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The Hematological and Blood Chemical Parameters of the Female Fat Tail Sheep Raised with Fermented Complete Feed Management

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ABSTRACT

The study aimed at evaluating the hematological and chemical parameters of the blood of female fat tail sheep raised with fermented complete feed (CF) management. It used 40 adult female fat tail sheep age 24-36 months and body weight in 30-35 kg and 3-4 of body condition score, which was raised in the individual stall with fermented complete feed (CF) management. Samples of blood were drawn once from the jugular vein before feeding in the morning. The results of hematological parameters were RBC (12.11±2.18 x10^6/µL), hemoglobin (12.40±1.96 g/dL), hematocrit (36.49±5.47%), MCV (30.46±3.38 fL), MCH (10.30±0.75 pg), MCHC (34.00±1.86 g/dL), eosinophils (3.15±7.70%), neutrophils (7.13±14.90%), lymphocytes (11.93±23.85%), and monocytes (0.30±0.88%). The results of chemical parameters were sodium (147.58±3.75 mmol/L), chloride (106.51±3.12 mmol/L), magnesium (3.66±1.38 mg/dL), albumin (3.36±0.31 g/dL) and glucose (40.28±9.12 mg/dL). The results of hematological and chemical parameters in the study could be the reference in monitoring the health of the adult female fat tail sheep raised with the fermented complete feed (CF) management.

Keywords: Blood chemistry, Female fat tail sheep, Fermented complete feed, Hematology

Introduction

Fat tail sheep are Indonesian endemic sheep with huge potential (Udo and Budisatria, 2011) of being meat-producing animals (Mulyono *et al.*, 2009). It is necessary in breeding the sheep to establish a standard reference for their health status. Blood profile is the most important information in establishing an animal's health status, nutrition status, the diagnosis and the prognosis of metabolic disorders, and monitoring the medical treatment progress of the animal (Beigh *et al.*, 2018). The determinant factor of blood profile variation is feed (Ghani *et al.,* 2016), while the determinant factor of the success in animal breeding is also fed (Hastuti *et al.*, 2011). It is necessary to innovative make use of local feed to solve the problem of limited feed. A balanced ratio of green forage and concentrate can shorten eating and ruminating time and also prolong the resting time of ruminants (Beigh *et al.*, 2016). Fermented complete feed (CF) management can be an alternative in supplying quality local feed for a long period (Suwignyo *et al.*, 2016). It is the best choice among the existing conventional methods in optimally making use of local agricultural feed source and in increasing animal's productivity at minimal cost and energy (Beigh *et al.*, 2016). It is proven that fermented CF management can replace the role of fresh forage commercial concentrate (Zakaria *et al.*, 2015) increase the weight gain of female Ettawa goats and help animal breeders warrant the availability of feed-in dry season (Pakpahan and Restiani, 2019).

The application of CF-based fed Bajra straw by (Dhuria and Sharma, 2010), mustard straw by Dhuria *et al.* (2011[a]), gram straw by Dhuria *et al.* (2011b), does not change the hematological and chemical levels of sheep. The best VFA production is found in the CF containing the stump of the Batu banana (Aswandi *et al.,* 2012). The complete feed with liquid cow rumen microbial bio activator results in high digestibility of dry matter and organic matter and increases the consumption of nutrients and the performance of Bligon goats (Munawaroh *et al.,* 2015). The fermented CF of *Bababsu palm* gives a positive nitrogen balance and improves the stability of rumen pH and N-NH3 in goats (Moreira *et al.*, 2016). The fermented CF with urea and EM-4 addition can increase consumption, digestibility, and body weight in Pampangan water buffalo (Riswandi *et al.*, 2014). The application of CF is reported to increase service per conception and milk production in cows (Susilowati *et al.,* 2020). It is reported that CF does not change the hemogram of Sahiwal cows (Kumar *et al.,* 2013) and lambs (Tripathi *et al.,* 2014), glucose, and protein in Barbari goats (Samanta *et al.,* 2003). Fermented amofer oil palm waste-based CF does not change the hematology of goats (Mayulu *et al*., 2012). The use of CF in fat tail sheep breeding to increase meat production is very urgent, while there have not been any blood parameters of female fat tail sheep in fermented CF management. Therefore, the study aims at evaluating the hematological and chemical profile of the blood of female fat tail sheep in fermented CF management.

