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Comparison of Temperature in Cows Suspect with Foot and Mouth Disease in the Pre-Treatment, During Treatment, and Recovering Phases

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Abstract

Foot and mouth disease (FMD) is caused by the genus *Aphthovirus* of the *Picornaviridae* family. This virus attacks cloven hooves and infects animals directly or indirectly. Clinical symptoms commonly experienced by animals affected by foot and mouth diseases are increased body temperature, excessive salivation, and lesions between the legs. High temperature or fever in clinical symptoms usually appears before forming vesicular lesions. Temperature can also be used as an essential indicator to determine animals' health and physiological status. FMD has several differential diagnoses or differential diagnoses including : Vesicular Stomatitis, Vesicular Exanthema in pigs, Swine vesicular disease (SVD), Pestilence in cattle, Bovine Viral Diarrhea Virus - Mucosal Disease (BVDV-MD), Jembrana. This study aims to compare the temperature comparison of cows suspect of foot and mouth disease (FMD) in the pre-treatment phase, namely the first day the cows showed clinical symptoms of FMD, during treatment, namely the fourth day after clinical symptoms appeared, and when they recovered. This study uses 6 cows showing clinical signs of FMD and originating from Sleman, Yogyakarta. Rectal temperature is measured using a thermometer and obtained the average temperature pre-treatment, during treatment, and recovery respectively: 40.32 °C; 38.78 °C; 38.33 °C. This data were processed using ANOVA statistical analysis and followed by Tukey's post hoc to determine which phase experienced a significant temperature difference. This study can be concluded that the temperature response in the pre-treatment phase increased above normal limits or fever, and returned to normal during the treatment and recovery phase.

Keywords: Cattle; FMD; Rectal Temperature; Fever

Introduction

Cattle are one of the livestock animals that are kept and cultivated because they produce the main products of meat, milk, and leather. In addition, cattle can also be used as a source of labor, manure as organic fertilizer, and biogas (Tumober *et al*., 2014). However, it cannot be denied that cattle are also living creatures that diseases can attack. These diseases, if not treated immediately, can cause a decrease in the level of productivity of meat and milk and even death. Diseases that often affect cattle include Viral Diarrhea (BVD), Salmonellosis, Infectious Bovine Rhinotracheitis (IBR), Brucellosis, and Bovine Anthrax (Milzam *et al*., 2018).

Based on the Minister of Agriculture Decree No.260/Kpts/TN.510/5/1986 Indonesia has been declared free from FMD since 1986. The FMD-free status will last 36 years until the beginning of April 2022. Foot and mouth disease (FMD) re-emerged and became one of the focuses of treatment in 2022 because almost all parts of Indonesia were infected by the virus that causes foot and mouth disease. Foot and mouth disease (FMD) is a disease caused by a

virus of the genus *Aphthovirus* in the *Picornaviridae* family that infects animals, especially cloven-hoofed animals, namely ruminants (cattle, goats, sheep), pigs and also most wildlife. Foot and mouth disease (FMD) is a disease caused by a virus of the genus Aphthovirus in the Picornaviridae family that infects animals, especially cloven-hoofed animals, namely ruminants (cattle, goats, sheep), pigs and also most wildlife (Gelolodo, 2017).

Foot and mouth disease (FMD) can be characterized by clinical symptoms, namely, high temperature, excessive salivation (hypersalivation), vesicle formation in the oral mucosa, nose, interdigital space, and coronary band of the foot (Jamal & Belsham, 2013). Before clinical symptoms of vesicles, animals affected by foot and mouth disease (FMD) will experience fever. According to Lonai *et al.* (2022), the presence of fever or high temperature in clinical symptoms of cattle infected with foot-and-mouth disease (FMD) is the body's response to foreign agents entering to reduce the survival of infecting pathogens. After the infection is cured, the body will re-regulate temperature to reduce excessive tissue damage (Mota-Rojas *et al*., 2021). Therefore, the temperature is one of the parameters that can be used to determine the recovery of cattle infected by FMD. However, there is no research on the temperature comparison of FMD-infected cattle from the pre-treatment, during-treatment, and recovery phases. Based on the above problems, it is necessary to conduct research on temperature comparison in FMD-infected cattle as one of the determinants of recovery based on clinical symptoms.

