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EVALUATION OF CLEANING AND DISINFECTION PROGRAMS FOR PRODUCTION OF HIGH QUALITY MILK AT DAIRY FARM LEVEL

BY

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ABSTRACT

The present study was carried out in a dairy farm in Abou Homous district at El-Behera Governorate in Egypt, for study the effect of cleaning and disinfection on the production of high quality milk. This work was planed by using three programs of cleaning and disinfection on sixteen dairy cows free from intramammary infection secured under the same circumstances. The three programs were farm program, cleaning with quaternary ammonium compound (QACs), and cleaning with Iodophores. The efficiency of the three programs was evaluated by bacteriological examination of individual milk samples and bulk tank milk in addition to swabs which were taken from different sites of milking machine including teat cups, pipeline, milk jars and milk tank before and after application of disinfectant programs. The mean total viable bacterial counts (cfu/ml) in individual cow milk samples by application of farm program, QACs and Iodophores were $1.8 \times 10^4 \pm 3.08$, $1.8 \times 10^4 \pm 2.8$ and $1.7 \times 10^4 \pm 1.53$, respectively while, the respective mean in bulk milk were $8.0 \times 10^6 \pm 2.33 \times 10^2$, $1.3 \times 10^6 \pm 7.1 \times 10$ and $2.72 \times 10^6 \pm 1.24 \times 10^2$. By application of farm program, QACs and Iodophores, Total viable bacterial counts were reduced to 96.45, 98.33 and 94.58; 94.34, 97.02 and 95.14; 94.46, 97.50 and 95.58 and 94.50, 97.86 and 97.50 %, respectively in teat cups, milk pipelines, milk jars and tank milk. The mean Coliform counts (cfu/ml) of individual cow milk samples during application of farm program, QACs and Iodophores were $5.5 \times 10^3 \pm 1.17$, $8.8 \times 10^3 \pm 1.7$ and $6.8 \times 10^3 \pm 2.31$, respectively while, the respective mean in bulk milk were $4.1 \times 10^6 \pm 2.6 \times 10^2$, $5.2 \times 10^5 \pm 2.4 \times 10$ and $1.3 \times 10^6 \pm 5.9 \times 10$. Coliforms were suppressed by 95.58, 98.97 and 93.81; 96.23, 99.17 and 94.93; 95.28, 97.88 and 97.22 and 94.88, 96.05 and 98.72 %, respectively. The mean value of *Enterococci* counts (cfu/ml) in individual cow milk samples by application of farm program, QACs and Iodophores were $2 \times 10^3 \pm 0.36$, $3.2 \times 10^2 \pm 0.6$ and $3 X 10^3 \pm 0.54$, respectively while, the respective means in bulk milk were $1.9 \times 10^5 \pm 5.0 \times 10$, $3.3 \times 10^4 \pm 0.3 \times 10$ and $2.8 \times 10^4 \pm 0.6 \times 10$. The reduction percentages for *Enterococci* counts of teat cups, milk pipelines, milk jars and bulk tank after using farm program, QACs and Iodophores were 96.42, 96.52 and 96.73; 96.11, 73.33 and 94.00; 98.38, 97.77 and 95.57 and 96.25, 97.64 and 95.70%, respectively.

The means of *Staphylococcus aureus* count (cfu/ml) in individual cow milk samples after application of farm program, QACs and Iodophores were $2.8 \times 10^3 \pm 0.47$, $2.5 \times 10^3 \pm 0.42$ and $3 X 10^3 \pm 0.36$, respectively while, the respective mean in bulk milk were $2.1 \times 10^4 \pm 0.6 \times 10$, $3.1 \times 10^4 \pm 4.7$ and $3.8 \times 10^4 \pm 1.0 \times 10$, respectively. *Staphylococcus aureus* in teat cups, milk pipelines, milk jars and tank milk was reduced by 96.92, 97.33 and 96.45; 96.41, 99.50 and 71.79; 97.33, 98.92 and 97.33 and 96.80, 97.86 and 96.22 %., respectively.

Our results concluded that the great efficiency results were obtained by application of QACs as they were absorbed readily to inert surfaces and appeared to adhere to the surface of microorganisms than other most other sanitizers used in dairy industries. So, it can be recommended

INTRODUCTION

Dairy animals are normally milked twice daily, and the milking machine has to be cleaned after each milking. Because of the complexity of milking machines and some of their components, cleaning and, in particular, disinfection may not fully effective. So that milk residues and associated bacteria are not completely removed from the equipment and tend to accumulate daily. Except in very cold weather bacteria multiply in the equipment between milking and their numbers may increase more rapidly than visible residues. Unfortunately, bacterial contamination can not be determined simply by inspection (Bramley and Mckinnon, 1990).