Materials and Methods

The location and the animals of study

The study was conducted at the sheep husbandry in Kepuh Kulon, Wirokerten, Banguntapan, Bantul, the Special Region of Yogyakarta (7.85°S 110.40°E.) with an average elevation of 63 m. The animals used in the study were 40 female adult fat tail sheep of 2-4 years of age and 30-35 kg of body weight from Kediri, East Java.

The composition of feed and fermentation

The Fermented CF used in the study was obtained from Klaten district of Central Java province, consisting of ground corn (10%), pollard (10%), ground soybeans (15%), fat concentrate A (10%), ground corncobs (40%) with the total weight of 400 kg. EM-4 microbial starter liquid (500 ml) was poured into 100 ml of water and 5 l of molasses were added and evenly stirred. And then, 400 kg of CF was added and eventually stirred. Subsequently, it was fermented in a closed feed container (anaerobic) for 3 days. It was harvested on day 3 and given to sheep. Each sheep got 0.8 kg-1 kg.

The composition of feed and fermentation

Blood samples were drawn from all of the sheep in the study after 120 days in fermented CF management. The blood was drawn before feeding in the morning on the jugular vein using a disposable syringe. Ten ml of the samples were divided into 5 ml and put into a vacutainer (Vaculab® Onemed) containing 0.05 mL of ethylenediaminetetraacetic acid (EDTA) for hematological examination. The BC-2800Vet auto hematology analyzer (RRC) was used to analyze the samples, including red blood cells, hematocrit, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), eosinophils, neutrophils, lymphocyte, and monocyte. The remaining 5 ml was put into a plain vacutainer (PT. Jayamas Medica Industri, Sidoarjo, Indonesia) and then centrifuged at 3.000 rpm for 10 minutes and the resulting serum was kept at -20ºC for blood chemical analysis. Blood chemical analysis included sodium, potassium, chloride, magnesium, albumin, triglycerides, and glucose. The analysis was made using the analysis kit supplied by Roche Diagnostics in Roche/Hitachi Cobas C systems Cobas C 502 analyzers (Japan).

Data analysis

The hematological and chemical data of the blood were presented in mean and standard deviation and then compared to the textbook normal value.

Results and Discussion

The results of the physical and clinical examination of all of the sheep showed that the sheep were healthy during the study with a body condition score of 3-4. The hematological parameters of the female fat tail sheep were summarized in Table 1. The RBC level of the sheep in the study was 12.11±2.18 (x10^6/µL), which was still in the normal limit according to the textbook (Byers and Kramer, 2010) that was 9.00-15.00 x10^6/µL. It was consistent with the study of the sheep with CF supplementation in Exogenous Fibrinolytic Enzymes Cocktail (Beigh *et al.*, 2018). The hemoglobin parameter of the sheep in the study were 12.40±1.96 (g/dL), which was consistent with the textbook was 9.00-15.00 g/dL (Byers and Kramer, 2010) and it was corroborated by Anbarasu *et al.*(2002) who conducted a study of the sheep with the basal feed of wheat straw (10.50 to 11.62 g/dL). The hemoglobin parameter in the study was higher than that found in Garut sheep with the feed made of 40% sprout waste and 60% concentrate at the level of 6.53±0.27 g/dL (Atik, 2015) and that found in Merinolandschaf sheep raise in an organic farm at the level of 9.26 g/dL (Antunović *et al.,* 2017). The

