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The Activity of Lactate Dehydrogenase in Sapera, Saanen, and Ettawa Crossbred Goats in the Different Physiological Statuses

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ABSTRACT

The enzyme that catalyzes the conversion of lactate to pyruvate is called lactate dehydrogenase (LDH), essential in producing energy present in cells for various tissues, including the liver, heart, and skeletal muscle. Although the increased LDH activity is due to vascular thrombosis, bleeding, and tissue damage, it is mainly in the liver and kidneys of infected animals. Consequently, it is essential to investigate the effect of breed and physiological statuses on LDH activities in Sapera, Saanen and Ettawa crossbred goats. Study serum enzymes use 128 healthy goats from Sapera, Saanen and Ettawa crossbred goats in different physiological statuses (adult buck, pregnant does, dry does, post-weaning, female kids, male kids, lactating does). The mean serum enzyme activities in Sapera, Saanen, and Ettawa crossbred goats were 802.90±0.34 U/l; 779.47±0.34 U/l and 773.34±20.22 U/l, respectively. LDH activity in male kids (930.72±0.31 U/l) and female kids (938.14±10.34 U/l) were highest, followed by post-weaning (781.48±30.37 U/l), adult buck (745.78±10.44 U/l), dry does (713.80±10.26 U/l), lactating does (704.90±10.23 U/l), and pregnant does (662.78±10.29 U/l). In addition, interaction breed and physiological statuses showed that LDH activity of female kids of Saanen (1848.00±20.29 U/l) was higher than other physiological statuses in three breeds of goats. This result concluded that physiological statuses influence LDH activities in Indonesia's Sapera, Saanen and Ettawa crossbred goats.

Keywords: *Enzyme, Ettawa crossbreed, LDH., Sapera, Saanen*

1. INTRODUCTION

The purpose of bringing in Saanen goats is to increase milk production. Crossbred between a Saanen and an Ettawa, it will produce a new dairy cow called the Sapera [1]. Although the best milk comes from crossing Etawah, it is not from Saanen or Sapera [1] but lacks comparison in metabolism, especially enzyme activities lactate dehydrogenase as a biomarker. Enzyme as a biomarker to detect, support diagnosis and therapeutic decision, prognosis, monitoring of disease, treatment evaluation, and health outcome and see cell damage or cell death [2] in an animal. One of the vital enzymes is lactate dehydrogenase (LDH). It is a glycolytic enzyme that reverses pyruvic acid to lactic acid [3]. Furthermore, serum lactate dehydrogenase in humans is helpful as a prognostic indicator in non-Hodgkin's lymphoma [4]. LDH activity is used to diagnose intramammary subclinical infections in sheep and dairy goats [5] reflected mastitis degree [6]. In addition, in the early detection of subclinical mastitis in Merino sheep, it is helpful as one of the variables [7] and acidosis in goats [8]. In cows, as an indicator in the lung damage [9], liver damage [10], present in uterine secretion and related with oestrus cycle [11], detecting pregnancy in Holstein and Hereford cows [12], different stages of milk production [13] and increase in amniotic fluid in peripartum [14]. LDH also investigates sarcocystosis in cattle [15] and liver steatosis in dairy cows [15]. In birds as an indicator of

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liver and skeletal muscle damage or cardiac muscle damage [16]. LDH is also a stress and muscle damage marker [17]. LDH can be considered a diagnostic indicator of lymphoma [18] and sarcoma [19]. LDH indicators for nonseptic peritonitis in horses [20] and moderate and severe colic in elephants [21].

LDH reported a significant variation between animal species [3, 22, 23, 24, 25 26] and tissue distribution, age [27], sex [28], and body measurements [29]. Wide variation needs to establish and compare LDH activity as a biomarker in dairy goats in Indonesia. So, knowing the comparison of LDH enzyme activity in Saper, Saanen, and Ettawa goats from all physiological statuses is the goal of this study.