The various utensils used for milking and handling are considered the most important sources from which bacteria may gain entrance to milk (Foster *et al.*, 1983).

If constant care is given through cleaning and sanitation of the equipment, milk of high bacteriological quality can be produced consistently. Consequently the shelf-life of the dairy products depends upon effective program to assure that all product-contact surfaces of equipment are properly cleansed and sanitized.

Quaternary ammonium compounds (QACs) are highly effective against vegetative bacteria and some fungi but not against spores. They are inactivated by protein, by a variety of natural and plastic materials and by anionic detergents and soap. Iodophores are effective against vegetative bacteria, spores, fungi, and both lipid containing and non-lipid containing viruses. They are rapidly inactivated by proteins and to a certain extent by natural and plastic substances and are not compatible with anionic detergents. They are active as long as they remain brown or yellow. Iodophores are relatively harmless to skin but some eye irritation may be noticed after their application (Collins *et al.*, 1995).

MATERIALS AND METHODS

The present study was carried out in a dairy farm at Abou Homous district in El-Behera province. Sixteen dairy cows free from intramammary infection, housed in free stables, sandy ground and fed on the same ration were selected for study the effect of cleaning and disinfection on production of high quality milk.

Collection of samples:

Swabs:

Cotton swabs were prepared from non-absorbent cotton with a length of 2 cm and thickness of 0.5 – 1 cm on stiff stainless steel wire. The swabs kept in their tubes which contain each 10 ml of quarter strength Ringer's solution then autoclaved (Harrigan and McCance, 1976).

Teat cups: Swabs were taken from the four teat cups and then pooled as one sample.

Pipelines: After removal of the rubber from the milk jars, swabs were taken from milk pipelines both rubber and stainless steel and the junctions between them. The samples were pooled as one sample.

Milk jars: Samples were taken from the upper and lower poles of the jars then one pooled sample was made.

Bulk tank milk: The samples were taken from different sites of the tank using a prepared sterile cotton swab, and then pooled to one sample.

Milk samples:

Individual animal milk samples (Boddie and Nickersonn, 1990): Udder was washed with running water, dried with individual paper towel. The fore milk was discarded then an individual milk sample (50 ml) from each cow teat was taken in a sterile MacCarteny tube.

Bulk tank milk samples: Samples of milk from the bulk milk tank were collected in a sterile milk sample bottles (250 ml).

Application of Sanitizers:

Iodophores:

The commercial preparation used was Iodophores 1% (1 liter/200 liter H_2O at 37°C in closed system for 15 minutes).

Quaternary ammonium chloride:

The commercial preparation used was Quaternary active sterilizer (2 ml/liter H_2O at 70°C in closed system for 15 minutes).

** The collected samples were repeated before and after application of farm program, Iodophores and QACs for a period of 6 weeks to each program.

Preparation of 10-fold serial dilution (APHA, 1992):

One ml of swabbing solutions and milk samples were added to 9 ml sterile saline solution and thoroughly mixed to make a dilution of 1:10 from which decimal dilution were prepared.

Microbiological examination:

All the previously prepared samples from swabbing and milk samples were examined for:

- Total viable bacterial count (TVBC) according to APHA (1992).
- Coliforms count (most probable number, MPN/ml) according to Harrigan (1998).
- *Staphylococcus aureus* count according to I.C.M.S.F. (1986).
- *Enterococci* count according to Efthymiou *et al.* (1974).

DISCUSSION

In most countries, the bacterial content is considered as one of the main factors in evaluation and determination the level of payment for milk. Cleaning and disinfection are complementary processes; neither process alone will achieve the desired end result. High quality milk with low bacterial and somatic cell counts cannot be produced unless milking equipment are effectively cleaned and disinfected between milking as well as the cows are kept healthy (Hayes, 1992).

Total viable bacterial count (TVBC):

Total viable bacterial count is an index of the effectiveness of sanitary procedures of milk machine and ignorance of the residents toward the fundamental aspects of good and safe house keeping of dairy animal as well as possible presence of subclinical mastitis (Leues *et al.*, 2003).

Table (1) showed that the means of total viable bacterial counts (cfu/ml) in individual cow milk samples by application of farm program, QACs and Iodophores were $1.8 \times 10^4 \pm 3.08$, $1.8 \times 10^4 \pm 2.8$ and $1.7 \times 10^4 \pm 1.53$, respectively while, the respective means in bulk milk were $8.0 \times 10^6 \pm 2.33 \times 10^2$, $1.3 \times 10^6 \pm 7.1 \times 10$ and $2.72 \times 10^6 \pm 1.24 \times 10^2$.

