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Derleme

Cow Milk Quality and Critical Control Points on Farm Conditions

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Abstract

Milk quality means different things to the different groups. To some it's simply low somatic cell count milk. To others it's a complex subject involving somatic cell counts (SCC), bacteria counts, management programs, premiums, cow health and welfare and more. Farmers are extremely focused on producing quality milk for two reasons. The main reason is consumer confidence and the second reason is economics. Quality control systems aimed the prevention of defects, rather than their detection.

Key words: Quality, milk, control, SCC, CCP, management

İnek Sütü Kalitesi ve Çiftlik Koşullarında Kritik Kontrol Noktaları

Özet

Süt kalitesi farklı kesimlere farklı anlamlar ifade etmektedir. Bazı kesimler sadece düşük somatic hücre sayısı (SHS) olarak ifade ederken, bazı kesimler SHS, bakteri sayısı, sürü idaresi uygulamaları, destekler, inek sağlığı, gönencesi ve diğer konuları ifade edebilmektedir. Çiftçiler kaliteli süt üretimini temel olarak tüketici güveni ve ikinci olarakta ekonomik nedenlerden dolayı istemektedirler. Bu bağlamda, kalite kontrol sistemleri, kalite tespitinden ziyade kalite oluşumundaki aksaklıkları önlemeyi amaçlamaktadır

Anahtar kelimeler: Kalite, süt, kontrol, SHS, KKN, sürü idaresi

Introduction

There are three types of hazards that can pose food safety and quality risks in a milk production system (Anonymous, 2007; Vágány et al. 2007). These are biological hazards, chemical and physical hazards. It is essential to identify the areas in the operation where threats are posed from these hazards, the Critical Control Points (CCP), and develop standard operating procedures to prevent issues from arising at these points. In this study, the identification of all potential hazards in milk production and the assessment of the severity of each hazard to milk quality shall be reviewed.

Biological Hazards: there should be a plan for controlling risks from viruses, bacteria, parasites and other contaminants. These controls must be considered from the standpoint of: 1. Introduction to the farm; 2. Exposure and spread within the herd; 3. General and specific measures for immunization; and, 4. Minimizing the risk of export to other farms.

Chemical Hazards: There should be a plan for handling and storage of pesticides, herbicides, feed additives, drugs, medicines and any potentially toxic materials.

Physical Hazards: There should be a plan for animal handling and treatment to minimize trauma and maximize comfort and care. This includes ventilation, traffic flow, housing facilities and animal handling equipment.

Critical Control Points at Farm

Cows: there is a general assumption that high standards of cow comfort and the management of clean cows equates to improved milk quality. Dairy farmers have responded by developing management practices that provide a safe and comfortable environment for their animals. Cook (2004), summarized in their review that the dairy housing improves cow comfort, keeps cows clean and dry, and improves milk quality by reducing the rate of infection with environmental pathogens. The teat cistern, teat canal, and the teat apex may be colonized by a variety of microorganisms though microbial contamination from within the udder of healthy animals is not considered to contribute significantly to the total numbers of microorganisms in the bulk milk, nor to the potential increase in bacterial numbers during refrigerated storage. Used bedding has been shown to harbor large numbers of microorganisms. Total counts often exceed 10^8-10^{10} per gram (Bramley, 1982; Bramley and McKinnon, 1990). Organisms associated with bedding materials that contaminate the surface of teats and udders

include streptococci, staphylococci, spore-formers, coliforms and other Gram-negative bacteria. Both thermoduric (bacteria that survive pasteurization) and psychrotrophic (bacteria that grow under refrigeration) strains of bacteria are commonly found on teat surfaces (Bramley and McKinnon, 1990; Murphy and Boor, 2006) indicating that contamination from the exterior of the udder can influence Lab Pasteurization Counts (LPCs) and Preliminary Incubation Counts (PICs). Recent research has emphasized the importance of the human/cow interaction in the success of the milk let down response and the milking process (Costa and Reineman, 2004).

Biosecurity is a key factor to keep animal healthy**.** The development of a biosecurity strategy, such as the breakthrough management, which is a programme for identifying problems before they occur, and later implementation and maintenance of changes necessary to achieve food safety and biosecurity goals, is discused by Cullor (2004). Biosecurity refers to management practices that reduce the chances infectious diseases will be carried onto the farm by animals or people. The Three Major Components of Biosecurity are **isolation**, **traffic control** and **sanitation** (Cullor, 2004). When effectively managed, these components go a long way toward ensuring a safe livestock production system. Furthermore, when effectively managed, these components meet the principle biosecurity objective of preventing or minimizing cross-contamination of body fluids (feces, urine, saliva, respiratory secretions, etc.) between animals, animals to feed and animals to equipment.