This study aimed to determine the temperature comparison of cattle suspected with foot and mouth disease (FMD) in the pre-treatment, during-treatment, and recovery phases.

Materials and method

This study used 6 cows suspected of foot and mouth disease (FMD). The types of cattle used in this study were 3 limousin cattle, 2 Simmental cattle, 1 ongole crossbreed cow. The six cows consist of 4 cows and 2 bulls. Clinical symptoms observed in animals suspect of foot-and-mouth disease are increased body temperature, excessive salivation, and sores between the legs. The cows were studied for a predetermined period, namely pre-treatment, during treatment, and when they recovered. All cows were examined, starting from showing symptoms of illness until the symptoms disappeared or recovered. A thermometer (Onemed Thermo One) conducted a rectal temperature examination. In addition, cotton and alcohol as materials for sterilizing thermometers have been used.

The method in this study has received approval from the commission *Ethical Clearance* Faculty of Veterinary Medicine, Universitas Gadjah Mada with number 078/EC-FKH/ Int./2022. This research was carried out from 25 August 2022 to 26 October 2022. The research location is in Sleman, Yogyakarta. Temperature data collection includes: three phases, namely, the phase pre-treatment, during treatment, and during recovery. The pre-treatment phase is where cows are known to experience clinical symptoms was attacked by FMD on the first day and had not received any treatment at all. During treatment, the cow is given medication to treat the symptoms caused and speed up the healing process or on the fourth day.

Checking the temperature begins with the cow was restrained to limit movement so the operator could easily insert the thermometer into the cow's rectal. The thermometer was inserted into the cow's rectal and waited until a sound indicated the device had read the temperature. The thermometer is cleaned using alcohol that has been poured on cotton with the aim that there is no contamination when used for other cows.

Rectal temperature data were entered into Microsoft Office Excel and analyzed using SPSS 16.0 software. Data analysis used the normality test method to obtain the results of normally distributed data or not, with Sig>0.05 (normally distributed data) then continued with the Analysis of Variance (ANOVA) test with a significance of $P<0.05$ to determine the temperature comparison in FMD suspect cattle, namely pre- treatment, during treatment, and recovery.

Results and Discussion

The results showed that the average rectal temperature in cows suspect with FMD in each phase, namely pre-treatment, during treatment, and recovery, is presented in Table 1. The average temperature in the pre-treatment phase (40.32 ± 0.70 °C), during treatment (38.78 ± 0.31°C), and during recovery (38.33 ± 0.54°C) were statistically significantly different (P <0.05) then followed by the Tukey test to find out which group had a significant difference. The results showed that the pre-treatment and during treatment phases differed significantly (P<0.05) (Figure 1). The pre-treatment and recovery phases were significantly different (P<0.05), and the treatment and recovery phases were not very different (P>0.343). The treatment phase greatly influences immunity to survive microorganisms or foreign agents that enter the body, resulting in a significant decrease in temperature. Meanwhile, the temperature has begun to stabilize from the treatment phase to recovery, so the temperature decrease is not essential.

In table 1. it can be seen that cows in suspect with the FMD virus have an average temperature of 40.32°C. The results of this study when compared with the average rectal temperature of cows according to Adhitia *et al*. (2022) state that the rectal temperature range for ordinary cows is 37.8 °C ± 39.4 °C.-Hence, the average temperature exceeds normal limits. Cattle infected with the hoof and mouth virus usually start with a fever before developing vesicular lesions. The fever is caused by inflammation in the body (Rainwater-Lovett *et al*., 2009). Inflammation is a response to defense against microorganisms that interfere with physiological processes in the body (Lonai *et al*., 2022). Fever is a survival mechanism by increasing core temperature during infection or systemic inflammatory processes to reduce survival and proliferation of infectious pathogens and activation of immune reactions (Mota-Rojas *et al*., 2021). The incubation period for FMD in cattle is between 2-14 days, depending on the number of infecting virus particles, the type of virus, and individual susceptibility. After an initial fever of 40°C that lasts a day or two, several vesicles develop on the tongue, palate, dental discs, lips, gums, snout, coronary bands, and interdigital spaces. Vesicles can also be seen on the teats, especially in lactating cows. Young calves may die before vesicle appearance because the virus tends to attack and destroy developing heart muscle cells (Kitching, 2002)