By application of farm program, QACs and Iodophores, total viable bacterial counts reduced by 96.45, 98.33 and 94.58; 94.34, 97.02 and 95.14; 94.46, 97.50 and 95.58; 94.50, 97.86 and 97.50%, respectively in teat cups, milk pipelines, milk jars and milk tank (Table 2).

This means that Iodophores and QACs were efficient on TVBC in comparison with the farm program. QACs are more efficient on TVBC than Iodophores.

Some machines are heavily contaminated, probably because of faults in design, incorrect layout of components, incorrect adjustments leading to an unbalanced flow of solutions or the use of solutions that are not hot enough. Thus numbers of microorganisms recovered by rinsing these machines ranged from $< 5.0 \times 10^5$ to $> 1 \times 10^9$ cfu/ml (Robinson, 2002).

Coliforms:

Table (1) showed that the means of Coliform counts (cfu/ml) in individual cow milk samples after application of farm program, QACs and Iodophores were $5.5 \times 10^3 \pm 1.17$, $8.8 \times 10^3 \pm 1.7$ and $6.8 \times 10^3 \pm 2.31$, respectively while, the respective means in bulk milk were $4.1 \times 10^6 \pm 2.6 \times 10^2$, $5.2 \times 10^5 \pm 2.4 \times 10$ and $1.3 \times 10^6 \pm 5.9 \times 10$, respectively.

Coliforms were suppressed in a percent of 95.58, 98.97 and 93.81; 96.23, 99.17 and 94.93; 95.28, 97.88 and 97.22 and 94.88, 96.05 and 98.72 % in the previously three programs, respectively (Table, 3).

Coliform counts provides an indication of both the effectiveness of cow preparation procedures during milking and the cleanliness of the cow environment as a major source of Coliforms in bulk tank milk is transportation of contaminated soil from the teats and udders into the milking machine. Although the Coliform organisms could able to incubate on residual films of milking equipment, however its counts less than 10cfu/ml indicate excellence in both pre-milking hygiene and equipment sanitation (Reinemann, 2002).

Table (6) revealed that after application of farm program, QACs and Iodophores programs, the isolated bacterial strains from different sites of milking machine were reduced with a various percentages.

From the previous results, it is clear that QACs is more efficient on Coliforms than Iodophores while, both of them could not be able to eliminate their presence and subsequently their dangers.

***Enterococci* count:**

Table (1) showed that the means of *Enterococci* counts (cfu/ml) in individual cow milk samples after application of farm, QACs and Iodophores programs were $2 \times 10^3 \pm 0.36$, $3.2 \times 10^2 \pm 0.6$ and $3 \times 10^3 \pm 0.54$, respectively while, the respective means in bulk milk were $1.9 \times 10^5 \pm 5.0 \times 10$, $3.3 \times 10^4 \pm 0.3 \times 10$ and $2.8 \times 10^4 \pm 0.6 \times 10$

The reduction percentages for *Enterococci* counts of teat cups, milk pipelines, milk jars and tank milk and bulk tank milk after using farm, QACs and Iodophores programs were 96.42, 96.52 and 96.73; 96.11, 73.33 and 94.00; 98.38, 97.77 and 95.57; 96.25, 97.64 and 95.70%, respectively (Table, 4).

It could be concluded that both Iodophores and QACs were efficient in suppression of *Enterococci* counts. These results are in agreement with that obtained by Katie and Stojanovic (1990) who used Iodophores sanitation of milking machine in concentration of 20 ppm available iodine. They reported that Iodophores had a good bactericidal effect against *Strept. agalactiae, Strept. dysgalactiae,* and *Strept. uberis.*

***Staphylococcus aureus* count:**

Table (1) showed that the means *Staphylococcus aureus* counts (cfu/ml) in individual cow milk samples by application of farm program, QACs and Iodophores programs were $2.8 \times 10^3 \pm 0.47$, $2.5 \times 10^3 \pm 0.42$ and $3 \times 10^3 \pm 0.36$, respectively while, the respective means in bulk milk were $2.1 \times 10^4 \pm 0.6 \times 10$, $3.1 \times 10^4 \pm 4.7$ and $3.8 \times 10^4 \pm 1.0 \times 10$.