Table 1. Hematology of female fat tailed sheep

Parameters	Mean	Textbook
RBC (106/µL)	12.11±2.18	9.00-15.00*
Hb (g/dL)	12.40±1.96	9.00-15.00*
Hematocrite (%)	36.49±5.47	27.00-45.00**
MCV (fL)	30.46±3.38	28.00-40.00*
MCH (pg)	10.30±0.75	8.00-12.00*
MCHC(g/dL)	34.00±1.86	31.00-34.00*
Eosinophyl (%)	3.15±7.70	0.00-10*.00
Neutrophyl (%)	7.13±14.90	10.00-50.00*
Limphocyte (%)	11.93±23.85	40.00-55.00*
Monocyte (%)	0.30±0.88	0.00-5.00*

* Byers and Kramer, 2010.
** Radostits *et al.,* 2000.

normal hemoglobin parameter of the study was consistent with the study of the sheep fed with the Bajra straw-based CF block by Dhuria and Sharma (2010). The percentage of the hematocrit parameter of the sheep found in the study was 36.49±5.47%, which was normal according to textbooks that were 27.00-45.00 % (Radostits *et al.,* 2000) and consistent with the study of the sheep with the treatment of ammoniated and fermented (Amofer) CF by Mayulu *et al.*(2012), which was 33.75±0.96%. The treatment of CF resulted in normal hematocrit and it was consistent with the study of Marga sheep with Bajra straw-based CF by Dhuria and Sharma (2010) and the study of Marga sheep with gram straw-based CF by Dhuria *et al.*(2011[b]).

The MCV parameter of the sheep in the study was 30.46±3.38 fL that was considered to be in the normal limit of the textbook parameter (Byers and Kramer, 2010) at level 28.00-40.00 fL and consistent with the MCV of the sheep reported by Saeed *et al.*(2019), which was at the level of 29.40±0.33 fL and also the MCV of the sheep with the CF supplemented with Exogenous Fibrinolytic Enzymes Cocktail, which was at the level of 27.00±0.25 fL (Beigh *et al.,* 2018). The normal MCV parameter of the sheep in the study was consistent with the study of the sheep fed with Moringa oleifera leaf meal by (Jiwuba *et al.,* 2016).

The MCH parameter found in the study was 10.30±0.75 pg considered to be in the normal limit according to textbooks (Byers and Kramer, 2010), which was at the level of 8.00-12.00 pg and consistent with the study of the sheep fed with Moringa oleifera leaf meal by (Jiwuba et al., 2016) and with the study of the sheep fed with the CF supplemented with Exogenous Fibrinolytic Enzymes Cocktail by (Beigh *et al.,* 2018) at 8.93±0.09 pg.

The MCHC parameter found in the study was at the level of 34.00±1.86 g/dL and in the normal limit according to textbooks (Byers and Kramer, 2010) that was at the level of 31.00-34.00 g/dL. It was also consistent with the MCHC level of the sheep fed with the CF supplemented with Exogenous Fibrinolytic Enzymes Cocktail, which was at the level of 34.06±0.45% (Beigh *et al.,* 2018) and with the MCH level of the sheep reported by Saeed *et al.* (2019), which was at the level of 36.30±0.17 g/dL. The normal MCV, MCH, and MCHC levels of the fat tail sheep in the study showed that there was not any anemia indication in the sheep (Jiwuba *et al.,* 2016) and Soul *et al.* (2019).

The eosinophils percentage parameter was 3.15±7.70% considered to be in the normal limit according to the textbook parameter (Byers and Kramer, 2010), which was at the level of 0.00-10.00%. The eosinophils in the normal limit have been reported in the sheep fed with the CF supplemented with Exogenous Fibrinolytic Enzymes Cocktail (Beigh *et al.,* 2018), in the free weaned sheep with the treatment of Katuk (*Sauropus androgynous*) flour (Putranto *et al.,* 2014), and the sheep fed with sericea lespedeza (Acharya *et al.,* 2015).

