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Comparison of Hematological Levels of Simmental-Ongole Crossbreed (SimPO) and Ongole Crossbreed (PO) Cattle Reared Semi-Intensively

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Abstract

Hematological analysis in cattle is an important basis for determining physiological conditions, biomedical study, and veterinary clinical diagnosis. This study aimed to determine the comparison of hematological values between Simmental-Ongole crossbreed (SimPO) and Ongole crossbreed (PO) cattle reared semi-intensively in oil palm plantations area. A total of 70 blood samples were collected from 35 female SimPO and 35 female PO cattle aged ± 3,5 years who reared from the same area. Blood samples were collected via the coccygeal vein as much as 3 ml, performed at 07.00 in the morning before being grazed on oil palm plantations. Blood samples were collected using a vacutainer tube containing Ethylene Diamine Tetra-Acetic Acid (EDTA) for further analysis using a hematology analyzer. Data from hematological examination results were then analyzed using an independent sample t-test with a significance level of $p < 0,05$. In results, reported that there were no significant differences in several hematological parameters that have been analyzed. We can conclude that there was no substantial hematological level in the SimPO and PO cattle reared semi-intensively on oil palm plantations.

Keywords: hematology levels, Ongole crossbreed, semi-intensive rearing, Simmental-Ongole crossbreed

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INTRODUCTION

The program for developing superior beef cattle through various crossbreeds has been widely implemented by various parties in order to obtain the potential of superior beef cattle. Some of the beef cattle resulting from these crosses are Simmental-Ongole crossbreed (SimPO) and Ongole crossbreed (PO) cattle. The PO cattle are widely reared because of their good reproductive rate and are reported to be able to adapt to hot climate conditions and poor feed quality (Sudrajad and Subiharta, 2014), while SimPO cattle are the product of a cross between male Simmental and female PO cattle. The results of this cross reported in superior traits such as short Calving Interval (CI) and Estrus Post Partus (EPP), better birth weight, and weaning than PO cattle (Christoffor and Baliarti, 2008). According to the study by Sumadi *et al*. (2008) the SimPO and PO cattle populations are respectively 43,6% and 34,3% of the total cattle population in Indonesia, however, study regarding the hematological status of these two cattle breeds which are reared semi-intensively is relatively little discussed. The semi-intensive rearing system is a rearing system where cows are grazed during the day and penned at night. This rearing system has the advantage that it can reduce the cost of forage and cattle stool can be applied directly to grazing areas (Maulana *et al*., 2018; Agustono *et al*., 2018). Bali cattle raised semi-intensively showed good productivity. Extensive and semi-intensive maintenance that utilizes palm oil industry by-products in several pilot projects at the farmer level and several private companies has been reported to be successful and shows positive results (Agus and Widi, 2018).

Hematological status has an important role as a support for physical examination in determining the prognosis and diagnosis of disease (Delfino *et al*., 2012; Roland *et al*., 2014). Hematological status also provides information regarding physiological conditions, animal health

status (Delfino *et al*., 2012; Klinkon and Ježek, 2012; Roland *et al*., 2014), evaluation of reproductive performance (Yuherman *et al*., 2017; Abramowicz *et al*., 2019), determining nutritional status and livestock management (Gaina *et al*., 2019; Yuherman *et al*., 2017), determining disease status, therapeutic actions and monitoring of disease management (Abramowicz *et al*., 2019; Kim *et al*., 2020), observation of stress levels (Delfino *et al*., 2014; Roberto *et al*., 2010; Rodrigues *et al*., 2010) and the effect on animal welfare (Gaina *et al*., 2019).

Factors that influence hematological values are age, season, gender, lactation, pregnancy, health, parity, and milk production status (Cozzi *et al*., 2011; Brscic *et al*., 2015). Temperature, time and location of maintenance, management, species, breed, infection factors, and laboratory factors are also factors that influence hematological values (George *et al*., 2010; Delfino *et al*., 2012; Delfino *et al*., 2014; Kim *et al*., 2020). The importance of hematological status means that there is a need for a study regarding the hematological status of SimPO and PO cattle reared semi-intensively on oil palm plantations in Indonesia. This is not only intended as basic data but is also expected to be able to support an ideal physiological profile in the rearing process so that it can have an impact on increasing the performance and productivity of local cattle in order to increase the cattle population in Indonesia.

