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Assessment of the hygienic quality of the surfaces in the dairy industry using "Contact Slide TM" and swab test

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Abstract

Microbiological hygiene in food production and processing aims to protect the consumer from pathogenic agents and assure food quality. Techniques and practices in the food industry have evolved to aid formal quality control systems in meeting international or company standards for total quality management systems as well as customer demands. HACCP (hazard analysis critical control point) systems and good hygiene practices are very important in meeting these obligations at an affordable cost, without compromising safety, quality, or service to the customer. The purpose of our study is to identify microbial risks by controlling process surfaces in dairy industry production areas. Our study focused on the analysis of 120 surface samples for the counting of Total Aerobic Bacteria using "Contact Slides" and swabbing from stainless steel surfaces in accordance with ISO 18593. In hygiene control, the Total Number of Bacteria and Enterobacteria provides an estimate of the level of contamination risk during production. The study was conducted in 4 milk establishments, respectively with 30 samples. The results showed a low hygienic quality, proving that 72 samples showed high levels of microbial contamination. 58 samples resulted in <50 CFU/24 cm^2, 49 samples 101-1,000 CFU/24 cm^2 and 23 > 1,000 CFU/24 cm^2. This situation necessarily requires the revision of the health protocols of these surfaces. Only in this way can the public health risk, caused by the consumption of milk ilk products, be produced in low hygienic conditions.

Keywords: Contact slide; swabbing; HACCP; contact surface.

1. Introduction

In any food processing environment, food waste in the production area can encourage and facilitate survival and growth of microorganisms, providing protection from the direct action of sanitizers and disinfectants and / or by providing a nutritious medium for the growth [2]. In Food Business Operators (FBOs), cleaning schedules are designed to reduce both food debris and microorganisms to a level that poses minimal risk to the safety or quality of the product [8]. An inadequately cleaned surface can, if in contact with food, lead to cross contamination and contribute to a product's microbial load [12]. This may result in a reduction of shelf life, but perhaps more disturbing is the possible presence of pathogens, especially those with a minimal infectious dose. Cross contamination has been identified as an important contributory factor in 39% of general foodborne disease outbreaks recorded in Europe [16]. Consequently, Hazard Analysis Critical Control Point (HACCP) based food safety management systems together with supporting prerequisite programs (PRPs) recommend that adequate cleaning and sanitation protocols must be in place to prevent contamination of the product during Processing [14]. However, studies have shown that the effectiveness of cleaning within the food industry is variable, indicating the need for assessment of the cleaning schedule [15]. It has been suggested that there is a clear legal obligation for food premises to be kept clean [14] and that every producer has the responsibility to identify, document, set up and monitor an appropriate cleaning program for all food-contact surfaces [6]. However, because there is no ideal method for determining the degree of surface cleanliness, there is no standard protocol for surface hygiene monitoring [5]. Traditionally, microbiological methods such as hygiene swabbing or agar contact plates are used to detect bacteria in the food-contact

surfaces [11]. Therefore, the results are retrospective and as such have limited value in preventative, proactive food management systems such as HACCP, which require that hygiene monitoring provide results rapidly to be applied for corrective action [3, 4]. Quantitative analysis in laboratory microbiological quality testing of surfaces aim to determine the number of microorganisms present for surface unit or per cm^2. Quantitative analysis aims to evaluate the burden of "indicator" microorganisms, whose high amount indicates a low hygiene. In hygienic control, the total number of bacteria and enterobacteria provides an assessment of the risk of contamination level during production. Qualitative analyzes are used to identify pathogenic microorganisms (eg *Salmonella spp* and *Listeria monocytogenes*). The result is expressed only as presence or absence of pathogen required on an area. This accomplished on the working surfaces aims to individualize the reservoirs of product contamination. As noted above one of the main goals, even as the main microbiological control of working surfaces, is the verification of the effectiveness of cleaning and disinfection operations It is possible that after the disinfection at the end of the work, traces of the disinfectant on the surfaces still remain. Possible residues may have a negative effect on the growth of bacteria taken from the surface and to eliminate the interference caused by disinfectant residues that could lead to an underestimation of the microbial population present, we must neutralize the antibacterial effects of disinfectants [13]. This is achieved by adding to the dilution solution or to agar medium RODAC/Contact Sile TM plates, appropriate amounts of substances that inactivate several different classes of disinfectants. There are available inactivation compounds capable of simultaneously neutralizing the antibacterial effects of more usable disinfectants in the market, which are used as a dilute solution if there is suspicion of disinfectant residual [8, 12].

2. Material and Methods

The sampling method and test procedure were carried out in accordance with ISO 18593-2004. The study was conducted in 4 milk establishments, through testing of 120 samples, respectively with 30 surface samples for the counting of Total Number of Bacteria. "Contact Slides TM" and swabb test from stainless steel surfaces from three pieces of equipment including raw milk transportation tank, raw milk cooling tank, and milk centrifuge.

2.1. Microbiological Sampling of Stainless Steel Surfaces:

2.1.1 Swabbing test

Sterile dacron swabs were moistened in sterile 1/4-strength Ringer solution (Oxoid) immediately before use, and a previously described standard surface swabbing protocol [6] was used to sample the surface. The swabs were then either streaked directly onto the surface of pre-poured PCA plates (spread plates) or snapped off into 10 ml 1/4 strength Ringer solution and vortexed for 10 s to release the bacteria from the bud before 1 ml PCA pour plates were prepared. All plates were incubated at 30°C for 24 h.