Record keeping is the milestone to get healthy milk from the cows for dairy farmers**.** Producers who adopt identification systems may discover that their cattle qualify for more lucrative marketing opportunities. The only way to verify many of these quality attributes is through record-keeping, which establishes and documents that the attribute(s) actually exist in the product. Traceability, a word totally foreign to the vocabulary of most dairy producers a few years ago, has become a term that they now hear at least once a day and often more. Quality Control Programs, is a written plan that describes how food should be prepared and served to ensure it is safe.

Management is another key factor to get healthy milk**.** It is clear that milkers, non-milkers and management have a role in the complex task of producing high quality milk. Management and employee must become very knowledgeable about the milk quality factor and the tasks that impact each factor. Dairy farmers who are involved in dairy cooperatives or another organisation get more advantage for their production system. Deming (1986) stressed the responsibilities of top management to take the lead in changing processes and systems. Dairy labor management is more than scheduling employees to milk, feeding, or treating animals. Farm employees deserve manager time, attention, and care whether they are full or part-time, temporary or permanent, or family members. Manure systems present hazards from asphyxiation, poisoning, drowning, and machinery entanglement and entrapment. Multiple deaths have occurred as a result of failure to follow appropriate procedures for working in these confined spaces. Another common hazard is failure to provide adequate guarding at manure tank openings and push off ramps to prevent entry by people, tractor scrapers, or cows.

Work description can be used efectively for quality milk production**.** Flow charts can be used to define a specific work routine for any work at farm configuration and size. A good milking routine prevents contamination of the milk. A consistent milking method at regular intervals, fast but gentle and complete milking, and sanitary methods during milking are all important aspects. In the case of hand milking, the danger of contamination coming from the milker is higher as compared with machine milking. For example, milker should therefore be free from contagious diseases. Nails should be well trimmed; she/he should wear clean clothes and should wash her/his hands with soap and water before milking, then dry with a clean towel (Sinha, 2000). Rodrigues et al. (2005) reported that formation of milk quality teams was helpful for improvements in mastitis control and to reduce losses associated with mastitis. Use of a team-based milk quality program was effective in encouraging adoption of recommended practices and improving milk quality. There are five steps to effective training: 1. prepare the workers, 2. explain the system, 3, demonstrate the system, 4. have the workers perform the system, and 5. summarize the workers' role in the system. Certification is also another solution method for the employee training for a certain interval for dairy farmer.

Milking Equipment: Dirty milking equipment is one of the main sources of infection of milk (Sinha, 2000). About 15 minutes before milking, milking equipment should be rinsed with a sanitizing solution. In this way, dust and contamination will be removed. The utensils

and equipment should not have any joints or open seams and should be free from dents, rust etc. Almeida et al. (2006) indicated that milking parlor and milk liner contamination correlated with bulk tank milk contamination that increased as milking progressed. Results also demonstrated that 10 of 35 milking practice critical points scored showed direct correlation with bulk tank coliform contamination and increased somatic cell counts. These 10 critical points were related to general hygiene, pre- and post-milking techniques and milker performance. *Staphylococcus aureus*, *Streptococcus uberis* and *Streptococcus dysgalactiae* subsp. *dysgalactiae* were the mastitis pathogens isolated most frequently. Any injuries to the teats or teat ends will eventually end up with a new case of mastitis. Important steps are proper milking techniques (attachment, alignment and removal of machines), proper milking machine design/function, routine and timely changing of inflations, and continuous maintenance of the milking equipment (cleaning pulsators, etc.). Periodic assessment of teat end condition may be a useful indicator. Environmental sources of injuries should also be controlled (bedding, housing, free stall design and maintenance, frostbite). Teat dips should be clearly identified, properly mixed and stored to prevent temperature degradation.

Galton demonstrated a direct relationship between premilking hygiene procedures and both bacteria counts in milk and incidence of clinical mastitis (Galton et al., 1988; Harmon, 2002). At the same time, adding steps to milking routine can reduce milking parlor profitability. In a performance analysis of parlor design and management strategies, Thomas concluded that abbreviated milking procedures (unit attachment and post dip vs. predip, wipe, unit attach and post dip) resulted in a 6% increase in performance (Thomas et al. 1996).

Cleaning and sanitizing procedures: Whether milking by hand or machine, good hygiene is essential (Harmon, 2002). The floors, walls, ceilings, windows, tables, shelves, cabinets, wash vats, non-product-contact surfaces of milk containers, utensils and equipment and other milkhouse equipment shall be clean. The product contact surfaces of all multi-use containers, utensils, and equipment used in the transportation, processing, handling, and storage of milk or milk products shall be effectively cleaned and shall be sanitized before each use (Jones, 2001). Many methods of premilking udder preparation are practiced by producers. Recently, many producers have adopted the practice of predipping teats. Use of the gel and predip procedures decreased bacterial count on teat ends and in harvested milk over counts with the wash treatment (Ingawa et al. 1992). The general rules states that after each milking the system shall be cleaned thoroughly and, immediately before the next use, the system shall be sanitized with an appropriate chemical sanitizer. Chlorine and iodine solutions are the most commonly used of the approved sanitizers. The combination of chemical and physical cleaning action helps remove milk residues from these components. Less efficient cleaning, using lower temperatures and/or the absence of sanitizers tends to select for the faster growing, less resistant organisms, principally Gram-negative rods (coliforms and Pseudomonads) and lactic streptococc.

