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Enhancing Synergistic Roles of Stakeholders for Development of Sustainable Livestock Production

Batu, Indonesia, October 19-21, 2016

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Leukocytes Profiles of Friesian Holstein Bulls Supplemented by Zinc

Sus Derthi Widhyari[1], Anita Esfandiari[1], Ietje Wientarsih[1], Gerard Yaga[2]

[1] *Faculty of Veterinary Medicine, Bogor Agricultural University,Bogor, Indonesia*
[2] *SKH, Student at Faculty of Veterinary Medicine, Bogor Agricultural University, Bogor, Indonesia*
Corresponding author: derthi64@gmail.com

Abstract

Zinc is a micro mineral that plays an important role in the immune system. Zinc deficiency increases susceptibility to diseases. The objective of this experiment was to study the effect of zinc supplementation in Friesian Holstein (FH) bulls on total and differential leukocytes. Ten healthy Holstein bulls, 16-18 months old, were divided into two groups, consisting of five bulls, i.e. with no added Zn (control) and 60 ppm of Zn supplementation, respectively. Zinc was administered daily for four months. Blood samples were taken from the jugular veins *and* anticoagulated with disodium ethylene diaminetetraacetic acid (Na2EDTA) to determine the total leukocyte values and differential leukocyte. Results of this experiment showed that supplementation of Zn 60 ppm tended to increase the total leucocytes and lymphocytes, and decrease the monocytes, eosinophils and neutrophils counts. However, the values were in the normal range. Zinc supplementation of 60 ppm in bulls for four months showed no effect on total leukocyte and leukocytes differentiation.

***Keywords**: Zinc, total leucocytes, differential leukocytes, Friesian Holstein bull*

Introduction

The use of bulls as a source of protein is not optimal. Therefore the use as a source of animal protein production can be increased. Management improvement especially on the quality and quantity of the feed will affect the health, production and reproduction of livestock. Zn deficiency will affect various physiological functions of the body, such as metabolism, hormonal synthesis and action of various enzymes. Severe Zn deficiency is characterized by decreasing immune cell function and increasing the incidence of infection. Zn mineral is an inorganic element that cannot be converted from other nutrients, therefore this mineral must absolutely be present in the feed, although the amount needed is relatively small. Zn need in dairy cows is between 40-60 ppm (Scaletti et al. 2004). Zn is needed in bulls for the improvement of reproductive status and of the quality of sperm. Information on the effects of zinc supplementation on the health status of the bulls by examining the total and differential leukocytes is very

limited. Therefore a research on the effects of Zn supplementation on the health status of the bulls should be done.

Methodology

This research was carried out at a dairy farm in Ciawi Bogor, and at Clinical Pathology Laboratory of Clinical, Reproduction and Pathology Department, Faculty of Veterinary Medicine, Bogor Agriculture Institute. Ten healthy Holstein bulls, 16-18 months, were divided into two groups (control, and group 1). The dietary, environmental, and husbandry factors were similar in both groups. Zinc (60 ppm) was added to concentrate of group 1, but no zinc sulfate was added to the diet of the control group. Blood samples were collected from the jugular veins before Zn supplementation (Pre Zn) and four months after the supplementation (Post Zn). Blood (10 mL) was collected with disposable syringes containing disodium ethylenediaminetetraacetic acid (Na2EDTA), from jugular veins. Blood was analyzed for the total and differential leukocyte counts. Total leukocyte values were determined by a hemacytometer, and differential leukocyte count was made from stained blood smears by May Grundwald-Giemsa.

Results and Discussion

The total of leukocytes circulating in the peripheral blood is strictly regulated within certain limits, and it changes if there is an inflammatory process. Leukocytes, which are partially formed in the bone marrow and partly in lymphoid tissue, are an active unit of a body's defense system. The total of leukocytes in cows ranged between 4000-12000 cells/μL. Lymphocytes, neutrophils, monocytes, eosinophils, and basophiles in the blood normal range are between 45-75%, 15-45%, 2-7%, 0-20%, and 0-2% respectively. The values of leukocytes in bulls with or without Zn supplementation can be seen in Table 1.