Staphylococcus aureus in teat cups, milk pipelines, milk jars and tank milk was reduced by 96.92, 97.33 and 96.45; 96.41, 99.50 and 71.79; 97.33, 98.92 and 97.33 and 96.80, 97.86 and 96.22 %., respectively (Table, 5).

From the previous results, it could be observed that Iodophores program is more efficient than QACs program in controlling *S. aureus*. This result is in accordance with that obtained by Babakhanyan and Asatryan (1990) who found that a 0.1% solution QACs has bactericidal effect on *S. aureus* when it exposed for 10 min at 20 °C. They concluded that QACs are recommended for use in combination with surface active agents for cleaning and disinfection of dairy equipment.

It could be concluded that QACs program is more efficient on TBC, Coliforms, *Enterococci*, *S. aureus* counts. QACs more efficient preferable than Iodophores as after disinfection surfaces treated with QACs retain a bacteriostatic film due to the absorption of the disinfectant on the surface; this film prevents the subsequent growth of residual bacteria (Hayes, 1992).

Microbial attachment and biofilm formation to solid surface provide some protection of the cells against physical removal of the cells by washing and cleaning. These cells seem to have greater resistance against sanitizers and heat. Thus spoilage and pathogenic microorganisms attached to surfaces can not be easily removed by washing, and later they can multiply and reduce the stability of dairy products (Wong, 1998 and Ray, 2001).

Table (1): Statistical analytical results of bacteriological counts (cfu/ml) of individual cows and bulk milk using different programs:

Counts		Farm program (Mean ± SEM)	QACs program (Mean ± SEM)	Iodophore program (Mean ± SEM)
Total bacterial count	(I)*	$1.8 \times 10^4 \pm 3.08$ a	$1.8 \times 10^4 \pm 2.8$ a	$1.7 \times 10^4 \pm 1.53$ a
	(B)**	$8.0 \times 10^6 \pm 2.33 \times 10^2$ a	$1.3 \times 10^6 \pm 7.1 \times 10$ c	$2.72 \times 10^6 \pm 1.24 \times 10^2$ b
Coliform count	(I)	$5.5 \times 10^3 \pm 1.17$ a	$8.8 \times 10^3 \pm 1.7$ a	$6.8 \times 10^3 \pm 2.31$ a
	(B)	$4.1 \times 10^6 \pm 2.6 \times 10^2$ a	$5.2 \times 10^5 \pm 2.4 \times 10$ c	$1.3 \times 10^6 \pm 5.9 \times 10$ b
Enterococci count	(I)	$2 \times 10^3 \pm 0.36$ a	$3.2 \times 10^2 \pm 0.6$ a	$3 \text{ X } 10^3 \pm 0.54$ a
	(B)	$1.9 \times 10^5 \pm 5.0 \times 10$ a	$3.3 \times 10^4 \pm 0.3 \times 10$ b	$2.8 \times 10^4 \pm 0.6 \times 10$ b
S. aureus count	(I)	$2.8 \times 10^3 \pm 0.47$ a	$2.5 \text{ X } 10^3 \pm 0.42$ a	$3 \times 10^3 \pm 0.36$ a
	(B)	$2.1 \text{ X } 10^4 \pm 0.6 \text{ X } 10$ a	$3.1 \times 10^4 \pm 4.7$ a	$3.8 \times 10^4 \pm 1.0 \times 10$ a

* Individual cows ** bulk milk

Table (2): Statistical analytical results of total bacterial counts (cfu/ml) of different parts of milking machine before and after using different programs:

programs		Teat cups (Mean ± SEM)	R*** %	Pipeline (Mean ± SEM)	R%	Milk jars (Mean ± SEM)	R%	Bulk tank milk (Mean ± SEM)	R%
Farm system	(before)*	$7.9 \times 10^5 \pm 82.3$		$2.3 \times 10^6 \pm 9.3x10$		$2.8x10^6 \pm 2.8x10^2$		$1.2 \times 10^6 \pm 2.11x10^2$	
	(after)**	$2.8 \times 10^4 \pm 7.5$	**96.45**	$1.3 \times 10^5 \pm 8.5$	**94.34**	$1.55 \times 10^5 \pm 2.4x10$	**94.46**	$6.6x10^4 \pm 1.1x10$	**94.50**
QACs	(before)	$9.6 x10^5 \pm 1.6x10^2$		$1.4x10^6 \pm 1.8x10^2$		$9.6 x10^5 \pm 8.8x10$		$4.6x10^6 \pm 6.0x10^2$	
	(after)	$1.6x10^4 \pm 3.6$	**98.33**	$4.16x10^4 \pm 7.9$	**97.02**	$2.4x10^4 \pm 4.2$	**97.50**	$9.8x10^4 \pm 1.0x10^2$	**97.86**
Iodophore	(before)	$1.2x10^6 \pm 3.8x10^2$		$3.5x10^6 \pm 7.1x10^2$		$1.2x10^6 \pm 2.5x10^2$		$9.8x10^5 \pm 1.0x10^2$	
	(after)	$6.5x10^4 \pm 3.7x10$	**94.58**	$1.7x10^5 \pm 2.8x10$	**95.14**	$5.3x10^4 \pm 1.2x10$	**95.58**	$4.4x10^4 \pm 8.4$	**97.50**

