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Hemorrhagic septicemia vaccination induced changed immunoglobulin G in Bali Cattle

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Abstract
Hemorrhagic septicemia is a fatal bacterial disease in cattle with high morbidity and mortality and causes economic losses. This study aims to measure the Immunoglobulin G titer in Bali cattle after Hemorrhagic septicemia vaccination. A total of 35 calves were divided into two groups. The treatment group was vaccinated with the Hemorrhagic septicemia vaccine, and the control group consist of non-vaccinated animals. The experiment animal was observed for 21 days. Blood samples were taken before and after 21 days of vaccination. The serum obtained was tested serologically using IgG ELISA Kit. The results of observation after vaccination all cattle still live without any clinical symptoms. The study showed vaccination of cattle by HS vaccine produced a significant rise of IgG titers in the serum of Bali cattle.

Keywords: Bali cattle, hemorrhagic septicemia, IgG, vaccination

1. Introduction
Hemorrhagic septicemia is an infectious disease caused by bacteria that primarily affects cattle and buffalo, and occurs as an epizootic outbreak in Asian and African countries. This disease causes high mortality and morbidity in livestock (Docksteader, 2022) [1]. Hemorrhagic septicemia is characterized by an acute disease (Kutzer *et al*., 2021) [2]. The disease is caused by Pasteurella multocida. Pasteurella multocida bacteria are gram-negative, non-motile and sensitive to penicillin (Karunasree, 2016) [3]. This bacterium is a normal flora in the upper respiratory tract of some animal species (Abdullah *et al*., 2013) [4]. The ability of these bacteria to enter and develop in the host is affected by the presence of capsules. Capsules or bacterial cell membranes are polysaccharide structures (Lipopolysaccharida / LPS) which is one of the most important factors in the malignancy of these bacteria. LPS is a surface antigen that is responsible for the pathogenesis of the disease (Furian *et al*., 2014) [5]. Pasteurella multocida B:2 and E:2 are serotypes that are lethal in cattle and buffalo (Shome *et al*., 2019) [6] that are major causes of economic losses in Asian and African countries (Almoheer *et al*., 2022) [7].
Haemorrhagic septicaemia is one of the most important bacterial diseases and is classified as one of the Strategic infectious Animal Diseases in Indonesia eradicated and controlled under the responsibility of the Central Government together with the local government). In Indonesia, in most Hemorrhagic septicemia endemic districts, outbreaks do occur throughout the year (Agung *et al*., 2020) [8]. This disease can be transmitted through direct contact with the mouth or nose secretions of infected animals either from carrier animals or animals that do not show clinical symptoms. Transmission can also occur due to animals ingesting or inhaling organisms in contaminated food or water.
Prevention and control of the disease can be achieved by correct reporting, accurate and rapid diagnosis, and strategic use of vaccines (Dartini and Narcana, 2015) [9]. Vaccination has been shown to greatly reduce the incidence of HS in endemic areas. The best measure to control the disease is through vaccination programs (Almoheer *et al*., 2022) [7]
Immunoglobulin G (IgG) level is sometimes used as an indicator to judge vaccine success, although this may not always be the best measure. Until now it is known that Immunoglobulin G is the most abundant antibody produced in the body to respond to vaccines in general. To assess the efficacy of vaccination again Hemorrhagic septicemia, we evaluated the

Immunoglobulin G (IgG) expression in Balinese cattle vaccinated with Hemorrhagic septicemia vaccine.

2. Materials and Methods

A total of 35 clinically healthy Bali cattle were used in this study. The animal is around one year old. The cattle used were humanely handled, and this research was approved by The Animal Ethics Committee, Faculty of Veterinary Medicine, Udayana University.

2.1 Sample Collection

All samples were vaccinated by intramuscular (IM) with SE vaccine (Pusvetma, Surabaya) and observed for 21 days. Blood samples were collected before vaccination and 21 days after vaccination. Blood samples are taken from the Jugolaris vein into plain Vacutainers (Becton Dickinson, Meylan, France).

2.2 Detection of Immunoglobulin G

Samples were analyzed immediately after collection by IgG ELISA KIT according to the manufacturer's protocol. Analysis IgG was carried out in the Balai Besar Veterinar, Denpasar.

2.3 Statistical analysis

The effects of vaccination on expression IgG were analyzed using Student T-test (Heath, 2000) [10]. Data analyses were carried out using SPSS for Windows version 25.

3. Results and Discussion

The results of observation after vaccination all cattle still live without any clinical symptoms. The IgG titer on 35 Bali cattle measured by ELISA technique showed that the titer of IgG before vaccination, the lowest was 0.246 µg / ml and the highest was 0.598 µg / ml with an average of 0.485±0.085 µg / ml and in 21 days after vaccination, the lowest was 0.553 µg / ml and the highest is 0.972 µg / ml with an average of 0.842±0.095 µg / ml as seen in Figure1.