Supplementation of Zn (60 ppm) tended to increase the total leucocytes and lymphocytes, and decrease the monocytes, eosinophils and neutrophils counts. This study showed that total leukocytes increased slightly at the end of the observation but the value was still in the normal range. The results of this study indicate Zn supplementation did not affect the total of leukocytes. Widhyari (2005) reported that the role of Zn is not to increase production of leukocytes or leucopoiesis, but the role of Zn is on the improvement of leukocyte cell function. Leukocytes, also known as white blood cells, are produced in the bone marrow, are an essential part of the body's immune system to fight off invading cells and bacteria, keeping our bodies healthy and infection-free. They move throughout our bloodstream, attacking any foreign bacteria, fungi, or viruses. During an infection, an increasing number of leukocytes can be found in certain areas of the body.

Table 1. Total and percentage of leukocytes in bulls for four months

Parameters	Leukocytes count (%)	
	Pre (0 month)	Post (4 month)
Control (No add Zn)		
Leukocytes ($x10^3/\mu L$)	7.07±1.80	7.41±2.81
Neutrophils (%)	34 ± 1.4	22±2.9
Eosinophils (%)	6±3.8	5±3.5
Monocytes (%)	7±1.3	4±2.2
Lymphocytes (%)	53±5.5	69±5.0
Basophiles (%)	0±0	0±0
Supplemented Zn 60 ppm		
Leukocytes ($x10^3/\mu L$)	6.86±1.34	7.76±1.47
Neutrophils (%)	34±3.91	22±6.6
Eosinophils (%)	9±1,1	2±1.3
Monocytes (%)	5±0.5	3±2.1
Lymphocytes (%)	52±5.3	73±5.6
Basophiles (%)	0±0	0±0

This condition indicated that giving of Zn supplemented too long period of time (4 months) did not give a better effect. In contrast to previous results showing the number of lymphocytes markedly increased in two months after 60 ppm Zn supplementation on calf growth period (Widhyari et al., 2014). This experiment showed that lymphocytes for the Zn 60 ppm group were higher than in the Zn0 group (Table 1). Zinc supplementation increased cytokine production by lymphocyte T helper, so that lymphocytes proliferated and differentiated. Zinc can increase the production of interleukin-1 by monocytes. Interleukin-1 serves to increase the production of interleukin-2, which acts as a stimulant in the proliferation of B lymphocytes and T lymphocytes. According to that Guo and Wang (2013), patients with hemodialysis who received zinc supplementation showed lymphocyte cell counts were significantly higher than patients without zinc supplementation. Zinc is an essential cofactor for thymulin, a hormone produced by the thymus. Thymulin serves to regulate the differentiation of T lymphocytes of young and adult T lymphocyte function and modulate the release of cytokines by peripheral blood mononuclear cells (Helge and Rink 2003). Winarsi (2004) reported that giving Zn for premenopausal women improved the amount of lymphocyte cells to produce catalase enzyme and dismutase superoxide enzyme (SOD). Increasing the activity of these enzymes would increase the ability of cells for proliferation and differentiation (Rink and Kirchner, 2000).

The neutrophils decreased in both groups, indicating that Zn supplementation did not affect to the neutrophils. The emergence of stress will be accompanied by changes in blood cell picture dominated by neutrophil cell and low lymphocyte cells. The administration of corticosteroid preparations would

cause lymphopenia and increased number of neutrophils in the circulation. Pinna *et al.*, (2002) state that Zn supplementation does not affect the counts of neutrophils, monocytes and lymphocytes in the circulation, but it effects the superoxide production by neutrophils cells and the secretion of interferon by monocytes. Giving Zn in vitro at concentrations of Zn 500 mol/L can generate chemotactic activation of neutrophil granulocytes cells (Helge and Rink 2003).

Conclusion

Results of this experiment showed that supplementation of Zn 60 ppm tended to increase the total leucocytes and lymphocytes, and decrease the monocytes, eosinophil and neutrophils counts. However, the values are still within the normal ranges. Zinc supplementation of 60 ppm had no effect on the total and differential leukocytes.

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