MATERIALS AND METHODS

Samples

A total of 70 female primiparous cattle aged ± 3,5 years consisting of 35 SimPO and 35 PO cattle were reared semi-intensively. Animal samples were enrolled using the purposive sampling method. The animal has been confirmed to have had a history of deworming treatment and a clinical examination has been carried out by a veterinarian to ensure the animal's health. Determination of SimPO and PO cattle breeds based on phenotypic characteristics. SimPO cattle are characterized by a dominant light brown color with a characteristic white hair pattern on the forehead. The head shape is flat and wide, the muzzle is black or pink. Their body posture is reported to be long and has large bones. The tip of the tail hair is reported to be white and the color of the track is reported to be reddish brown or black (Triyono, 2003). According to Sudrajad and Subiharta (2014), the characteristics of PO female cattle are white skin throughout the body, black muzzle, lateral triangular head shape, long horns, wavy, hump and red or black vulva. The age of the cattle used was based on examination of the replacement of at least 1 pair of milk teeth with permanent teeth, while the primiparous status was based on recordings from the breeder. Cattle were reared semi-intensively on oil palm plantations where the animals will be grazed in the morning at around 08.00 am and penned at 17.00 in the afternoon. Additional feed in the form of 2 kg of concentrate was fed in the afternoon.

Blood Collection

A 3 ml blood sample was collected in the morning at 07.00 from the coccygeal vein using a vacutainer tube containing EDTA. The samples that have been collected are then stored at room temperature for 2 hours and then analyzed using a hematology analyzer. Parameters analyzed include red blood cells (RBC), white blood cells (WBC), hemoglobin (Hb), lymphocytes (LYM), hematocrit, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpusucular hemoglobin concentration (MCHC), and platelets.

Data Analysis

Data from hematological examination results in quantitative form were then analyzed using IBM® Statistical Product and Service Solutions® (SPSS) software, with an independent sample t-test and a significance of $p < 0,05$. The data that has been analyzed will be presented in the form of mean and standard deviation.

RESULTS AND DISCUSSION

Hematological evaluation of SimPO and PO cattle reared semi-intensively on oil palm plantations was reported in Table 1. The results of

Table 1. Comparison of hematological values of SimPO and PO cattle reared semi-intensively

Parameter	Breed		p-value	Std. Error	References*
	SimPO	PO			
WBC (10^3/µL)	8,03 ± 2,23[a]	8,63 ± 2,27[a]	0,27	0,53	5,1–13,3
RBC (10^6/µL)	7,49 ± 1,02[a]	7,81 ± 1,13[a]	0,21	0,25	4,9–7,5
Hb (g/dL)	11,64 ± 1,36[a]	11,97 ± 1,58[a]	0,32	0,35	8,4–12,0
PCV (%)	38,14 ± 4,81[a]	39,29 ± 5,26[a]	0,34	1,20	21–30
MCV (fL)	51,10 ± 3,09[a]	50,45 ± 2,83[a]	0,36	0,70	36–50
MCH (pg)	15,63 ± 1,21[a]	15,39 ± 1,15[a]	0,38	0,28	14–19
MCHC (g/dL)	30,86 ± 2,13[a]	30,48 ± 1,32[a]	0,37	0,42	38–43
PLT (10^3/µL)	184,40 ± 93,57[a]	168,40 ± 74,41[a]	0,43	20,20	160–650
LYM (10^3/µL)	4,52 ± 1,44[a]	4,13 ± 1,39[a]	0,25	0,33	1,8–8,1

[a,b]Different superscripts in the same row indicate significant differences ($p < 0,05$).
*References: Weiss and Wardrop, (2010).

data analysis showed that there were no significant differences ($p > 0,05$) in hematological parameters between SimPO and PO cattle.

The RBC are one of the components in the blood that bind to Hb in the oxygen distribution process (Aspinall and Cappello, 2015; Purnama *et al*., 2019). In this study, RBC levels between the two types of cattle did not differ significantly ($p > 0,05$). These results are in contrast to the study by Adam *et al*. (2015) and Sofyan *et al*. (2020) that breed has a significant effect on RBC levels. The RBC level of SimPO cattle in this study was 7,49 ± 1,02 10^6/µl, which means it is in the normal range, and is also in accordance with the study by Septiana *et al*. (2019) and Hartono *et al*. (2019), i.e., 6,64 ± 1,44 10^6/µl and 10,83 ± 4,68 10^6/µl, respectively. The evaluation results in PO cattle were above the normal range, i.e., 4,90–7,50 10^6/µl. Several results can occur because as RBC passes through the pulmonary capillaries, hemoglobin combines with oxygen, producing oxyhemogobin.

