 The percentage of Fresh Semen Motility. Motility is the ability of sperm to move properly through the female reproductive tract or through water to reach the egg and fertilize the ovum. The best spermatozoa movement is progressive movement or active movement forward [4] stated that the percentage of motility of bull’s spermatozoa below 40% indicates that the semen has a poor quality. The fertile bull has 50% to 80% progressive motile spermatozoa. Based on these criteria, in rainy season, PO cattle in Central Lampung and in West Lampung (56.67 ± 11.55%) is a fertile bull. On the other hand, in dry season, PO cattle in Central Lampung and Pesawaran (53.33 ± 5.77%) are fertile bulls. However, The [21] recommends the minimal motility is 30%. Based on these criteria, all PO cattle at all altitude have a good percentage of motility.

The fertile bulls can be further processed into frozen semen if their motility is > 60% [18, 2]; at least 65% [22]; at least 60-65% [14, 23]. Moreover, if it will be produced as liquid semen, the minimum requirement of cattle motility is > 70%. The result of this study indicates that PO bulls, in both seasons could not be a source of frozen semen. Based on the statement from [9], high motility will improve the ability of spermatozoa for fertilization.

One effort that can be done to increase the percentage of semen motility is the provision of traditional supplements such as the research of [24]. Provision of traditional supplements can significantly increase the motility of Bali bull’s spermatozoa from 80.3 ± 8.2 to 88.7 ± 5.5. The content of supplement is protein, aphrodisiac, vitamin E and boron. Protein deficiency in young bulls will decrease libido and poor quality of semen[25]. Aphrodisiac is useful for stimulating libido and blood circulation of the genitals [26]. Vitamin E as an antioxidant that can protect spermatozoa against peroxidative that could damage and decreasing the number and motility of spermatozoa [27]. Boron is...
used to increase testosterone levels, the most responsible hormone in generating sexual desire (libido) [28].

3.2.4 The Percentage of Living Spermatozoa of Fresh Semen. The percentage of living spermatozoa is a good category in rainy season only for PO cattle in West Lampung (70.00 ± 17.32%), while in dry season, PO cattle in Central Lampung (63.33 ± 5.77%) is a good category. Hafez [20] assumed that the percentage of live fresh cattle semen is around 60-80%. The highest percentage of living spermatozoa in rainy season is PO cattle in Lampung Tengah (73.33 ± 5.77%) and the same result in dry season is PO cattle in Central Lampung (63.33 ± 5.77%). Moreover, the percentage of living spermatozoa of PO cattle in the lowland is still higher than the results of [11] that is 53.7 ± 24%, however it is less than the result of [32] that is 78.18 ± 12.25% and [9] that is 93.5 ± 2.1%.

3.2.5 The Abnormality of Fresh Semen. Semen abnormality is the damage that occurs in spermatozoa. Defected spermatozoa have two primary abnormalities that occur during spermatogenesis and secondary abnormalities if they occur after spermatogenesis [29]. Based on the recommendation of The BSE systems of the Society for The riogenology and the WCABP in [21], the minimum normal sperm is 70%, it means all bulls in both seasons of abnormality can still be categorized as a normal sperm. However according to [30], fertility of semen is a good category if the amount of spermatozoa abnormal is not more than 20%. Different opinion is given by [31], he said that if the primary abnormality is more than 10% so it can affect fertility.

[13] assumed that the abnormality is divided into four categories ie low <5%; moderate 5-10%; high 10.1-15% and very high >15%. Based on this, PO cattle in Central Lampung both the rainy season (1.85 ± 1.09%) and the dry season (4.40 ± 1.27%) is in the low abnormality category. Abnormalities during the rainy season are more varied, ie entering the category of low, medium and very high. Abnormalities in the dry season are in the low and medium category.

The determination of environmental compatibility for bulls is based on microscopic examination of concentration, motility and abnormality. Based on these three criteria, PO cattle has a good reproductive conditions at all three elevations.

4. Conclusion

According to the data it was concluded that PO bull living in low temperature place has a normal semen volume, the consistency is mostly watery to moderate, fresh semen pH is in the normal range and the color of semen are all normal both in the rainy and dry seasons. The suitability of the environment for bulls is based on the microscopic examination of concentration, motility and abnormality. Based on these criteria, PO cattle have a good reproduction conditions at all three altitudes.

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