2. MATERIAL AND METHODS

Review and approval of the research protocol have been issued by the Ethics Committee Ethical Clearance for Preclinical Research, Integrated Research, and Laboratory Testing at Gadjah Mada University, Yogyakarta, Indonesia, with license number 00032/04/LPPT/VII/2021.

2.1. Animal

128 clinically healthy Sapera, Saanen, and Ettawa crossbred goats in different physiological statuses, i.e., male kids (=18), female kids (n=14), post-weaning (=25), dry does (=20), pregnant does (=9), lactating does (=10), and adult bucks (=32) selection by random. Here, we use all animals considered healthy, without physical disabilities, and have normal reproduction that comes from dry cages, and they are also adult males. Meanwhile, based on physical and clinical examination, animals are declared clinically healthy if their body condition score (BCS) is in the range of 4-5 on a scale of 1-5.

2.2. Blood samples and analysis

At 7 am blood samples will be taken through the jugular vein in each of the goats used in the study, it is 5 ml of blood. Then, the blood will be transferred to a sterile tube that does not contain anticoagulant (PT. Jayamas Medica Industri, Sidoarjo, Indonesia); the next step is for 15 minutes, it will be centrifuged 3000 RPM and then using the technical kit is provided by Roche Diagnostics, it will be analyzed. Precisely in Roche / Hitachi Cobas c analyzer Cobas c 502 (Japan) system.

3. RESULT AND DISCUSSION

Overall estimate LDH activity in three breed dairy goats in Indonesia (Table 1) was 371.03±413.47 U/L, higher than textbook 238-440 U/L by Kaneko [30], in the range 304.20±143.00 U/L in goats and 583.80±83.60 U/L in sheep both located Rahim Yar Khan, Pakistan [31] but lower than 838.20±0.03 U/L in dairy goats [32] and 1.509.06±901.40 U/L in Spanish Ibex from Andalusia [33]. There was no breed influence on LDH activities in Sapera, Saanen, and Ettawa crossbred goats were 802.90±0.34 U/l; 779.47±0.34 U/l, and 773.34±20.22 U/I, respectively. Physiological statuses showed (Table 1) those female and male kids higher than an adult buck, dry does, lactating does, and pregnant does ($P<0.05$) and not different with post-weaning ($P>0.05$). This same result and phenomenon in buffalo [27] and shorthorn cows [3], Saanen kids from birth until three months of age [34] that is with increasing age, a decrease in LDH will occur, this indicates that the distribution of isoenzymes changes towards adult pattern [2]. In Saanen goats breeding in Afyonkarahisar Province, Turkey, LDH is more elevated in adults than in the youngest group [1]. No age and sex influence LDH in goats in Rahim Yar Khan, Pakistan [31] and Spanish Ibex from Andalusia [33]. Unlike in Merinolandschaf ewes, this research reported that LDH is higher in lactating ewes than non-pregnant and pregnant [35]. LDH also mentions that this will be significantly higher in cows at the end of gestation until day 5th postpartum [2].

Table 1. LDH activity in three breed dairy goats in different physiological statuses

Source of variation	LDH (U/I)
Overall	371.03±413.47
Significantcy of Breed	0.0007
Sapera	802.90±0.34
Saanen	779.47±0.34
Ettawa Crossbred	773.34±20.22
Significantcy of Physiological statuses	<.0001
Male kids	930.72±0.31
Female kids	938.14±10.34
Post-weaning	781.48±30.37
Does	713.80±10.26
Pregnant	662.78±10.29
Lactation	704.90±10.23
Buck	745.78±10.44

This result showed that female kids of Saanen were higher than other physiological statuses in this breed ($P<0.05$). On the other hand, both Sapera and Ettawa crossbred goats showed no difference in all physiological statuses in both ($P>0.05$). This result indicated Saanen goats same tren in Saanen in Iran [34].

This result concluded that physiological statuses influence LDH activities in Indonesia's Sapera, Saanen and Ettawa crossbred goat.

AUTHORS' CONTRIBUTIONS

All author's contributions for this research, i.e., Sarmin designed the model research, Irkham Widiyono sampling and analysis, and Devita Anggraeni was prepared manuscript

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