Jurnal Veteriner
pISSN: 1411-8327; eISSN: 2477-5665
Terakreditasi Nasional, Dirjen Penguatan Riset dan Pengembangan,
Kemenristek Dikti RI S.K. No. 36a/E/KPT/2016

September 2018 Vol. 19 No. 3: 412-418
DOI: 10.19087/jveteriner.2018.19.412
online pada http://ojs.unud.ac.id/index.php/jvet

Anemia and Eosinophilia in Traditional Goat Farmers: Early Markers of *Strongyle* Zoonoses

(ANEMIA DAN EOSINOFILIA PADA PETERNAK KAMBING TRADISIONAL: PENANDA AWAL ZOONOSIS STRONGYLUS)

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ABSTRACT

The spread of zoonoses between humans and animals can increase with the presence of specific contacts between the two. As well as intensive contact between farmer and goat. Anemia is a common hematologic change encountered in infection and zoonoses so it can be used as an early indicator for zoonoses. Nevertheless, anemia itself cannot lead to a specific etiology thus differential leukocyte count and goat fecal examination can be a good supporting test. Understanding the etiologies of the disease is critically important in preventing the decline in human's quality of life as well as economic losses. This cross-sectional study included 30 farmers who were recruited by purposive sampling method. They agreed to do a CBC examination with 22 parameters. From the test, 37% of them showed mild anemia. There were 45% farmers with microcytic hypochromic anemia while the rest had normocytic normochromic anemia. There was an increased number in eosinophil and segmented neutrophil from anemic farmers, 18% and 9% respectively. Besides, 13% of goats physical examination indicated as below normal conditions characterized by lean bodies, lymph node swelling, and pale mucosa. Whereas 38% goat's fecal test showed evidence of *Strongyle* eggs. The research suggests a possible interrelation between animals, humans, and the environment with an increased risk of zoonoses. Anemia and eosinophilia that occur can be an early marker which will be decisive not only for the success of the disease progression reduction but also the long term suppression of the economic loss.

Keywords: CBC profile; dairy goat farmer; zoonoses; *Strongyle*

ABSTRAK

Penyebaran zoonosis di antara manusia dan hewan dapat meningkat dengan adanya kontak spesifik di antara keduanya. Begitu pula dengan adanya kontak yang intensifantara peternak kambing dan ternak peliharaannya. Anemia merupakan perubahan hematologi yang sering terjadi pada infeksi sehingga ia dihilangkan dapat dijadikan sebagai penanda awal terjadinya infeksi penyakit zoonotik zoonosis. Namun, anemia tidak dapat mengarahkan pada suatu etiologi yang spesifik sehingga menghitung jenis leukosit dan pemeriksaan feses kambing dapat menjadi tes pendukung yang baik. Memahami etiologi penyakit sangat penting dalam mencegah penurunan kualitas hidup dan kerugian ekonomi s. Studi potong lintang ini melibatkan 30 peternak yang dipiliht dengan metode *purposive sampling*. peternak menyetujui untuk melakukan pemeriksaan hematologi rutin dengan 22 parameter. berdasarkan hasil uji, 37% peternak menunjukkan anemia ringan. Terdapat 45% peternak dengan anemia mikrositik hipokromik sedangkan sisanya memiliki anemia normositik normokromik. Dari peternak anemis, terdapat peningkatan kadar eosinofil dan neutrofil sebesar 18% dan 9%,. Selain itu, Berdasarkan pemeriksaan fisik13% kambing mengindikasikan kondisi kesehatan di bawah normal yang dicirikan dengan tubuh yang kurus,

pembengkakan nodus limfatik, dan mukosa pucat. Sebanyak 38% kambing, berdasarkan hasil uji pada feses ditemukan adanya telur *Strongyle*. Penelitian ini menunjukkan kemungkinan ada interrelasi antara hewan, manusia, serta lingkungan dengan peningkatan risiko zoonosis.

