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Derleme

Quality Concept for Dairy Profitability

Serap Göncü Karakök

Çukurova University, Agriculture Faculty, Animal Science Department, 01330 Adana-Turkey

e-posta: sgoncu@cu.edu.tr; Tel: +90 (322) 338 6813/28; Fax: +90 (322) 338 65 76

Abstract

Food processing and farming are rapidly moving toward quality assurance programs. Many industries have already implemented quality assurance programs as cost effective ways of reducing risk, maximizing profitability and assuring their customers of quality products. These quality assurances programs can be very valuable management tools, as the dairy industry seeks to respond to the ever ever-increasing demands of the consuming public. For each module a farm chooses to complete, the program implementer will develop a farm plan that is consistent with program standards but is adapted to individual farm situations.

Key words: Quality, milk, control dairy, profitability

Süt Sığırcılığının Karlılığında Kalite Kavramı

Özet

Besin işleme ve yetiştiricilik hızlı bir şekilde kalite kontrol programlarına yönelmektedir. Pek çok endüstriyel sektör, tüketicilerin kaliteli ürün talebini garantilemek, karlılığı maksimum kılmak, riski azaltmanın düşük maliyetli yolu olarak halen kalite kontrol programlarını kullanmaktadır. Bu kalite kontrol programları, süt sığırcılığında da günden güne artan tüketici taleplerine karşı oldukça değerli bir idari uygulama aracı olabilir. Her yapıdaki işletme standart programları yürütecek kendi yapısına uygun bir çiftlik planı seçerek bunu tamamlayabilir.

Anahtar kelimeler: Kalite, süt, kontrol, süt sığırcılığı, karlılık

Introduction

Milk is synthesized in specialized cells of the mammary gland and is virtually sterile when secreted into the alveoli of the udder. As a rule, unhealthy dairy cows have the potential to give milk that is lower in quality and wholesomeness. Mastitis, an infection of the udder, is one of the most common heard health concerns. Mastitis in dairy cows, which is most often the result of a bacterial infection (contagious or environmental), causes an increased in milk somatic cell levels (i.e. blood cells that fight infections). While the legal limit for bulk herd milk is differ from 400,000 to 750,000/ml, counts exceeding 200,000 generally indicate some level of mastitis in the herd and also the potential for quality defects in raw milk and in processed dairy products (Anonymous,2006), quality defects are generally the result of enzymes associated with infection and somatic cells those breakdown proteins, milk fats and other components resulting in reduced cheese yields and flavor defects (i.e. bitterness, rancidity) in cheese, pasteurized milk and other dairy products

Quality concern is a relatively new term on dairy farms to describe the process of work and how it is accomplished. It implies that every task has an expected level of quality that all personnel on the farm have agreed upon and accepted. A core concept in implementing quality is a set of management practices to help farmers increase their quality and productivity. Dairy farms with quality certification comply with the specified criteria for animal health, welfare, nourishment, hygiene and environmental aspects. Quality issues will result in an ability to both maintain and improve quality while controlling the increases the cost. Global trade markets shift some animal health and product quality concerns, while also increasing competition pressure. Changing societal perceptions emphasize concern about animal welfare, environmental issues, food purity, rationale for antibiotic use, and development of resistant bacterial strains. These factors will continue to demand responses from the livestock industries and quality assurance principles will provide the best framework for responding (Garry, 2006). Systems and standard control procedures such as Good Manufacturing Practices (GMP), Hazard Analysis Critical Control Points (HACCP), and Total Quality Management (TQM) are widely accepted as the basis of quality assurance and food safety regulations among large and progressive dairy establishments around the world.

In this study, it will be reviewed that identification of

critical control point in dairy sector and assessment of the severity of each hazard to milk quality

Milk composition

Milk has been referred to as the complete liquid food. It has primarily adequate amount of calories, only natural source of lactose, good quality proteins, fats, iodine, calcium, phosphorous, potassium, vitamin A, vitamin D, thiamine, riboflavin and niacin. Other nutrients are also present in smaller amounts. Milk composition varies because of diet, breed, genetics, mastitis, stage of lactation of the cow, as well as environmental conditions and many other factors.. The composition of milk of various breeds is given in Table 1.

The specific composition of the major milk constituents is very important to dairy product manufacturers. For example, large changes in types of fatty acids found in milk fat will influence the flavor and texture of high fat dairy products such as butter, ice cream, and high fat cheeses

Changes in the milk protein fraction (types of caseins or whey proteins which are present) can influence moisture, texture, flavor and yield of various cheeses. Changes in milk minerals can influence heat stability of milk proteins and protein coagulation during cheese making. Therefore, changes in the chemical composition of milk components can have as much or more impact on dairy product manufacturing and product characteristics than changes in total percentages of individual milk solids components.

Milk quality criteria

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 (SCCs), 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. 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.

