Effect of lactation on haematological constituents in Sapera and Ettawa crossbred goats

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Abstract. The aim of this study was to compare the change in haematological constituents values during the lactation phase of Sapera and Ettawa crossbred goats. Eight lactating Sapera and nine Ettawa crossbred goats were used in this study. Blood samples were taken aseptically through the jugular vein. The mean of corpuscular hemoglobin (MCH) and corpuscular hemoglobin concentration (MCHC) levels of lactating Ettawa crossbred goats were significantly higher (P < 0.05) than those of lactating Sapera crossbred goats. There was no significant difference in red blood cells (RBC), hemoglobin (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), white blood cells (WBC), mean corpuscular hemoglobin (MCH), lymphocytes (L), and neutrophils (N) levels (P > 0.05). It was found that MCHC and MCH levels in lactating Ettawa crossbred are significantly higher (P < 0.05) than those of the lactating Sapera goats. It indicated that lactating Ettawa crossbred goats have more maintenance or even higher oxygen carrying capacity that enhances oxygen supply for metabolism than that of lactating Sapera goats. Oxygen supply played an important role in the process of milk synthesis.

1. Introduction
Lactation is a physiological process that can change several parameters in the blood [1] and is considered as a metabolic stressor [2] that can change the animal’s metabolic profile [3, ] because the process uses 80% of the metabolites circulating in the blood for milk synthesis [5], milk production [6], and mammary gland growth [7]. The change in the metabolism occurs not only as a result of the physiological status but also depending on the breed [2, ] in addition to the fact that each breed shows variation resulting from different nutritional and physiological conditions [8]. The vital indicator of the metabolic and physiological change is hematological profile of the animal, and it has been reported that goats have wide inter-breed hematological variations [2]. Hematological profiles are important in evaluating the health status of animals [5], the diagnosis of metabolic diseases, the assessment of the nutritional status of the animals [1], and the welfare and productivity of the animals [8]. To the best of our knowledge, there is no published data on the change in the hematological profile during the lactation phase of Ettawa and Sapera crossbred goats [9]. Such hematological variations in lactating goats has been reported in Messina does [10], dairy goats (Soares et al., 2018), Egyptian Baladi goats [11], Kilis does [4], and Surti goats [12]. In the present study, we aimed to compare the difference in hematological value during the lactation phase of Sapera and Ettawa crossbred goats.
2. Material and methods

2.1. Place and animal

The study was conducted in Sukoharjo district, Central Java, Indonesia. In total, 17 lactating goats were included in the study (150 days post-partum), comprising eight Sapera goats (milk production 1.5–2.0 L/day/tail) and nine Ettawa crossbred goats (milk production 1.2–1.5 L/day/tail). Each breed was 1.5–2 years old and their body weight ranged from 50 to 55 kg and parity from 2 to 3. All the experimental animals were declared clinically healthy at the time of sampling and were fed the same composition of concentrates and complete silage composed of cane of green corn, rind of green pea, Indigofera sp, and kefir milk with chemical composition shown in Table 1. About 1.5 kg concentrate and 4 kg of complete silage/animal was distributed twice a day. Water was offered ad libitum.

2.2. Blood sampling

In total, 10 mL blood sample was transferred into a sterile tube containing EDTA, while the remaining 5 mL was transferred into a sterile tube that did not contain any anticoagulant. All of the samples were transferred in ice as soon as possible.

2.3. Statistical analysis

The T-test was used to compare the data on hematological analysis of the blood samples of lactating Sapera and Ettawa crossbred goats. Data were analyzed using Statistical Package for Social Science version 17.0 (SPSS USA).

3. Result and discussion

Lactation is one of the stressors in livestock [11] because milk synthesis and production takes place during the lactation phase [13]. The haematological responses of the lactating Sapera and Ettawa crossbred goats are summarized in Table 1. The MCH level in the lactating Sapera goats was significantly lower at 31.32±7.21 (pg) (P < 0.05) than that in lactating Ettawa crossbred goats at 42.20±4.62 (pg). The MCHC level in the lactating Sapera goats was significantly lower at 31.76 ± 7.63 (g/dL) (P < 0.05) than that in lactating Ettawa crossbred goats at 42.37 ± 6.11 (g/dL). This indicates that lactating Ettawa crossbred goats have more maintenance or even increasing oxygen carrying capacity, which [14] consequently enhances the oxygen supply [15] for metabolism and for milk synthesis [16] than that of lactating Sapera goats. However, the low MCHC level in the lactating Sapera goats was still consistent with the study reported on lactating does [11]. The low MCHC level in Sapera goats was also reported in cows and heifers in the first month of lactation. This probably occurs because of iron deficiency [3] during lactation. Meanwhile, there was no significant difference between the two breeds in RBC, Hb, PCV, MCV, WBC, MCH, L, and N levels (P > 0.05). Levels of RBCs in lactating Sapera goats was 2.64 ± 0.96 (×10^6/µL); there was no significant difference (P > 0.05) with 20.44 ± 35.059 (×10^6/ µL) in the lactating Ettawa crossbred goats; both were considerably low [17]. The lower level in the two goat breeds in the study was consistent with that reported in lactating does [11], lactating Baladi goats [2], and lactating Tsigai ewes [18]. The low RBC count in both the lactating goat breeds may be attributed to the haemodilution effect resulting from an increase in plasma volume and/or the increasing water mobilization to mammary gland through the vascular system.