Kata-kata kunci: profil hematologi; peternak kambing; zoonosis; *Strongyle*

INTRODUCTION

As a tropical country, Indonesia is one of the countries in Southeast Asia that has potential in spreading new infectious diseases. (Coker *et al.*, 2011) Through a direct or indirect contact, diseases originally from animals can infect humans, or vice versa, which then known as zoonoses. (World Health Organization, South-East Asia Region, 2011) In addition, zoonoses may also be transmitted to the host when pathogens develop in appropriate non-animal sites such as soil and pigeon dropping. Based on World Health Organization (WHO) data, six out of ten people with infectious diseases are those who get the infection from animals, and three out of every four emerging infectious diseases in humans are also obtained from animals. (WHO, 2011). The number indicates the high risk for zoonotic infection. This situation can lead to the loss of productive year and eventually to economic losses. Therefore, early detection of zoonotic diseases is an important step towards an outbreak prevention, provision of appropriate management, and human's quality of life as well as economic losses prevention.

Recognizing zoonoses can be done by learning the factors that contribute in it. Therefore, the study needs to be done on an area that has a high intensity of interaction between animals and humans, such as dairy goat farming in Cimalaka District, West Java. In addition to a strategic location, the farm located on the slopes of Mount Tampomas is classified as a critical land of sand mining. The farm is managed by 30 families who joined "Kelompok Peternak Kambing PE Simpay Tampomas." In their daily life, they still manage farms traditionally and pay less attention to a good farming practice. Nevertheless, they have enough interest to learn how to manage livestock in an integrated way. For them, dairy goat farming plays a major role in building the family economy through the sale of dairy products, goat manure, and goat itself. (Yunita *et al.*, 2017) Due to the high potential of income earned from healthy goats, this requires goat farmers to intensively take a good care of their goats. Widyastuti *et al.* (2017) revealed the highest prevalence of goat infection maintained by "Kelompok Peternak Kambing PE Simpay Tampomas" are skin disease and helminthic infection. If the farmers and infected goats interact intensively then zoonoses will be more likely to occur.

Human can be infected by various pathogens. Parasitic infection is one of the most common infections in humans and animals in developing countries. (Jaffry *et al.*, 2009; Samad, 2011) A study done by Singh *et al.* (2014) in several goat farms in India revealed gastrointestinal nematode *Strongyle* infections in the goats. Another study conducted by Beyecha, Kumsa and Beyene (2014) at goat farms in Ethiopia also showed a high prevalence of ectoparasite infestations in goats. Albeit zoonoses occur, animals and humans do not always show certain clinical symptoms. (Warwick and Corning, 2013) which causes the difficulty to identify the infected animals or humans. Therefore, to deal with this difficulty, it is necessary to examine humans and animals as well as the environmental condition.

Naturally, immune responses occur in the human body after the entry of a foreign body, as in infection. The response can be detected through various media, including hematology profile as one of the simplest method to detect an early changes in the body. Besides evaluating human condition, an examination of animal's health status and fecal egg count needs to be done as well as the environmental condition. Based on the description, This study aimed to describe the hematology profile of goat farmers also their knowledge about zoonotic disease related to helminthic infection found in their livestocks' feses. Thus can prevent the onset of various diseases in the goat farmers and decreased productivity.

RESEARCH METHODS

The research method was cross-sectional study. The study draws on primary data from traditional goat farmers in Cimalaka District, Sumedang Regency where this study was integrated with society service held by Faculty of Medicine, Universitas Padjadjaran. A

purposive sampling was conducted to include 30 farmers from existing community group called "Kelompok Peternak Kambing Simpay Tampomas, Sumedang" as subjects for this study.

Prior to data collection, a request for ethical clearance to the Health Ethics Research Committee of Faculty of Medicine, Universitas Padjadjaran has been submitted. The ethical agreement was issued on October 9th, 2017 with No. 957/UN6.C.10/PN/2017. As for the participant, they were received an information form that explains the procedure of the blood drawing and consent form. They were informed that all data will remain confidential including their identity that is accessible only to the researchers.

The data was obtained in one day by means of questionnaire interview, Complete Blood Count (CBC) measurement including hemoglobin (Hb) and differential leukocyte count, as well as goat's fecal test resulting the amount of egg/gram feces data. Questionnaires were asked to find out the breeding behavior and farmers' knowledge related to zoonoses. On CBC examination, a minimum sample of 5 cc blood from each farmer was needed. The samples were divided into two microtainer, EDTA tube and plain tube. Each tube was filled with 2.5 cc blood. Then, the blood samples were processed in the laboratory of Clinical Pathology Department in Hasan Sadikin General Hospital, Bandung. Parasitological examination in goat's feces was done by quantitative fecal egg count method following the standard procedures in "Balai Pelayanan Veteriner Cikole, Lembang."

