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Mini Review

Somatic Cell Count in Milk and Antioxidant

Hirotada Tsujii*

Professor Emeritus, Japan

***Corresponding author:** Hirotada Tsujii, Professor Emeritus, Shinshu University, 8304 inamiminowa-mura Kamiina-gun Nagano Prefecture, post code: 399-4598, Japan

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Introduction

Somatic cell count (SCC) is generated by the cow's immune system to combat inflammation or mastitis of the mammary gland. The SCC is closely related to inflammation and breast health, these so SCC are accepted as the international standard measurement of milk quality. The milk somatic cells are cells derived from leukocytes (75% leukocytes) and mammary secretory tissues (25% epithelial cells) that infect bacteria and repair tissue damage.

The number of somatic cells increases in response to pathogenic bacteria like Staphylococcus aureus, a cause of mastitis. Generally in milk from a healthy mammary gland, the SCC is lower than 1×10^5cells/ml, while bacterial infection can cause it to increase to above 1×10^6cells/ml [1]. Cow side measurements of somatic cell count provide tested in several tests such as California's mastitis test (CMT) [2]. Milk loss due to increased SCC cause economic loss for dairy producers. Dairy cows with higher cell numbers are treated more frequently with antibiotics and they can be found in milk of sufficient concentration. Residues of antibiotics in milk are at risk of developing human health problems [3].

The SCC in the milk vary, due to many factors, including seasonal and management effects. The SCC in the milk increases after calving, but it declines rapidly and tends to rise towards the end of lactation [4]. Mastitis is caused by bacterial invasion into the udder. During most mastitis infections, the number of somatic cells present in the udder increases to help the cow fight the infection. At the beginning of the mastitis, blood and milk neutrophils are higher than normal cattle [5].

Neutrophils are a type of white blood cell and the main function is phagocytosis and intracellular killing by engulfing bacteria, the respiratory burst, and by digestion by lysosomal enzymes. The ability of neutrophils to phagocytose foreign particles is important for protection of the mammary gland. Although, neutophils phagocytose and kill pathogen via exerting their bactericida effects through a respiratory burst that produces Reactive Oxygen Species (ROS). ROS causes peroxidation, enzyme inhibition, and damage to cells and tissues in mammary gland. Mastitis could induce the increase of free radicals formation in milk and leading to oxidative stress [6,7]. In addition, milk with a higher SCC is positively correlated with malondialdehyde (MDA) levels in milk [8]. MDA increases lipid peroxidation in mastitis and more free radical release and oxidative stress increases [9,10]. Mastitis is caused by the action of various inflammatory mediators including cytokines, chemokines, prostaglandins and leukotrienes, which play a central role in breast defense, such as inflammation and immune mediation and regulation. The main cause of mastitis is due to suppression of the immune system, and there is an increase in the evidence that nutritional factors are associated with mastitis in cows [11]. All of them play a central role in mammary defense by mediating and regulating inflammation and immunity.

The major impact of nutrition on udder health is via maintains immunity and defends inflammation and pathogen mediation. Trace minerals and vitamins that affect breast health are selenium and vitamin E, copper, zinc, vitamin A and β-carotene [12]. Vitamin E is directly related to the neutrophil function of dairy cattle by enhancing the function of neutrophils and improving the ability to kill blood [13]. Furthermore, administration of vitamin E decreased the production of neutrophil superoxide anion and interleukin-1 (IL-1) production, and the incidence of mastitis decreased [14-16].

Selenium (Se) is involved in the antioxidant system via its role in the enzyme glutathione peroxidase and thioredoxin reductase located in the cytosol of the cells. In cattle, selenium deficiency can have a profound effect on mastitis [10,17,18]. Neutrophils obtained from cows fed Se-supplemented diets killed a mastitis pathogens more efficiently compared to neutrophils from cows fed the Se-deficient diet [19]. Similarly, Se-supplemented diets' cows showed that challenge-exposed to Escherichia coli had a faster influxof neutrophils to the site of the infection compared to Se-deficient diet cow [20]. Heifers supplemented with Se and vitamin E had fewer infectious diseases during lactation, fewer cases of clinical mastitis, shorter infection periods, and lower milk SCCs, compared with unsupplemented heifers [21,22]. In addition, Weiss et al. [22] reported that there is a clear interaction between complementary Se and vitamin E. The status of supplemented with Se and vitamin E in dairy cows is involved in the health of the mammary gland, leading to cases of clinical mastitis, short duration of infection, and reduction of milk SCC [23].

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