The resulting parameter of the neutrophils percentage in the study was 7.13±14.90% considered to be in the normal limit according to the textbook parameter (Byers and Kramer, 2010), which was at the level of 10.00-50.00%, indicating that the sheep were not being infected by any pathogenic organism because neutrophils played an important role in phagocytosis and eliminated microorganism in the body (da Silva *et al*., 2015). The normal neutrophil level was also reported in the sheep fed with the CF supplemented with Exogenous Fibrinolytic Enzymes Cocktail (Beigh *et al.,* 2018) and in the free weaned sheep with the treatment of Katuk flour (Putranto *et al.,* 2014).

The resulting parameter of the lymphocyte in the study was 11.93±23.85% that was lower than the normal limit of the textbook parameter (Byers and Kramer, 2010), which was at the level of 40.00-55.00%. It has been reported that the lymphocyte parameter decreased in the goat kids with the treatment of 3% alfalfa protein-xanthophyll concentrate (Szymanowsk *et al.,* 2017) and in females pre-weaning Kacang sheep with the treatment of Katuk flour supplement (Putranto *et al.,* 2014). Lymphocytes level was the key in sheep immunity system (Pradhan, 2016). The low lymphocytes level was indicative of the decrease in cellular immunity (Saki *et al.,* 2018) and it might have related to the protein content of feed in addition to other possible environmental stressing factors (Acharya *et al.,* 2015). It has been reported that lymphocyte increased in West African dwarf sheep with the treatment of Saccharomyces cerevisiae supplementation (Osita *et al.,* 2018). Also, the report by da Silva *et al.* (2015) that lymphocyte did not change in the sheep with the treatment of propolis extract and sodium monensin. The resulting percentage level in the study was 0.30±0.88% considered to be in the normal limit of the textbook parameter (Byers and Kramer, 2010), which was at the level of 0.00-5.00%. The resulting monocyte in the study was lower than that found in the sheep fed with Ziziphus mucronata and Parkia biglobosa, which was at the level of 5.00 to 9.00% (Wada *et al.,* 2014). Osita *et al.* (2018) also reported normal monocyte levels in the sheep fed with the feed fortified with *Saccharomyces cerevisiae* yeast and in the sheep fed with the CF supplemented with Exogenous Fibrolytic Enzymes Cocktail (Beigh *et al.,* 2018).

The chemical parameters of the blood of the female fat tail sheep were summarized in Table 2. The resulting sodium parameter in the study was 147.58±3.75 mmol/L considered in the normal limit of the textbook parameter (Radostits *et al*., 2000), which was at the level of 139.00-152.00 mmol/L. It was consistent with the sodium level of the sheep fed with *Ziziphus mucronata* and *Parkia biglobosa*, which was at the level of 130 to 173 mmol/L.However, it was higher than

Table 2. Biochemistry parameters of female fat tailed sheep

Parameters	Mean	Textbook
Sodium (mmol/L)	147.58±3.25	139.00-152.00 *
Potassium (mmol/L)	5.16±0.59	3.90-5.40*
Chloride (mmol/L)	106.51±3.12	95.00-103.00*
Magnesium (mg/dL)	3.66±1.38	0.30-2.80*
Albumin (g/dL)	3.36±0.31	2.40-3.00*
Triglycerides (mg/dL)	28.28±14.56	8.85-36.28*
Glucosa (mg/dL)	40.28±9.12	50.00-80.00*

* Radostits *et al.*(2000).