Milk can show large quality differences, which milk processors, must take into account. Two types of criteria are used for paying by quality physio-chemical and bacteriological. Physio-chemical criteria usually relate to the fat and protein content, the basic rate of which per kilo of milk varies from one to another. The basic price will be obtained for fat content generally between 3.8 and 4.2%, and protein content between 2.9 and 3.4%. Each degree of fat or protein content (0.1% or 1 gram/litre) results in a premium being paid above the basic rate and a reduction below this rate. In developed countries, there is a question of not collecting unsound milk (e.g. containing over 100,000 bacteria or more than 400,000 somatic cells for E.U. standards - Anonymous, 2006). Testing for better bacteriological quality could result in finding specific bacteria such as Coliforms, Staphylococcus, Lysteria and Butyric spores. Similarly, the presence of antibiotics and the milk temperature during collecting can be used as quality criteria and for price reduction. In developing countries, for small scale dairy plants the tests normally carried out for physio-chemical and bacteriological quality are density to determinate possible adulteration by water and acidity to determine suitability for processing.

Godefay and Molla (2000) reported that the hygienic quality of raw milk from the collection centre was poor with a mean total bacterial count of 1.3 x 10(7) cfu/ml. Milk sampled from the udder contained mainly staphylococci and micrococci as udder-specific bacteria, while samples taken at later stages were additionally contaminated with bacteria of environmental origin (especially Enterobacteriaceae). Furthermore researcher concluded that lack of knowledge about clean milk production, use of unclean milking equipment and lack of potable water for cleaning purposes were some of the factors which contributed to the poor hygienic quality of raw milk in dairy farms.

Table 1. Gross composition of milk of various breeds, g/100g.

	Body Wt. (kg)	Milk Yield (kg)	Fat (%)	Protein (%)	Lactose (%)	Ash (%)	Total Solids (%)
Holstein	640	7360	3.54	3.29	4.68	0.72	12.16
Brown Swiss	640	6100	3.99	3.64	4.94	0.74	13.08
Ayrshire	520	5760	3.95	3.48	4.60	0.72	12.77
Guernsey	500	5270	4.72	3.75	4.71	0.76	14.04
Jersey	430	5060	5.13	3.98	4.83	0.77	14.42
Shorthorn	530	5370	4.00	3.32	4.89	0.73	12.9

http://www.foodsci.uoguelph.ca/dairyedu/intro.html

Bacteria can increase in raw milk due to poor milking methods, inadequate cleaning of milk equipment, poor cooling and in some cases, as a result of mastitis. Good quality raw milk is required to make good quality dairy products. Once raw milk is defective, it cannot be improved during processing, and defects often become more pronounced. There are many factors that can influence the quality of raw milk, many of which are tested for. Good production and herd management practices help ensure low bacteria counts and reduce the risk of the presence of pathogens in the raw milk. While the legal limit for total bacteria in farm raw milk is 400,000/ml (Anonymous, 2006), milk with counts of 10,000 or less is considered to be of desirable quality. Microbial contamination can generally occur from three main sources from within the udder, from the exterior of the udder and from the surface of milk handling and storage equipment. The health and hygiene of the cow, the environment in which the cow is housed and milked, and the procedures used in cleaning and sanitizing the milking and storage equipment are all key in influencing the level of microbial contamination of raw milk. Equally important are the temperature and length of time of storage which allow microbial contaminants to multiply and increase in numbers.

In general, these quality programs and systems are quality control, quality assurance, and quality management. Milk quality is all about prevention on each step of production. Quality control systems aimed the prevention of defects, rather than their detection. Quality control occurs at every step in the production,as a raw material on farm condition. Consumers, processors and regulatory agencies are increasingly interested in the safety and wholesomeness of milk resulting in increased emphasis on the farm management to insure the production of milk quality. Despite technical advances in milk processing, the quality of milk is still determined at the dairy farm. Milk quality is milk produced to predetermined standards. Measurements such as bacteria levels, somatic cell count, butterfat, protein and others are dependent upon management strategies implemented in the milking parlor.

A variety of diagnostic tests are routinely used to evaluate milk quality on dairy farms. Tests such as bulk milk bacterial counts, bulk tank somatic cell count and tests for adulterants such as water, sediment or antibiotics are routinely used by regulatory agencies. Other tests such as individual cow somatic cell count values, *Staphylococcus aureus* milk antibody tests, the California Mastitis test, milk conductivity and milk microbiology are often used diagnostically to investigate milk quality problems.

Veterinarians also use various types of antibiotic susceptibility tests to help guide mastitis treatment decisions (Ruegg, 2002). The raw milk quality parameters, testing procedures and limits and how they may influence the quality of dairy products were summarized by many studies (Hullar and Brand 1993; Ruegg, 2002; Anonymous, 2006)

Demands on quality by milk processor has always been a central point of the professional discussion and is today more relevant than ever. The term "quality" encompasses every trait of importance and of demand by processors or customers. Quality can be defined as "conformance to requirements." Someone sets the standards; the product or service then meets those specifications. Quality then is a value, a philosophy, and a system within which there is a conscious effort to meet goals or requirements. The consumer demands safe and wholesome dairy products that can be purchased without any doubt. For raw milk the term quality is extremely comprehensive. There is a quality pyramid based for dairy products based on these kinds of perimeters. In summary, firstly the basic foundation of this pyramid is about the safety of these products, the second is the nutritional value and thirdly there must be the service to satisfy consumers for the long term. Some of the most important quality aspects are:

- Quality of content and physical-chemical condition
- Hygiene quality: bacteriological and cytological traits, absence of pathogens and other contaminants
- Sensorial quality
- Nutritional quality
- Technological quality (processing ability)

Every milk processor, but especially the producer of trade mark products has very specific demands on raw milk quality. Demands are product dependent and thus they can vary. Therefore the concept of "raw milk quality - product dependent" does not indicate that for example raw milk used for producing milk powder can have a lower level of quality. It rather indicates that especially premium cheese producers have to consider a wider spectrum of the complex system of raw milk quality. Within the group of cheese producers again there are differences in relation to perception of raw

milk quality, if we only think about raw milk cheese processing.

The production of cheese is a complicated transfer process of milk and demands that the milk used fulfils all quality demands related to cheese making. Important aspects here are the whole milk content, physical and chemical conditions, no water adulteration, absence of antibacterial agents and many other aspects.

Dairy and Quality

The food industry, like many other industries, has used basic quality control programs, and more complex quality assurance programs and quality management systems, in its efforts to achieve food quality. These programs and systems can include components that are devoted specifically to food safety. For instance, any quality control system can be integrated into a food industry, quality management system, or inspection and monitoring of materials, products, and processes for food safety hazards can be part of a quality control program. International Organization for Standardization's ISO 9000 encompasses all the activities of a company to ensure that it meets its quality objectives, while HACCP (Hazard Analysis and Critical Control Point) is directed towards ensuring food safety. The ISO 9000 standards were brought by the International Organization for Standardization (ISO) and the HACCP standards by the Codex Alimentarius Commission (CAC). These standards have assumed importance worldwide both as an essential requirement to tap the market potential and as a marketable feature of the company. Since the global market has become more demanding in terms of quality, safety and timely delivery, installation of the ISO 9000 Quality Management System and HACCP by the food industry is essential for getting a competitive international edge

Vagany et al. (2006) were determined five critical control points in their study. These critical control points were reported as starting of production (chemical hazard), formation of cow groups (cows at the same production level) (Biological hazards), examination of milk, filtration of milk (physical hazard) and cooling. Rodrigues (2005) reported that herds did not discuss milk quality frequently with dairy professionals, and herds having greater bulk milk SCC reported less consultation with their herd veterinarian. Adoption of standardized protocols and frequent training of dairy operators resulted in greater milking performance and lower estimates of clinical mastitis. Protocols should describe tasks and define management procedures. Frequent training of personnel was an important practice used to achieve high quality milk.

The theories of HACCP have not been applied to live animal production units (Cullor, 1997), which may become problematic for animal and plant agriculture if various groups begin demanding that such programs be implemented on the farm. An important definition is that of a critical control point—a point, step, or procedure at which control can be applied and a food safety hazard can be prevented, eliminated, or reduced to an acceptable level.

Correct implementation of the HACCP principle requires that scientifically documented steps and preventive measures exist that can be effectively applied at known critical control points. At present, determination of critical control points may be possible for on-farm implementation for chemical or physical hazards. These areas currently are essentially addressed by current livestock quality assurance programs (e.g., poultry, swine, beef, and dairy). However, potential biological hazards that may exist on the dairy or other production units do not have well-known critical control points. It may be easy to outlaw the presence of bacteria, viruses, and parasites on the farm, but this rule will be hard to enforce.

There are opportunities at present to develop HACCP plans to address concerns about chemical residues (e.g., antibiotics, herbicides, or pesticides in milk or cull cows). Until critical control points for zoonotic diseases are known, the dairy industry can adapt and implement good dairy practices to aid in managing animal health problems and to begin addressing pathogens of disease. On-farm procedures to monitor the presence of emerging and reemerging human pathogens will need to be established in the near future. Probable critical control points on the farm for many of these human pathogens will be housing and bedding, water and waste management areas, hospital pens, calving pens, treatment areas, bulk tank milk, and young stock and cull animals. By adapting a national standard of good dairy practices for the production of milk and dairy beef, many worries surrounding potential chemical and microbial residues leaving the production unit can be alleviated through documentation and education.

On-farm HACCP programs for chemical or physical hazards are possible to develop and implement. However, it is currently difficult to improve food safety substantially using HACCP on the farm. For instance,

no current scientific evidence supports any of the control points available on the farm for implementation to reduce or eliminate the hazard of *E. coli* O157:H7 (ECO157: H7). The key features that are necessary to eradicate a pathogen (e.g., a single host, no wildlife reservoir, production of identifiable clinical disease, and availability of a cost efficient diagnostic assay) do not exist for *E. coli* O157:H7.

Results

Producers may gain financially from shipping higher quality milk (quality premium) or better quality market cows; they may reduce their risk of infectious diseases, production losses or meat/milk residues through conscientious participation in quality assurance program. There are no guarantees of increased profit through this quality assurance program, but many progressive dairy producers are expressing interest in improved marketability of their products and reduction of risk. The quality assurance program may be the answer for these producers

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