The levels of Hb in lactating Sapera and Ettawa crossbred goats were 7.84 ± 1.42 g/dL and 8.51 ± 1.01 g/dL, respectively. The values were similar (P > 0.05) within the physiological range of 8%–12% reported on goats by Kramer [17]. The levels of RBCs and Hb were stable in lactating Sapera and Ettawa crossbred goats, which were similar to those of Baladi goats [19]. PCV in lactating Sapera goats was 26.30% ± 8.31%, which was not significant (P > 0.05) with 20.38% ± 3.28% in Ettawa crossbred goats; however, PCV in Ettawa crossbred goats were lower than those reported by Kramer [17] which may be caused by differential mobilization of water into the mammary gland, which occurs
in the circulation system to meet the need for water in milk production, in addition to (13,16,17) major shift in metabolism leading to oxidative stress [21] leading to increase in lipid peroxidation, decrease in antioxidant capacity [22], and decrease in PCV [23]. Lower PCV was also reported in early lactating Maltese goats [24]. Low PCV in Ettawa crossbred goats was consistent with that reported on lactating does and ewes [11], lactating Barki ewes [16], 3 weeks after parturition in Kilis does [4] and lactating Ossimi sheep [1]. There are some reports suggesting that PCV was related to parity [20] but in this study, there was no difference in the parity between Sapera and Ettawa crossbred goats.

MCV in lactating Sapera goat was 99.10 ± 9.45 fL, which was almost equal to 100.00 ± 9.79 fL in Ettawa crossbred goat (P > 0.05); both higher than the parameters reported by Kramer (17) in lactating free ranging goats [25] and lactating Alpine goats [26]. The level of WBC in lactating Sapera was 12.5 ± 30.62 (10³/µL), which was almost equal to 14.30 ± 30.94 (10³/µL) in lactating Ettawa crossbred goats (P > 0.05), both in range parameter reported by Kramer [17]. This result was contrary to that observed in the lactating Baladi goat wherein there was significant reduction in WBC level [19]. WBC level in the two goat breeds in the present study was consistent with the report on Surti goats [12] and Tsigai ewes [18] but was lower than that of the lactating Baladi goats [27]. Lymphocyte level in lactating Sapera was 52.85% ± 12.45% similar to 43.67% ± 8.60% in lactating Ettawa crossbred goats (P > 0.05), both in range parameter reported by Kramer (17) Neutrophil level in lactating Sapera goats was 47.14% ± 12.45% similar to 56.32% ± 8.60% in lactating Ettawa crossbred goats (P > 0.05), both higher than that in lactating Ossimi sheep [1] and free ranging goats [25]. The N level in the goat breeds in the study was higher than that of the lactating does and ewes [11].

Table 1. Hematological changes in lactating Sapera and Ettawa crossbred goats

| Parameters | Sapera | Ettawa crossbred | p value |
|------------|--------|------------------|--------|
| MCH (pg)   | 31.32 ± 7.21 | 42.20 ± 4.62 | 0.002  |
| MCHC (g / dL) | 31.76 ± 7.63 | 42.37 ± 6.11 | 0.007  |
| RBC (×10⁶/µL) | 26.44 ± 8.10 | 20.44 ± 3.51 | 0.072  |
| Hb (g/dL) | 7.84 ± 1.42 | 8.51 ± 1.01 | 0.288  |
| PCV (%) | 26.30 ± 8.31 | 20.38 ± 3.28 | 0.079  |
| MCV ( fL) | 99.10 ± 9.45 | 100.00 ± 9.79 | 0.784  |
| WBC (10³/µL) | 12.50 ± 30.62 | 14.39 ± 30.94 | 0.262  |
| Lymphocytes (%) | 52.85 ± 12.45 | 43.67 ± 8.60 | 0.101  |
| Neutrophils (%) | 47.14 ± 12.45 | 56.32 ± 8.60 | 0.101  |

4. Conclusion

In conclusion, this study showed that MCHC and MCH levels in Ettawa crossbred goats were higher than those of the Sapera goats, indicating the capacity to consume sufficient amount of oxygen for milk synthesis. The two goat breeds had the same response in terms of decrease in RBC, Hb, PCV, MCV, WBC, L, and N levels.

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