The temperature in the pre-treatment phase was measured before drug administration and supportive therapy, namely on the day the cows first showed clinical symptoms in the form of hypersalivation and decreased appetite. Foot and mouth virus (FMDV) virus can be detected 24 hours post-infection, whereas fever (rectal temperature >40°C) and vesicular lesions are observed together 48 hours post-infection (Arzt *et al*., 2019). In the research, all cows experienced an increase in temperature that exceeded the normal limit Pre-treatment. In cattle that experienced fever or rectal temperature >40°C in this phase, 83.3%, the rest only increased excessive temperature without fever. According to research by Alexandersen *et al*., (2002), foot and mouth disease (FMD) showed mild clinical symptoms at 1-2 after infection. Fever with a temperature above 40 ° C begins after 1-2 days and lasts up to 5 days. The average time for the fever to develop is on day 2. In the other group, the fever lasted from 1 to 3 days. The duration of the fever is also affected by the infecting virus strain and the treatment for each cow. According to Burrows *et al*. (1971) although there is some individual variation in the thermal response of

Table 1. The average temperature of cows suspect with FMD from the previous phasem treatment, cure, and recovery

Cattle Code (Factor)	N	Temperature (°C)	**Normal Temperature**
Pre-Treatment	6	40,32 ± 0,70[a]	37,8 °C ± 39,4 °C *
During Treatment	6	38,78 ± 0,31[b]	
Recovery	6	38,33 ± 0,54[b]	(Edhitia *et al*., 2022)
Superscript (b,b,) in the same column shows no significant differece			

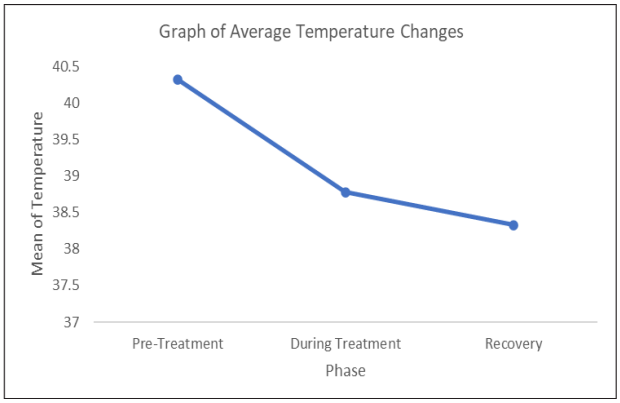

Figure 1. Graph of average temperature changes in the pre-treatment, during treatment, and recovery phases

animals to infection, the general pattern is the same 16 to 24 hours after the animal is infected the rectal temperature increases for some time from 4-8 hours with a maximum temperature of 41,1°C to 41,5 °C and then returns to near normal.

The graph of temperature changes is in figure 1. It can be seen that during the treatment phase, the average temperature in cattle was 38.78 °C. When compared to the temperature before treatment in this phase, the cow's temperature dropped 1.54 °C from 40.32 °C. Based on the results of Tukey's analysis, there was a significant change ($P<0.05$) between the two phases. The decrease in temperature, which previously had a fever to normal, is influenced by the body's immune system to fight infectious agents that can interfere with physiological processes. The immune system is a mechanism to protect the body against foreign agents by identifying and killing pathogenic substances. The immune response consists of innate (natural/non-specific) and adaptive (specific) immune responses. Innate immunity, namely phagocytic cells (monocytes, macrophages, neutrophils), can kill various pathogens. Adaptive immunity is in the form of lymphocyte cells (T cells and B cells) whose role is to identify specific immune responses by recognizing the structure of pathogenic materials so that this adaptive immunity can quickly respond if the same pathogen re-infects (Sudiono, 2014)

