The differential account of white blood cell as an image of immune system from flying fox (*Pteropus spp*) as a reservoir host

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Abstract. Flying fox (*Pteropus spp*) has been reported as a host reservoir of several microorganisms. Reservoir host is a species that serves primarily as a maintenance host for a pathogen related to the immune system. The purpose of this research is to describe the white blood cells differential account of Flying-foxes as a picture of the immune system and bioindicator of environmental changes. The Bloods are collected from The two adult Flying fox bats in December 2018. They were bought from a hunter in Wera Village, Bima district, Sumbawa Island. The Blood samples were collected from the axillaries vein of the bat for blood smears. The blood smears were Giemsa stained then examined for The white blood cells differential counts. The differential white blood cell (WBC) counts (%) of blood smear of Flying foxes are Eosinophils (2.25±1.71%), Neutrophils (14.00±2.45%), Basophils (13.75±4.11%), Monocytes (29.75±4.99%), and a Lymphocytes (40.25±9.03%). The highest percentage of Lymphocytes describe of the effectors of adaptive immunity and the highest percentage of Monocytes describe of the effectors of innate immunity. The lymphocytes and monocytes have an important role in the immune system and can be bio-indicator of environmental changes.

1. Introduction

Bats (*Pteropus spp*) has been declared to be a reservoir host of several microorganisms. Reservoir host is a species that acts as a host of hosts and pathogens with minimal morbidity or mortality or does not show clinical symptoms due to infection with microorganisms. Reservoir animals can be interpreted that these animals are custodians of pathogens with low levels of morbidity and mortality that are not even sick due to pathogenic infections [1]. This is certainly very related to the immune system of bats, especially the differential white blood cells that play a role in innate immunity (which will affect adaptive immunity.

Some types of bats have been reported to be a reservoir of the virus. Bats of the genus *Pteropus* which are fruit eaters have been reported to carry the Nipah and Hendra virus in Australia [2]. The report of some researchers also states that some types of bats can be a reservoir of bacteria that can infect humans such as Escherichia coli and Proteus spp. Mühl Dorfer [3] reported that Escherichia coli has been found from several types of bats, both fruit and insect bat. *Proteus spp.* has also been identified from the genus Bats from hunters on Sumbawa Island [4]. Kholik et al [5] documented that *Eonycteris spelaea* has been documented as a Bartonella-like reservoir in the presence of an *intraerythrocytic corpuscles*. The fact that bats can be a reservoir of several microorganisms is certainly not separated with white blood cells as part of the bat's immune system. White blood cells or leukocytes consisting of neutrophils, basophils, eosinophils, lymphocytes, and monocytes play an important role in bat resistance in...
neutralizing infections from microorganisms. Neutrophils and Monocytes are stated to play a very important role in the innate immune system, whereas lymphocytes play a role in adaptive immunity and recognition of parasites and pathogens [6]. Lymphocytes play an important role in the immune system because they are closely related to antibody production, Natural Killer cells and T cell mediation in neutralizing infections [7], while Monocytes are closely related to macrophages and interferon production in immune cell communication. Fensterl and Sen [8] stated that monocytes produce Interferon-alpha (IFN-α) in the activation of immunocompetent cells.

Data on white blood cells differential account consisting of neutrophils, basophils, eosinophils, lymphocytes, and monocytes is expected to be a prediction of the immune system portrait of bat (Pteropus spp) so that it can explain the bat as a reservoir host of microorganisms and also bioindicator of environmental change.

2. Material and Method

This type of research is a laboratory exploration of differential leukocytes from the blood of two bats (Pteropus spp) collected in December 2018 and purchased from Hunters in Wera Village, Bima Regency, Sumbawa Island. Blood samples are collected from the axillary veins of bats and put into tubes with Ethylene diamine tetraacetic acid (EDTA) for the production of blood smears. Blood smears were stained with Giemsa staining. Thin blood smears are made on glass objects and dried and then fused with 96% ethyl alcohol for 2 minutes and stained with Giemsa for 8 minutes. After staining the slide blood will be washed with flowing distilled water and dried at room temperature. Blood smear slides are then examined under a microscope with magnification (1000X) to see the presentation of leukocyte differentiation (white blood cells). Calculation of the differential percentage of white blood cells using 2 slides per blood sample. The percentage of leukocytes is calculated based on leukocyte counts up to one hundred under a microscope with a magnification of 1000x [4].

3. Results and Discussion

The results of calculating the differential percentage of white blood cells from a blood smear on two bats (Pteropus spp) with the Giemsa staining method are as follows: eosinophils = 2.25 ± 1.71%, neutrophils = 14.00 ± 2.45%, basophils = 13.75 ± 4.11%, monocytes = 29.75 ± 4.99%, and lymphocytes = 40.25 ± 9.03%. The percentage of Monocytes and Lymphocytes of Pteropus spp more higher than mammals like humans, there is a difference. Human white blood cells contain lymphocytes 20 to 45%, Basophils 1 to 2%, Eosinophils above 5%, Monocytes 5% of total Leukocytes [9], while neutrophil levels are between 50 and 70% of total Leukocytes [10].

The results of calculating the differential percentage of white blood cells of the bat showed that lymphocytes and monocytes in normal blood of Pteropus spp have high levels when compared with mammals, for example, humans. The high lymphocytes percentage value of Pteropus spp indicated that Pteropus spp can produce antibodies quickly and they can induce the formation of a natural killer when microorganism infections occur, so the microorganism will be immediately neutralized. Larosa and Orange [7] reported that lymphocytes play a very important role in the immune system because they are closely related with the production of antibodies, Natural Killer cells and T cell mediation in neutralizing infections. Lymphocytes will differentiate into lymphocyte plasma cells which will produce specific antibodies that will neutralize microorganisms. This happens because lymphocytes are unique cells in adaptive immunity because they have clonal antigen receptors that are specific to microorganisms [11].

High monocyte results in Pteropus spp blood indicated that phagocytosis of microorganism that infects bats will happen quickly. Abbas et al [11] explained when organism infected with microorganisms, Monocytes will be activated and differentiate into macrophages in tissues such as microglia in the central nerve, buffer cells in the liver, osteoclasts in bones and macrophages in the alveoli of the lungs. This states that the presence of microorganisms that enter will experience
phagocytosis quickly. In addition Monocytes can also be antigen-presenting cells (APC) which will present antigens on immunocompetent cells to be neutralized. Monocytes are stated that will produce Interferon-alpha (IFN-α) in the activation of immunocompetent cells when microorganism infections occur [8].

Neutrophil levels of *Pteropus spp* are lower than human Neutrophil levels indicated that there is a lack of inflammation when the bat is in a normal state. Neutrophils are stated to play a very important role during the initial occurrence of microorganism infections and the occurrence of inflammation associated with natural immunity [11]. Neutrophil levels will be high when an organism under stress and the presence of cancer. Basophil levels of *Pteropus spp* are high when compared with Basophils levels in humans physiologically, there are showed that bats are very sensitive to environmental changes that will cause allergies. Basophil levels in the case of allergic reactions and changes in the environment or parasites. Changes of Neutrophils, Eosinophils, and Basophils can be used as bioindicators of stress and allergies due to environmental changes.

4. Conclusion

A high percentage value of monocytes and lymphocytes in bats gives predictions about the immune picture that can be resistant to microorganism infections so that it can become a reservoir animal. The value of Neutrophils, Eosinophils and Basophils can be used as a bioindicator of environmental change through analysis on Neutrophils, Eosinophils, and Basophils.

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