Determination of Non-Fat Dry Matter Content and Somatic Cell Count in Camel and Cow Milk

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With **AOUACHRIA Amira Narimane,** from El Oued University, Algeria, we determine non-fat dry matter content and somatic cell count in cow and camel milk at the Animal Science Laboratory, Faculty of Agriculture, University of Aydın Adnan Menderes, Türkiye. Camel milk samples from Kaya Brothers Camel Farm and cow milk samples from a dairy cattle farm were used.

Non-fat dry matter content (NFDMC) in milk was determined by using a 32 brix portable Refractometer and SCC was determined by Direct Microscopic Somatic Cell Count (DMSCC) procedure as outlined in Form FDA-2400d.

Determination of NFDMC

A few drops of milk sample are slowly placed on a prism under the cover of the refractometer, and then the NFDMC in the milk is determined by holding it to the light and reading the number corresponding to the image formed on the scale inside.

Photo 1. Reading non-fat dry mater content in milk (taken by AOUACHRIA Amira Narimane)

Determination of Somatic Cell Count (SCC) in Milk

What is somatic cells in milk

Somatic cells in milk can be listed as milk-producing epithelial cells, lymphocytes, monocytes, neutrophils, basophils and acidophilus cells in udder tissue (Batu, 1978).

Pathogens that enter the udder tissue from the teat during or after milking cause an infection with the toxins they secrete, and they damage the cells here and destroy their structure and kill them. This is due to the decrease in the milk production capacity of the mammary tissue and the destruction of the milk-producing epithelial cells on the inner surface of the alveoli in the mammary tissue. The production of neutrophils, another type of somatic cell, is increased by sending a signal to the immune centers by macrophages, a type of somatic cell found in the mammary tissue and mixed with milk.

When an infection occurs in the breast, white blood cells flow from the blood circulation to the inflamed area, the milk production function of the udder tissue changes, causing a decrease in milk production capacity and a change in the structure of the milk produced (Harmon, 2001). Polymorphonuclear neutrophils (PMN) produced by lymph nods are sent to the damaged udder tissue. They destroy the pathogens here by phagocytosis.

As the epithelial cells, whose structure is deteriorated due to various toxins produced by pathogens that cause inflammation, mix with the milk, lymphocytes produced by the lymph nods and sent to the damaged area in the udder are also present in the milk. The number of somatic cells that increase in response to infection or injury is closely related to udder health and infection, and Harmon (2001) stated that somatic cell count is an international standard measurement associated with milk quality.

While there are some somatic cells in the milk produced by a healthy udder tissue, the number of somatic cells in the milk produced by the udder tissue of a cow is over 200,000 cells/ml, which is considered to be an indication of the udder infected with pathogens, in other words, mastitis (Doho and Leslie, 1991). The high number of milk somatic cells (Boichard and Brochard, 2012; Koeck et al 2012; Berry et al 2011; Koç, 2011; Gernand et al 2012; Koç, 2015), which has a high correlation with mastitis, is also high in raw milk, and the inflammation intensity in the udder is high. It causes significant decreases in milk yield due to the destruction of milk-producing epithelial cells (Atasever and Erdem, 2009; Koç et al., 2021). The decrease in the lactose content in the milk produced depending on the severity of the inflammation, the decrease in the casein content and the increase in the whey protein content, the increase in the sodium and chloride content and the decrease in the potassium content can be listed as the changes in the composition of the milk caused by the high somatic cell count (Litwinczuk et al. 2011; Barlowska et al. , 2009; Koç, 2015; Koç, 2021). These changes in the structure of milk not only reduce the quality of the dairy product produced from these milks, but also reduce the cheese yield in case this milk is processed into cheese, resulting in shortening the shelf life of dairy products, thus leading to significant economic losses.

Detection of somatic cells, which is a raw milk quality criterion, is made with milk samples taken from the teat, the milk mixture produced by the four teats, or from the milk cooling tank. While determining which teat has mastitis by analyzing the milk sample taken from each teat, it is determined whether the animal has mastitis in the sample taken from the milk mixture produced by the four teats, but each teat should be examined to determine which teat or teats have mastitis. By analyzing the milk samples taken from the bulk tank milk, an idea can be obtained about the prevalence of mastitis in the herd.