The hematological data result was analyzed and classified based on WHO's anemic severity: mild, moderate, and severe. (World Health Organization, 2011) Whereas anemic types were characterized by measuring mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC). A meticulous process of data analysis was done using Microsoft Excel 2016.

RESULTS AND DISCUSSION

Farmers who are members of 'Kelompok Tani Peternak Simpay Tampomas' are consisted of 21 women and 9 men. Most of them are in the age range of 60-69 years old. Most farmers, 18 of them (60%), lived in a house which is more than 10 meters from their livestock enclosure. A total of four farmer's houses (13%) were 5.1-10.0 meters from the livestock enclosure, three others (10%) were 0-5 meters away, while the other five farmers (17%) gave no information. Based on Pritchard's assertion (2011), the distance between farmer's house with goats' stall environment may also increase the risk of zoonotic transmission. The closer the distance, the higher the risk.

For a farmer, caring for and maintaining the health of his livestock is a must because these will certainly affect their income. Faced with this situation, farmers will eventually have an intense interaction with their livestock which will have a significant impact in zoonotic transmission. (Klous *et al.*, 2016) To explore the interaction pattern, an interview was conducted and the results were presented in Figure 1. Of the seven indicators presented, the management as one of the critical success factors of husbandry is still considered not implemented properly. This can be seen from the awareness of cleanliness of the stall and poor milking activities. These aspects can have an impact on the decline of husbandry success and increased risk of zoonoses. It is possible that this poor management is due to the lack of knowledge and skills of farmers and related to their educational status. Based on the interview results, most farmers' educational level are relatively low. Between the goat farmers, 1% of them did not enter a formal school, 67% have only an elementary education, 20% completed junior high school, and another 10% completed senior high school. Higher cognitive ability will contribute significantly to an enhanced ability to comprehend and process complex information and indirectly affect farming behaviors. The conditions occuring in Kelompok Tani "Simpay Tampomas" farmers could be a possible barrier and cause some considerable difficulties. These contribute to the lack of knowledge of farmers related to how to raise a good and healthy goat.

From the interview, generally, the knowledge of farmers in dealing with common diseases in goats is quite good. However, their knowledge about zoonotic diseases are still poor (Figure 2). This result along with the pattern of interaction farmer – goat can certainly rise the risk of zoonotic incidence. When zoonoses occur, animals or humans do not always show certain clinical symptoms. (Warwick and Corning, 2013) Therefore, to anticipate the occurrence of zoonoses it is necessary to know early markers which are easy to be done, one of them through