In addition to the immune system as the body's natural immunity, it is assisted with medication and supportive therapy to support recovery. Treatment is carried out to reduce clinical symptoms such as fever, pain, allergies, and supportive therapy to increase the animal's immune system. Treatment given includes antibiotics, antihistamines and antipyretics. According to Hodnik et al. (2020), there is no specific treatment for FMD cases, so treatment given aims to reduce clinical symptoms and prevent infection secondary. Supportive therapy given to cows suspected of FMD is vitamins b-complex and brown sugar water. B-complex vitamins play a role in metabolism energy, protein and fat so as to maintain body health (Megawati et al., 2021). Giving brown sugar water can reduce stress and improve livestock performance. According to Joris & Fredriksz (2019) brown sugar contains 66.187% sucrose, which is the part of carbohydrates with a function main energy source. Therefore, this supportive therapy can increase the body's resistance and help the immune system work properly optimally in neutralizing viruses.

Comparison of the temperature during the treatment phase and during recovery shows no significant change ($P>0.05$). This insignificant change between the phases during treatment and during recovery indicates that the temperature begins to stabilize, this state can be maintained because the infectious agent has been reduced its virulence. This follows Mota-Rojas et al. (2021), which states that once the infectious agent is cured, the febrile response will be set back to avoid tissue damage during the inflammatory process. Nonetheless, the average temperature decrease from the treatment phase to recovery, which can be seen in (Table 1), is from 38.78 °C to 38.33 °C**.** In the research, the cure rate refers to the disappearance of clinical symptoms caused by the disease, namely high temperature, hypersalivation, decreased appetite, and lesions on the feet. The temperature is measured after the clinical symptoms have disappeared. Data on the results of temperature measurements from the six cows in the treatment phase leading to recovery can be seen in (Figure 2). It was found that four cows experienced a decrease in temperature, with one cow experiencing a drop in temperature below the standard limit, one cow having a constant temperature, and one cow having a temperature rising but still within normal limits.

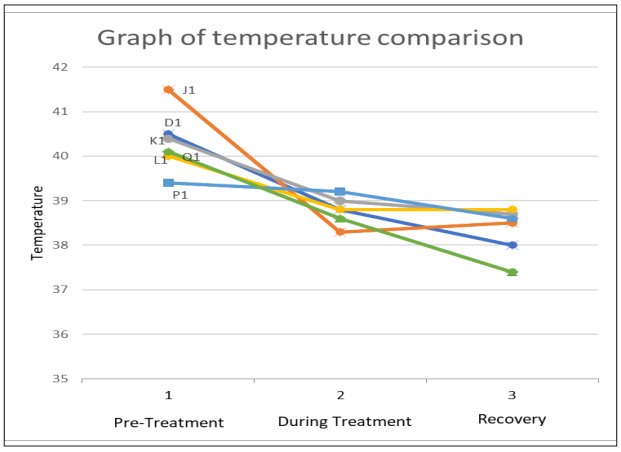

Figure 2. Graph of temperature comparison in each cow in the pre-treatment, during treatment, and recovery phases

Based on the results of the graph in (Figure 2), cows with code (J1) from the during treatment phase to recovery experienced a temperature increase of 0.2 °C. The cow code (Q1) is in the recovery phase, which is 37.4°C, so it is below the average temperature of a cow. The rise and fall of these temperatures can be influenced by high environmental temperatures and excessive feed consumption, increased body metabolism, consuming a lot of feed, heat stress, and low nutritional quality (Rinca *et al*., 2022). Furthermore, for cows with code (L1), the temperature during treatment and recovery remain at 38.33 °C. This indicates that cows with code (L1) can maintain thermoregulation in their bodies. The body has a mechanism to maintain temperature under normal conditions utilizing of the hypothalamus to balance excess heat production from metabolic activity in the muscles and liver with heat loss from the skin and lungs (Susanti, 2012). The temperature in the recovery phase is when the animal's body can maintain its thermoregulation system, characterized by the average temperature remaining in the normal range.

Conclusion

Cattle suspect with foot and mouth disease (FMD) experienced significant changes in temperature during the pre-treatment and treatment phases. Cattle in the pre-treatment phase have a high temperature and generally have a fever. This happens because, at the time of infection, the body raises the core temperature to reduce the viability of the virus. During the treatment and recovery phase, the temperature has returned to normal due to immune mechanisms and is also supported by supportive therapy.

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