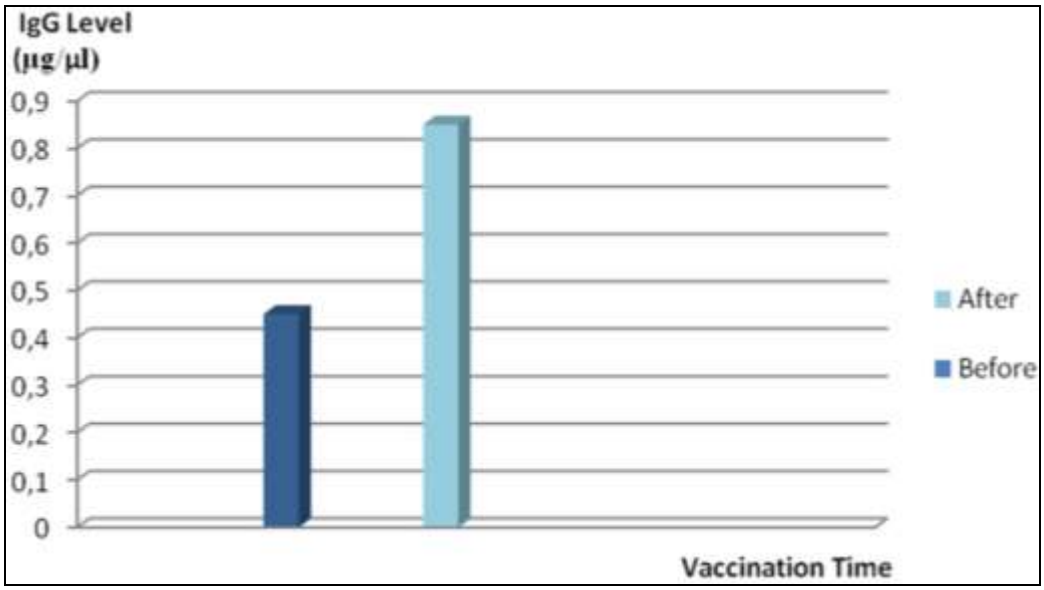

Fig 1: IgG level before and after vaccination.

This result indicates that vaccination can stimulate antibody formation against the SE vaccine. After being tested by Student T- test, it was found that titers of IgG in Bali cattle showed that vaccinated with HS were affect significantly IgG titers (p<0.01).

The immune system can recognize the difference between the part of the body's systems and its foreign bodies entering the body. In general, immunity systems can be divided into humoral immunity and cellular immunity (Herliani *et al*., 2020) [11]. The humoral immunity system consists of antibodies and fluid that are secreted from body organs. HS vaccine antigens that are foreign to the body are first responded to by APC cells such as macrophages, dendritic cells, and B cells. B cells that express BCR can bind antigens such as LPS (lipopolysaccharide) from bacterial walls. Once inside the cell, the antigen is broken down into smaller peptides and this peptide enters through a peptide bond gap from MHC II and allows MHC II to present the surface of the APC (antigen-presenting cell) cell membrane. By APC cells, the peptide antigen is presented to CD4 + T cells. The interaction between APC cells and T cells is mediated by MHC II molecules in APC and TCR and CD4 molecules in Th cells. In addition, involved various co-stimulators between APC cells and Th cells that can strengthen or suppress the Th cell response to antigens. APC cells can produce IL-1 which triggers B cell proliferation, whereas Th cells produce various cytokines that play a role in the proliferation and differentiation of naive B cells into plasma cells or memory cells (Hong *et al*., 2018) [12]. In the production of antibodies, the most important cytokines are IL2, IL4, IL6, and INFγ produced by Th cells and function to trigger the differentiation of naive B cells into plasma cells to produce antibodies.

The animals immunized with HS vaccine had a high level of IgG antibodies as compared to the control group consisting of non-vaccinated animals. According to Cantona *et al*. (2020), [13] the average value of cattle antibody titer after the HS vaccination was able to trigger a protective antibody response. This result was supported by the result of Gowrakkal *et al*. (2014), [14] the vaccine can stimulate high antibody titer in the vaccinated animal. There has been an increase in serum IgG concentrations after vaccination, in contrast to the observation of Hodgson *et al*. 2005, [15] who reported that an increase in IgG titers occurred gradually in serum throughout 6 to 10 weeks after vaccination. The reasons for this in the present study may have been that the vaccine was used rapidly to have stimulated a clear humoral response to the primary vaccination.

4. Conclusion

From the results of the study, it can be concluded that the rise of Immunoglobulin G in Bali cattle vaccinated with HS vaccine is significantly higher than in non-vaccinated animals.

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