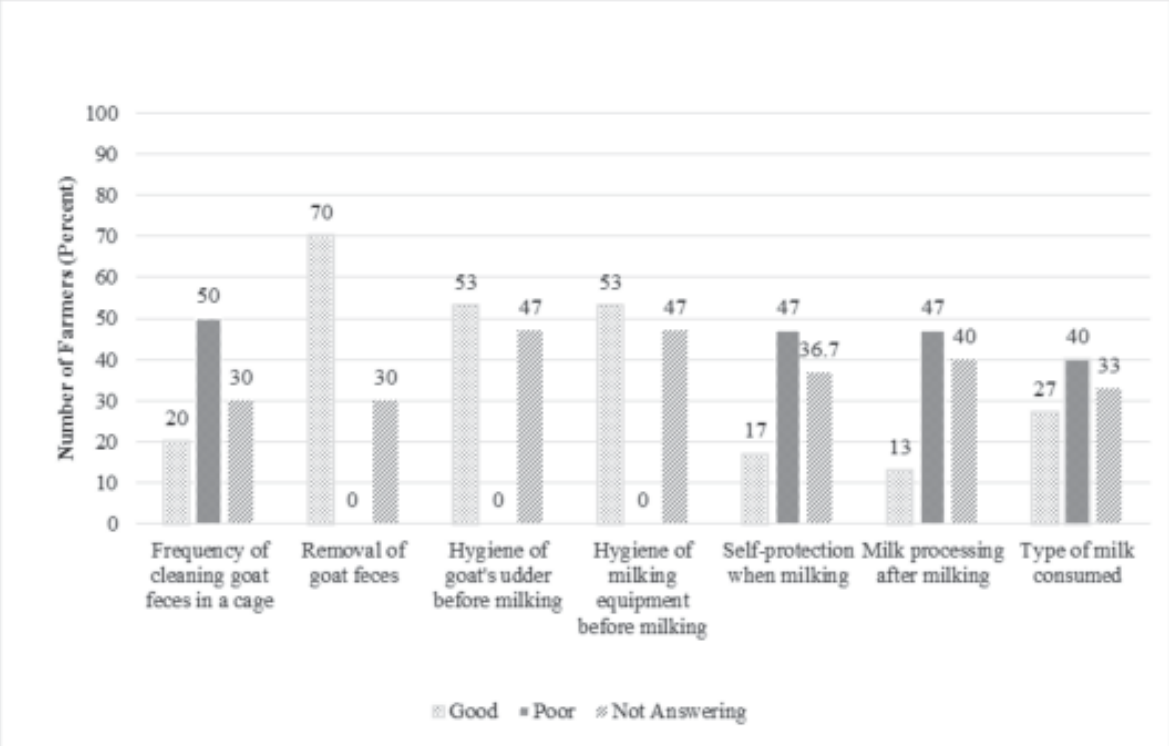

Figure 1. Patterns of care and daily contact between farmers and goats (N= 30)

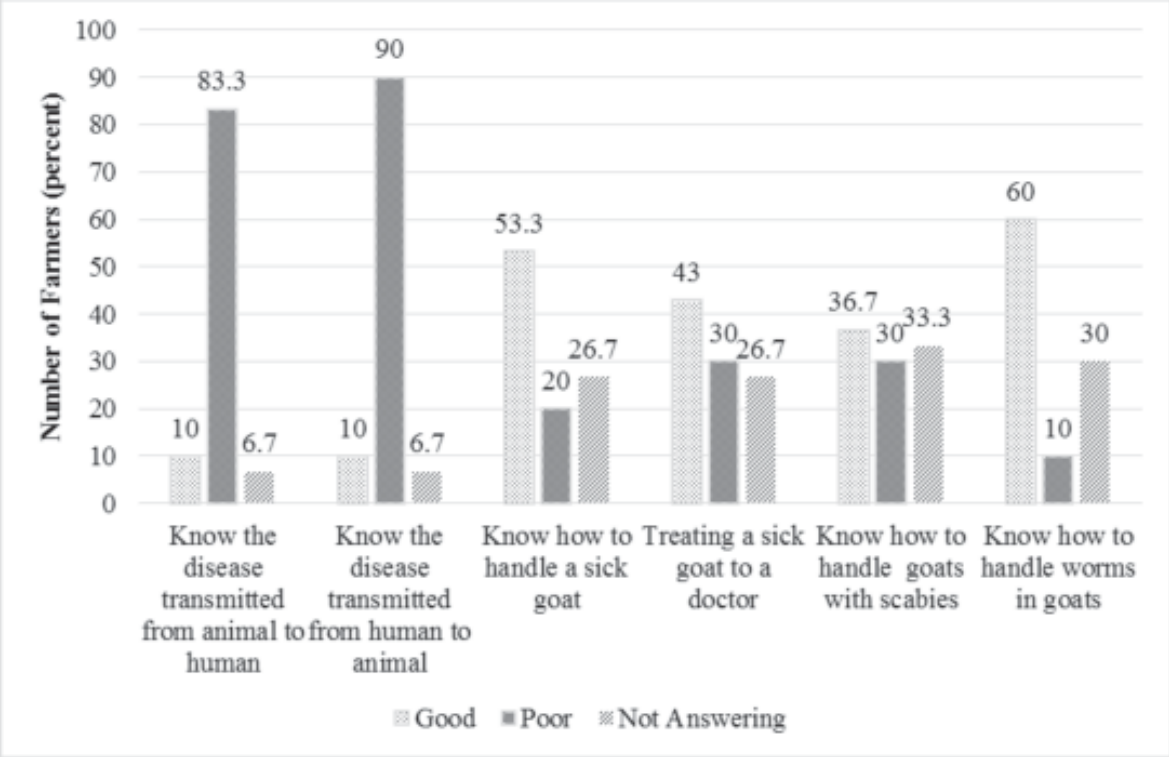

Figure 2. Assessment of zoonotic disease knowledge (N= 30)