the mean sodium level of the sheep fed with *Ziziphus mucronata* (Wada *et al*., 2014). The normal sodium parameter was consistent with the study of the sheep fed with different feeds such as grass, grass mixture, and leguminous diets (Osita *et al.*, 2018). The resulting potassium parameter in the study was 5.16±0.59 mmol/L considered to be in the normal limit of the textbook parameter (Radostits *et al*., 2000), which was at the level of 3.90-5.40 mmol/L. It was also consistent with the potassium level of the sheep fed with Ziziphus mucronata or Parkia biglobosa, which was at the level of 3.90 to 5.50 mmol/L (Wada *et al.,* 2014). The normal potassium level was also reported in the male sheep fed with yeast-fortified feed (Shehu *et al*., 2014) and also in the sheep fed with different feeds such as grass, grass mixture, and leguminous diets (Osita *et al.,* 2018). Chloride parameter represented homeostasis indicator (Piccione *et al.,* 2012). The resulting chloride parameter in the study was 106.51±3.12 mmol/L considered to be in the normal limit of the textbook parameter (Radostits *et al.*, 2000), which was at the level of 95.00-103.00 mmol/L. It was also consistent with the chloride parameter of the sheep fed with Ziziphus mucronata or Parkia biglobosa, which was at the level of 95.00-128.00 mmol/L (Wada *et al.,* 2014). The resulting magnesium parameter in the study was 3.66±1.38 mg/dL. The lowest magnesium level was still in the normal limit of the textbook parameter (Radostits *et al*., 2000), which was at the level of 0.30-2.80 mg/dL. The variation of the magnesium levels was influenced by the difference in feeds (Mohammed *et al.*, 2017).

The resulting albumin parameter in the study was 3.36±0.31 g/dL. It was higher than the textbook albumin parameter (Radostits *et al.*, 2000), which was at the level of 2.40-3.00 g/dL. It was consistent with the study of the sheep by Anbarasu *et al.*(2002), which was 3.30 0.11 g/dL, and also with the study of the sheep fed with the CF supplemented with Exogenous Fibrinolytic Enzymes Cocktail by Beigh *et al.* (2018), which was at the level of 3.57 0.05 g/dL. Normal albumin parameter was also reported in the sheep fed with the CF with a supplement (Anbarasu *et al.,* 2002). It was reported that albumin increased in the sheep fed with grass (Osita *et al.,* 2019) and in the growing sheep with the treatment of the supplement of *S. cerevisiae supplementation* yeast culture (Rahman *et al*., 2012). However, there were also studies suggesting that albumin was not influenced by feeds (Eldaw and Ahmed, 2016).

The resulting triglyceride parameter in the study was 28.28±14.56 mg/dL considered to be in the normal range according to textbooks 8.85-36.28 mg/dL (Radostits *et al.,* 2002), was consistent with the triglyceride level of the sheep fed with the CF supplemented with exogenous fibrinolytic enzymes cocktail (Beigh *et al.*, 2018), which was at the level of 32.63±0.59 mg/dL. It was lower than the triglyceride level of the sheep reported by Saeed *et al.* (2019), which was at the level of 23.59±1.16 mg/dL. The research showing that the sheep fed with the CF had a normal triglyceride level was consistent with the study by Beigh *et al.* (2018).

The resulting glucose parameter in the study was 40.28±9.12 mg/dL and consistent with the textbook (Radostits *et al*., 2002), which was at the level of 50.0-80.00 mg/dL. It was corroborated by the study of the sheep with the treatment of supplementary feed by Anbarasu *et al.* (2002), which ranged from 45.42 to 49.08 mg/dL). It was also consistent with the study of the glucose level of the sheep fed with the CF supplemented with exogenous fibrinolytic enzymes (Beigh *et al.,* 2018), which was pada level 48.70± 0.64 mg/dL and also with the glucose level of the sheep fed with fresh *L.* arrecta plus concentrate (85/15), which was at the level of 38.50 mg/dL (Ginting *et al.,* 2011). However, it was lower than the glucose level of Barbari sheep fed with the CF for 3 weeks, which was 53.59±0.85 mg/dL (Samanta *et al.,* 2003). The normal glucose level of the sheep fed with the CF was also consistent with the studies by Dhuria and Sharma (2010) and Beigh *et al.* (2018).

Conclusions

The hematological and chemical parameters of the blood of the female fat tail sheep could be the reference in monitoring the health of the adult fat tail sheep in fermented complete feed management.

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