Milking Routine: The milking routine is where the dairy farmer has the greatest opportunity to control quality on their dairy. The seven habits of highly effective milking routines identified by Ruegg et al., (2000) are summarized as:

1. Cows are calmed and clean before milking.

2. Cows are grouped by infection status (or milked in a way to avoid transfer of pathogens by the milking machine).

3. A consistent premilking cow prep is used.

4. Teats are clean and dry before attaching milking units.

5. Milking units are attached properly (At the correct time, without excessive air admission and adjusted to hang evenly on all four quarters.

6. Milking units are promptly and properly removed at the end of milking

7. Cows are managed post-milking (Application of post milking sanitizer kept standing to allow teat canals to close).

Milking shall be done in the milking barn, stable or parlor. Every milker must wear gloves during milking. Gloves will reduce the risk of bacteria that comes from the milkers hands. A dairy farmers hand can be a primary source of Staph Aureus and various environmental bacteria. The flanks, udders, bellies and tails of all milking lactating animals shall be free from visible dirt. All brushing shall be completed prior to milking. The ideal lag time should be 90 seconds with an acceptable range of 75-120 seconds. For years, we have always talked about a 60 second lag time, however researchers have found out as milk production has

increased, too many cows were having units put onto empty teats (Johnson, 2006).

Storage and transportation

Milk for industrial processing can be transported to the dairy plant by the farmers themselves, or it can be picked up at the dairy farm. It is important to remember that under a unsuitable environment milk will spoil within 3–4 hours. So any means of cooling that will lower the temperature of milk from 38° C at milking will help to prevent multiplication of bacteria. Due to organizational or economic difficulties, it may not be possible to cool the milk on the farm. In areas far away from the dairy plant it may be troublesome to collect milk and take it directly to the plant. In such cases, especially if there are many small suppliers, it is be preferable to take milk first to a collection point, and then transport it from there to the dairy plant or milk collection centre.

Feeds and feeding

Feeding programs are designed to meet the requirements of all classes of cattle on the farm or ranch. Feeding levels are adjusted when environmental stresses (wind, rain, snow, extreme cold, etc.) increase nutrient requirements, so cattle remain healthy. The relationship between feed quality and animal performance is important and encompasses not only the quantitative amounts of all feed components, but also the digestibility and metabolism of those components (Hular and Brand 1993). Thus, the challenge for nutritionists and others involved in animal feed production is to consistently monitor all aspects of the feed production system being used and measure those variables that are good indicators of quality control. An overall evaluation of feed quality delivered can be derived by determining the variation in the five important points that affect feed consistency. They are 1)variation of incoming ingredients, 2) variation in feed mixing efficiency, 3) variation in efficiency of delivery of mixed feed from mixing point to the animals, 4) variation in analytical procedures and 5)variation in offered diets and the diets consumed by animal especially in total mixed ration applications. All scales and metering devices must be tested for accuracy upon installation and at least once per year thereafter. Equipment must be constructed and maintained to prevent lubricants and coolants from contaminating ingredients or feeds. Excessive spills, leaks and dust problems must be prevented. All ingredients should be inspected for any abnormality that may result in a quality risk when added to the feed, and representative samples taken for assays (Richardson, 2006). Three factors of major importance have been identified to adequately provide water to feedlot cattle: water quality and quantity, trough space allowance, trough cleanliness.

Monitoring and evaluating system

Information management on a dairy goes through four steps: collect, analyze, interpret and act upon. Firstly manager has to decide to what kind of data which they need. And then other steps of analysis will be taken at farm. Monitoring of the production chain and production process is a vital element of the quality system. For this reason, each link in the chain is subject to ongoing inspection. Independent organisations must carry out these inspections. The goal is to monitor both the system and the workers; both employee performance and milk quality results need to be evaluated.

Conclusions

Farmers are extremely focused on producing quality milk for two reasons. The main reason is consumer confidence and the second reason is economics. They fully understand that they will get more milk per cow with a lower SCC and they get a premium from their milk plants which are very significant. But every farm must have determined critical points of fresh milk production chain in their conditions. By continuous control of these critical points the possible hazards can be prevented so the milk quality can be improved and maintained for the consumer confidence.

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