

## CHAPTER 1 INTRODUCTION

### 1.1 Research Background

Simmental is one of beef cattle breed, included in the Taurus Boss. There are many Taurus bos cattle such as Simmental, Limousine, and Angus. The level of body weight gain is very high (Soeharsono et al. 2010) and has an important role in fulfilling the needs of meats in society, the demand weight up to 650-660 kg and grows rapidly. Based on the above considerations, it is necessary to preserve and accelerate the increase in Simmental cattle population. Through the use of artificial insemination (AI) recipient technology, effort to accelerate the increase in Simmental cattle population can be done. The quality of semen has a great impact on the success of the AI practicing, which includes dilution and storage of semen. Semen diluter have several requirements, such as providing food substances as an energy source of spermatozoa, able to prevent cold shock, containing substances that can stop or inhibit the activity of bacteria found in semen, act as a buffer to prevent changes in pH and include maintaining the balance of osmotic pressure and electrolytes (Bebas et al. 2016). Dilution of semen is an attempt to increase the volume of semen, reduce the density of spermatozoa and maintain the survival of spermatozoa to a certain storage time limit in conditions below or above freezing (Kusumaningrum et al., 2002). To minimize the damage of spermatozoa cells due to cold shock can also be supported by the addition of antioxidants. The damage caused by many things, some of which are age factors, infection of the testicular organs, lack of protamine levels, hormonal, contaminated toxic chemicals, drugs, hyperthermia in the testes

semen apoptosis, and especially high level of reactive oxygen species (ROS) (Priyanto, et al., 2015). ROS also has the ability to reduce sperm motility through peroxidation of sperm cell membranes induced by ROS causing a decrease in flexibility and movement of sperm tails. (Tremallen, 2008). According to statements (Jackson, 2005, Singh, 1992), the body itself can limit the damage caused by free radicals by equipped a set of defence systems to counteract attack of free radicals or oxidants. The defences systems is antioxidant like micronutrients namely  $\beta$ carotene, vitamin C and vitamin E (Hariyatmi, 2004). But in certain circumstances, the production of free radicals or reactive oxygen compounds exceeds the body's defensive ability called oxidative stress (Agarwal et al., University of North Sumatra, 2005). One of the vitamins that are a fat-soluble antioxidant, able to captivate free radicals, and prevent chain reactions is Vitamin E (alpha-tocopherol) (Suryohudoyo, 1995). Based on the background above, the researcher wanted to examine the effect of adding alpha-tocopherol to diluter on motility, viability, and plasma membrane integrity of Simmental cattle spermatozoa in cooling temperature conducted.

## 1.2 Problem Statements

1. Does the supplementation of alphotocopherol into semen diluent can maintain Simmental cattle spermatozoa motility percentage in 5°C temperature?
2. Does the supplementation of alphotocopherol into semen diluent can maintain Simmental cattle spermatozoa viability percentage in 5°C temperature?

3. Does the supplementation of alphotocopherol into semen diluent can maintain Simmental cattle spermatozoa plasma membrane integrity percentage in 5°C temperature?

### 1.3 Basic Theories

A rapid decrease temperature can cause very influential metabolism and viability of spermatozoa cells condition. During the storage process, spermatozoa often decreased motility and fertility caused by cold shock. Therefore, in the process of storing semen, it is necessary to add an ingredient in the form of an antioxidant to diluent that can overcome free radicals (Herdis et al., 2002). One of the mediators of male infertility and make sperm dysfunction and the decreasing percentage of motility is oxidative stress (OS) and it is a condition associated with increased oxygen-induced cell damage and oxygen-derived free radicals known as reactive oxygen species (ROS). (Argawal, et al., 2014). Excessive production of reactive oxygen species (ROS) makes oxidative stress (OS) appear to surface and carry out intimate effects on sperm plasma membranes then follows the functional integrity of the sperm. (Homa, et al., 2015). The structure of the sperm itself has very specific. Like specific lipid composition, high polyunsaturated fatty acid content, plasmalogens, and sphingomyelins (Sanocka, et al., 2004). If in a fatty acid does not contain antioxidants, otherwise react with a double fat bond. When added antioxidants, the active peroxide will react with these antioxidant therefore free radicals can be stopped by adding an antioxidant (Winarsi, 2007). Vitamin E functions as an intracellular antioxidant is most powerful in preventing peroxidation of unsaturated fatty acids for the cell wall as to avoid peroxidative

damage that affects the viability and fertility of spermatozoa (Donnelly et al., 1999; Agarwall et al., 2004). Vitamin E can effectively stabilize membrane peroxide lipids, play a role in preventing lipid peroxidation and oxidative stress spermatozoa. Alpha-tocopherol is a form of fat-soluble vitamin E that is an antioxidant and capable of capturing free radicals and preventing the occurrence of chain reactions. Bebas et al. (2016).

#### **1.4 Research Purpose**

The purpose of this study:

1. To know the effect of alpha-tocopherol supplementation in semen diluent towards spermatozoa motility of Simmental cattle semen in cooling temperature at 5°C.
2. To know the effect of alpha-tocopherol supplementation in semen diluent towards spermatozoa viability of Simmental cattle semen in cooling temperature 5°C.
3. To know the effect of alpha-tocopherol supplementation in semen diluent towards spermatozoa plasma membrane integrity of Simmental cattle semen in cooling temperature 5°C

### 1.5 Research Benefit

The results of this study are expected by adding alpha-tocopherol into diluent and input for the management of semen preservation from Simmental cattle as an effort to maintain the quality of semen, this method can be an information material for researchers, academics and agencies that are related to the success of insemination in Simmental cattle.

### 1.6 Hypothesis

1. The supplementation of alpha-tocopherol in semen diluent can to maintain the spermatozoa motility of Simmental cattle in cooling temperature at 5°C.
2. The supplementation of alpha-tocopherol in semen diluent can to maintain the spermatozoa viability of Simmental cattle in cooling temperature at 5°C.
3. The supplementation of alpha-tocopherol in semen diluent can to maintain the spermatozoa plasma membrane integrity of Simmental cattle in cooling temperature at 5°C.