Several results are in accordance with the study by Adam *et al*. (2015) and Sofyan *et al*. (2020) that the RBC level in the *Bos indicus* species is higher when compared with other breeds. Different results were reported by Sarmin *et al*. (2021) that normal RBC levels in PO cattle are in the range 4,90–6,45 10^6/µl. The higher RBC value in PO cattle may also be caused by nutritional factors where this study used feed from palm oil waste as reported by Santiago *et al*. (2022). The semi-intensive rearing management factor in SimPO and PO cattle has the potential to be a factor in increasing RBC values as reported by Radkowska and Herbut (2014).

The WBC are a constituent of blood which functions as a defense mechanism and the body's immune system (Aspinall and Cappello, 2015; Dhabhar *et al*., 2012). WBC values and proportions describe the distribution of leukocytes which are influenced by various factors such as animal type, breed, age, gender, and animal health status. The WBC values of SimPO and PO cattle were reported to have no significant difference ($p > 0,05$). These results are also in accordance with the report of Sofyan *et al*. (2020) there is no difference between Aceh cattle and Zebu cattle. The WBC levels in both breeds in this study were at normal levels i.e., 5,10–13,30 10^3/µL. Similar results were also reported by Sarmin *et al*. (2021) in PO cattle is in the range of 7,00–10,24 10^3/µl, while in SimPO cattle the WBC value is on average 10,83 ± 4,68 10^3/µl (Hartono *et al*., 2019).

The Hb is a complex protein composed of iron which functions to distribute oxygen (Aspinall and Cappello, 2015). The Hb levels have a positive correlation with RBC levels in the blood, and also have a positive correlation with the nutritional status provided (Ochefu *et al*., 2020). The Hb levels in these two types of cattle are in the normal range of 8,40–12,00 g/dL. These results are in accordance with the report by Septiana *et al*. (2019) and Hartono *et al*. (2019) that the Hb value is on average 11,00 ± 0,62 g/dL and 14,38 ± 6,78 g/dL. A study conducted by Sarmin *et al*. (2021) found that the normal range

for PO cattle Hb is in the range of 8,96–10,77 g/dL. Variations in Hb levels from various references may be caused by various factors such as season, feed, age, species, environment, sampling time, and the method used.

Hematocrit plays a role in determining hydration status in animals, by comparing the number of red blood cells with the entire blood volume. This parameter is influenced by various factors such as age, production status, breeding system, season, and feed (Cunningham, 2002). The results of the study reported that the PCV values of the two breeds did not differ significantly. The PCV levels in this study were above normal levels, namely 21–30%. Similar results were also reported by Sarmin *et al*. (2021) that normal PCV levels for PO cattle are in the range of 26,02–32,79%. The high PCV value of SimPO and PO cattle is probably caused by the presence of abundant feed supplementation factors, in this case concentrate which tends to influence PCV levels (Ochefu *et al*., 2020; Dinul *et al*., 2022). Another possibility is that the environmental temperature rises, causing the animal to lose fluids through the respiratory system and its plasmatic volume is low, which causes an increase in hematocrit values (Garcia-Navarro, 2005). The maintenance management aspect may also be a factor in increasing the PCV value, as stated by Radkowska and Herbut (2014) that outdoor and pasture maintenance has a tendency to increase the PCV value.

The MCV is the result of calculating the average volume in one erythrocyte cell. The MCV levels in these two types are above normal levels of 36–50 fL. Similar results were also reported by Sarmin *et al*. (2021) that normal MCV levels for PO cattle are in the range of 49,95–54,96 fL (Fahrimal *et al*., 2020). The MCH is the amount of Hb contained in red blood cells. MCH levels in both breeds are still within the normal range, namely 14,00–19,00 pg. Sarmin *et al*. (2021) have reported that MCH in PO cattle is in the range of 16,43–18,61 pg. The MCHC is a calculation of the average concentration or level of hemoglobin in one red blood cell (Cunningham, 2002; Hidayah *et al*., 2021). The MCHC levels in this study were in the normal range of 30,00–36,00 g/dL. Similar results were also reported by Sarmin *et al*. (2021) that MCHC in PO cattle is in the range of 30,71–34,55 g/dL.

Platelets are components of blood that have an important role in the blood clotting process (Aspinall and Cappello, 2015). Platelet levels in SimPO and PO cattle are in the normal range of 160–650 10^3/µl. Similar results were also reported by Sarmin *et al*. (2021) that PO cow platelet levels are in the range of 167,25–333,50 10^3/µl.

CONCLUSION

We may conclude that there was no statistically significant difference in the hematological parameters of SimPO and PO cattle reared in oil palm plantations using a semi-intensive method.

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