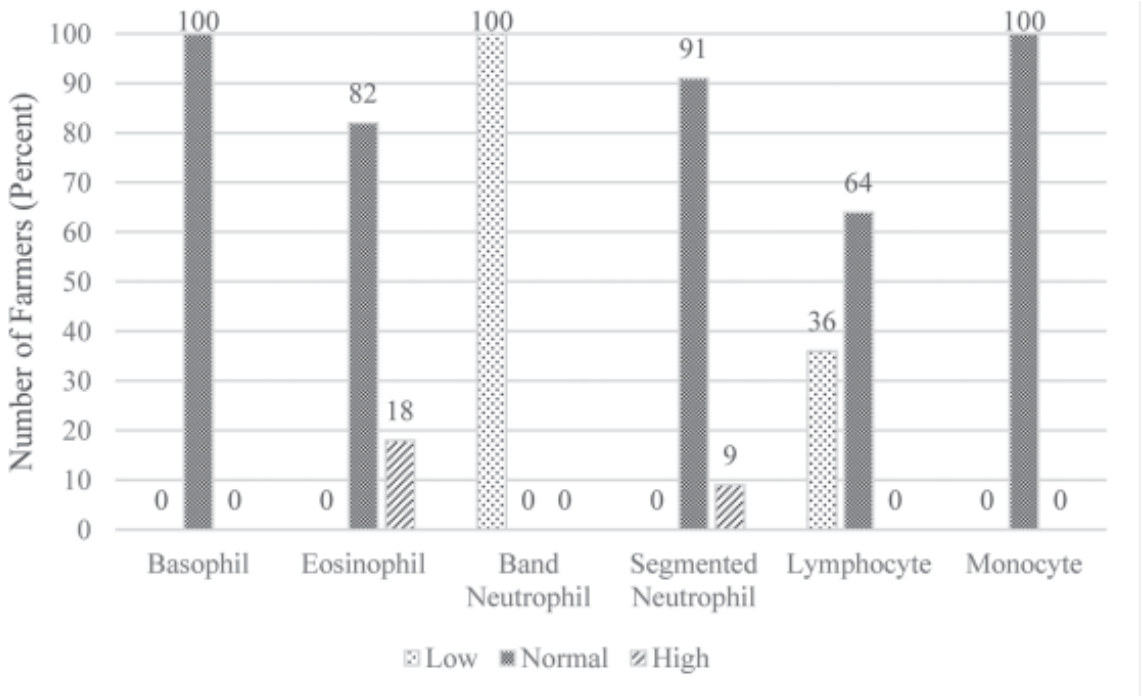

Figure 3. Distribution of differential leukocyte count result of the anemic farmers (N= 11)

CBC examination of the farmer that could show an acute inflammatory response.

Zoonotic disease is quite diverse. Some diseases in goats can be transmitted to a farmer either through direct or indirect contact. In a study conducted by Widyastuti *et al.* (2017), bloating and skin diseases cases have the highest prevalence in goats raised by the Kelompok Tani Peternak Simpay Tampomas followed by intestinal worms, mastitis, respiratory diseases, eye diseases, and seizures, respectively.

Some human worm infections may be the etiologies of blood loss or anemia, such as infection caused by hookworm (Hyun *et al.*, 2010), *Schistosoma haematobium* (Bustinduy *et al.*, 2013), *Trichuris trichiura* (Bayoumy *et al.*, 2017), and *Strongyle* (Cringoli *et al.*, 2008). In this study, the goat's fecal test showed the presence of *Strongyle* in 38% of the sample. *Strongyle* is a common gastrointestinal nematode (GIN). (Mohammed *et al.*, 2016) *Strongyle* eggs will hatch into rhabditiform larvae. In humid and optimum temperature, the larvae will be infective filariform larvae. (Bundy *et al.*, 2012) Infection by *Strongyle* can occur in humans when they accidentally consuming plant material and water contaminated with this larvae.. Higher prevalence of *Strongyle* infection in humans occurs in populations with poor sanitation, rural areas, or farmers or herders. Generally, someone infected with *Strongyle* does not show any specific clinical symptoms, except when a heavy worm burden infection happens, he/she may experience epigastric pain, diarrhea, mild anemia, and eosinophilia. (Bundy *et al.*, 2012)