2.1.2 Flexible "Contact Slide TM" Method

Flexible "Contact Slide TM" method was also used to sample stainless steel surfaces (Verran, J. et al 2010). Each slide contained nutritional medium on both sides: On one side Plate Count Agar - a general growth medium that detects a consistent number / total in food mainly used in the dairy industry and the other VRBG - specific for the detection of the *Enterobacteriaceae* type, featuring pink / purple colonies. The advantage of using "Contact Slide TM" is the presence in medium of a neutralizer for possible residues of disinfectants / detergents used for surface cleaning. This provides accurate readings after their incubation. Choosing two different mediums on both sides of the slide, allowed two surfaces to be sampled for two indicators simultaneously, or selecting different surfaces with each slide. Slide testing is a sure, reliable, economical and rapid indicator of the presence of microorganisms. The use of this technique provides a larger area of contact. Each side of a slide evaluates approximately 2 1/2 × 5 cm and both sides were pressured for a few seconds in order to gain material across the surface of 24 cm2. The slides were then incubated at 30 ° C for 24 to 48 hours.

3. Results and Discussion

Reference standards, understood as values that inform about the quality of the processing and the wellness of the food, are taken from: Albanian and / or European norms (these are mandatory values that should not be exceeded); authoritative sources (scientific literature or guidelines of accredited bodies as International Commission on Microbiological

Specification for Foods, WHO). Contamination criteria of food contact surfaces associated with Total Number of Bacteria expressed in CFU / 24 cm^2 consider a good hygienic condition, values <50, those of 101 to 1000 and > 1000 as a high microbial burden and consequently low hygienic quality, or otherwise, high contamination risk for food products in contact with these surfaces. The results obtained by using Contact Slide TM showed a low hygienic quality of the three selected surfaces (crude milk transport tanks, cooling tanks and milk centrifuges), confirming that 72 samples presented high levels of microbial contamination. 58 samples resulted in <50 CFU/24 cm^2, 49 samples 101-1,000 CFU/24 cm^2 and 23 samples > 1,000 CFU/24 cm^2. Meanwhile, using swabs, a slight recovery of bacterial content of the surfaces after inoculation and incubation was observed, showing that only 56 samples were above allowed values.

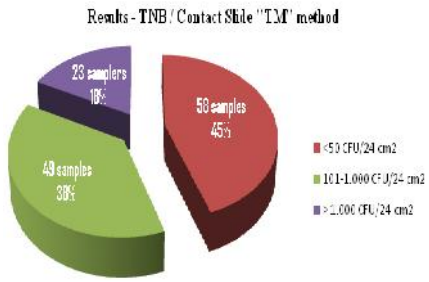

Figure 1. Results for Total Number of Bacteria with the Contact Slide "TM" method.

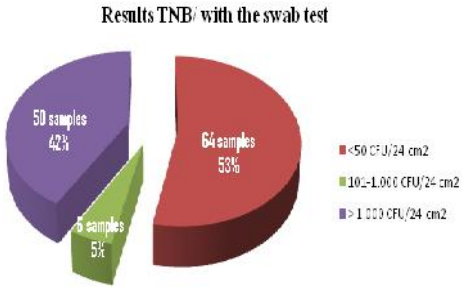

Figure 2. Results for Total Number of Bacteria with the swab test.

Compromising of good hygiene almost always results in the creation and spread of pathogenic microorganisms as well as food damage from the contact and processing surfaces. This leads to contamination of products with dangerous microorganisms, making them unsafe for human consumption [1, 8]. Good hygiene practices are a primary preventive measure and monitoring their effectiveness not only provides an early warning of possible problems, but are also evidence of proper care. Good hygiene practices (GHPs) are essential to guarantee food safety. Their application is required by law in accordance with national and international food hygiene rules and are often considered as prerequisites for food safety systems based on Hazard Analysis and Critical Control Points (HACCP) [7, 10]. At the national level, the implementation of the Instruction no. 20, dated 25.11.2010 "On the Implementation of Preliminary Programs, Good Hygiene Practices, Good Manufacturing Practices and Procedures based on Hazard Analysis and Critical Control Points (HACCP) in Food Establishments" and Instruction no. 22, dated, November 25, 2010 "On general and special hygiene conditions for food establishments and food business operators", necessarily requires sampling and testing of surfaces in contact with food, not only as an obligation for FAO within the framework of official control/autocontrol, but also as a guarantee to the Albanian consumer. The situation verified in our study, necessarily requires the revision of the sanitation protocols of these surfaces in 4 dairy establishments. Only in this way the risk to public health from the consumption of milk/derivatives produced in low-quality hygienic facilities can be prevented. Referring to contemporary reports and experiences [16, 17], this study provides a critical comment on the use of methods for verifying the efficiency of surface sanitation operations in contact with food, proposing the application of the bioluminescence method as a very effective way of "photographing" and obtaining quite rapidly the result of the surfaces, thus enabling rapid intervention to correct the critical points in the Food Business Operators.

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