Photo 2. Spreading the milk samples on the area of slides with dissecting needle (taken by Atakan KOÇ)

There are three practical methods used to determine the somatic cells in milk: Californiya Mastitis Test (CMT), Direct Microscopic Somatic Cell Count (DMSCC) and Electronic Somatic Cell Counting method.

While CMT gives a result whether the teat is mastitis or not, it is not known how many cells there are. Electronic SCC devices report the number of cells per 1 mL in milk, but the devices are very expensive. In the DMSCC method, it can be easily calculated by counting under the microscope by staining the milk sample with appropriate dyes according to the method. In the DMSCC method, it is also possible to determine the cell types in milk.

Photo 3. Dying the slides with stain (taken by AOUACHRIA Amira Narimane)

SCC Determination by DMSCC Method

Milk sample is poured into an area of 5x20 mm2 (=100 mm2) with 0.01 mL of milk with the help of a suitable micropipette. The milk is spread evenly all over the area with a dissecting needle and left to dry to fix the cells. The strips are stained with the previously prepared methylene blue dye mixture in the dried milk and in room temperature it is waited for about 30 minutes for this dye to penetrate into the nuclei of the somatic cells.

The slides are then washed in water to remove excess dye and after drying the cells are counted under a microscope.

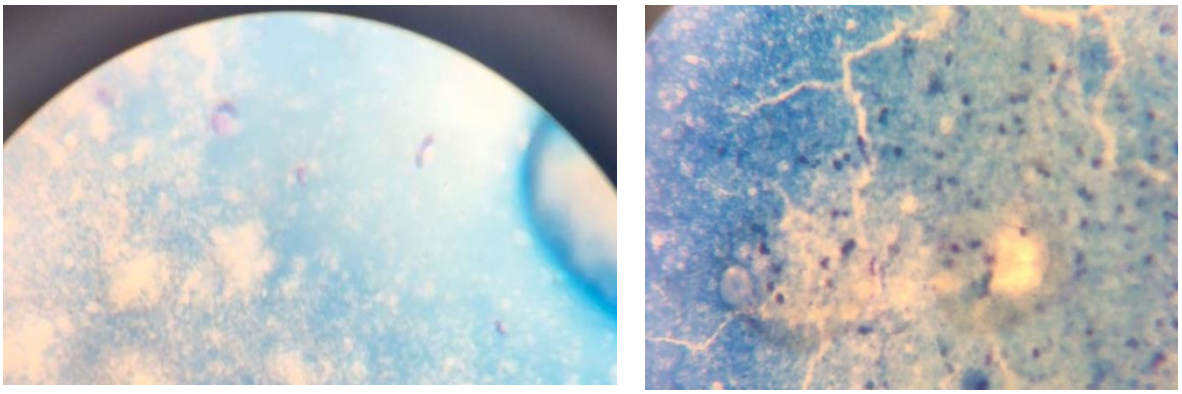
Preparation of dye solution,

40 mL of 1.1.1-trichloroethane is mixed into 54 mL of ethyl alcohol (96%) in a closed bottle, the mixture is heated to 65°C in a water bath, 0.6 g of methylene blue chloride is added, mixed well and kept in refrigerator conditions for 12-24 hours. 6 mL of glacial acetic acid is added to this mixture and filtered on a non-coarse filter paper (Eyduran, 2002).

Photo: Washing the slides with water (taken by Atakan KOÇ).

Counting somatic cells

By calculating the area of the microscope field of view, a coefficient is obtained to adapt this field of view to the area on the slide (100 mm^2). On the other hand, since 0.01 mL of milk sample is used on a 100 mm^2 area on the slide, to express this number in mL, a coefficient is obtained by multiplying by 100. Thus, the number of SCC obtained from the field of view is multiplied by the coefficient obtained, and the number of somatic cells in 1 mL is calculated.



a b

Photo: Some somatic cells in camel milk seen under a light microscope. a) camel milk, b) cow milk (taken by AOUACHRIA Amira Narimane).

Preparing three parallel strips from each milk sample on the slide and counting from 10 random areas on each strip, then calculating the mean and then taking the average of the three strips to obtain the raw SCC value will allow for a more accurate count.

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