Anemia is common in inflammatory conditions as well as in zoonotic diseases. It may appear as a consequence of previous blood loss. It is also associated with an infection process that usually accompanied by an inflammatory response. In this study, there were 37% of farmers' blood samples depicting anemia (men's Hb normal value: 13 or higher; women's Hb normal value: 12 or higher). (WHO, 2011) They consisted of five men and six women. Regardless of comorbid factors, the severity of anemia could be assessed by measuring Hb thus can be classified according to WHO classification. The average Hb for male farmers was 11.3 g/dL which showed mild anemia, while the average for female farmers' Hb was 11.6 g/dL and classified as mild anemia based on WHO classification. Based on erythrocyte morphology, 45% of anemic farmers had microcytic anemia (MCV <80 fL), which is commonly caused by iron deficiency, thalassemia, anemia of chronic anemia, and sideroblastic anemia. While the rest experienced normocytic anemia (MCV 80-100 fL), the causes are more diverse, for example due to hemolysis and chronic disease. (Janus and Moerschel, 2010)

Anemia of inflammation is anemia caused by chronic inflammatory processes, usually accompanied by elevated levels of inflammatory cytokines. AI occurs due to a slight decrease in erythrocyte survival combined with erythropoiesis disturbance. Both of these can be triggered by inflammatory cytokines. (Ginder, 2012; Nemeth and Ganz, 2014). In inflammation, pro-inflammatory stimuli cause excessive erythrophagocytosis by macrophages and increase iron uptake by the reticuloendothelial cells.(Ginder, 2012; Nemeth and Ganz, 2014). In addition, there is an increase in hepcidin, which leads to increased endocytosis and ferroportin proteolysis. This causes iron accumulates in its cytoplasmic ferritin (Ganz and Nemeth, 2009). Normal or increased serum ferritin concentration due to that process becomes AI's characteristic which differentiates it from iron deficiency anemia. But since this study did not have complete iron data, so further study is imperative to analyze the association of iron concentration with anemia of inflammation. Erythrocyte morphology in AI usually gives a normocytic normochromic description, as in 55% of the sample results in this study. But in another study, (Ginder, 2012) about 20% to 50% of cases exhibit slightly microcytic appearance. This could happen in certain conditions as in prolonged AI.

Someone infected by a worm parasite is generally eosinophilic. Eosinophilia is a condition when the eosinophil is more than 6%. This result was obtained from differential count examination along with 5 other parameters: band neutrophils, segmented neutrophils, lymphocytes, monocytes, and basophils. As shown in Figure 3, the increased number only occurred in eosinophil and segmented neutrophil, 18% and 9% respectively. Eosinophilia is commonly associated with atopic disease, persistent chronic infections including parasitic, and hematologic malignancies. (Valent, 2009)

For goats' health status, examination of 11 aspects consisting vital signs, nutritional status of livestock, appetite, and a general checkup, was done. The result showed a decrease of health status in 13% goats. To add further complexity, zoonoses transmission is intertwined with environmental condition. It appeared that 10 out of 15 stalls were dirty. This could be a conducive environment for certain pathogens to survive thus increasing the likelihood of zoonoses. Zoonoses can have either direct or indirect impact on the health of livestock and livestock production. (Samad, 2011) Direct impacts can be related to disease symptoms and livestock products reduction, whereas indirect impacts can lead to a reduction in farmers' quality of life and economic losses.

CONCLUSION

The result of animal fecal examination and human blood test in this study may show an increased risk of zoonotic disease. Most farmers exhibit normocytic anemia as well as eosinophilia that usually occurs in parasitic infections. This is thought to be related to the discovery of 13% of goats with poor health status and 38% positive finding of *Strongyle* eggs in goats' feces.

SUGGESTION

For further research, the use of CBC and differential leukocyte counts can be more accurate when human fecal examination and absolute number of eosinophil are performed as well.

ACKNOWLEDGEMENT

The authors would like to express our sincere gratitude to Universitas Padjadjaran for the support also Rector of Universitas Padjadjaran, Research Director, PKM and Innovation of Universitas Padjadjaran, Dean of Faculty of Medicine, Universitas Padjadjaran. The authors state that there is no conflict of interest with the parties concerned in this study.

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