* before application programs ** after application of programs *** Reduction percent

Table (3): Statistical analytical results of Coliforms counts (cfu/ml) of different parts of milking machine before and after using different programs:

Programs		Teat cups (Mean ± SEM)	R %	Pipeline (Mean ± SEM)	R%	Milk jars (Mean ± SEM)	R%	Bulk tank milk (Mean ± SEM)	R%
Farm system	(before)	$1.2x10^5 \pm 2.3x10$		$8.5x10^5 \pm 2.1x10^2$		$1.4x10^6 \pm 1.8x10^2$		$4.5x10^5 \pm 1.5x10$	
	(after)	$5.3x10^3 \pm 98$	**95.58**	$3.2x10^4 \pm 9.45$	**96.23**	$6.6x10^4 \pm 8.4$	**95.28**	$2.3\ x10^4 \pm 8$	**94.88**
QACs	(before)	$3.5x10^5 \pm 4.5x10$		$6.8x10^5 \pm 9.4x10$		$4.3x10^5 \pm 2.8x10$		$1.9\ x10^6 \pm 3.4x10^2$	
	(after)	$3.6x10^3 \pm 1.22$	**98.97**	$5.6x10^3 \pm 1.4$	**99.17**	$9.1x10^3 \pm 2.5$	**97.88**	$7.5x10^4 \pm 1.5x10$	**96.05**
Iodophore	(before)	$5.5x10^5 \pm 2.9x10^2$		$1.5x10^6 \pm 3.1x10^2$		$3.6x10^5 \pm 8.3x10$		$2.2x10^5 \pm 6.7x10$	
	(after)	$3.4x10^4 \pm 2.7x10$	**93.81**	$7.6x10^4 \pm 2.3x10$	**94.93**	$1.0x10^4 \pm 3.87$	**97.22**	$2.8x10^3 \pm 1.2$	**98.72**

Table (4): Statistical analytical results of *Enterococci* counts (cfu/ml) of different parts of milking machine before and after using different programs:

programs		Teat cups (Mean ± SEM)	R %	Pipeline (Mean ± SEM)	R%	Milk jars (Mean ± SEM)	R%	Bulk tank milk (Mean ± SEM)	R%
Farm system	(before)	$2.8x10^4 \pm 5.42$		$1.8x10^5 \pm 1.2x10^2$		$3.1x10^4 \pm 9.45$		$4.8x10^4 \pm 0.4x10$	
	(after)	$1.0x10^3 \pm 0.36$	**96.42**	$7.0x10^3 \pm 4.25$	**96.11**	$0.5x10^3 \pm 0.33$	**98.38**	$1.8x10^3 \pm 0.6$	**96.25**
QACs	(before)	$4.6x10^4 \pm 9.8$		$3.0x10^4 \pm 8.5$		$3.6x10^4 \pm 7.5$		$3.4x10^4 \pm 6.66$	
	(after)	$1.6x10^3 \pm 0.49$	**96.52**	$0.8x10^3 \pm 0.4$	**73.33**	$0.8x10^3 \pm 0.3$	**97.77**	$0.8x10^3 \pm 0.3$	**97.64**
Iodophore	(before)	$4.6x10^4 \pm 5.5$		$6.0x10^4 \pm 1.1x10$		$7.0x10^4 \pm 6.8$		$1.0x10^5 \pm 1.9x10$	
	(after)	$1.5x10^3 \pm 0.3$	**96.73**	$3.6x10^3 \pm 1.1$	**94.00**	$3.1x10^3 \pm 0.65$	**95.57**	$4.3x10^3 \pm 1.55$	**95.70**

Table (5): Statistical analytical results of *Staphylococcus. aureus* counts (cfu/ml) of different parts of milking machine before and after using different programs:

programs		Teat cups (Mean ± SEM)	R %	Pipeline (Mean ± SEM)	R%	Milk jars (Mean ± SEM)	R%	Bulk tank milk (Mean ± SEM)	R%
Farm system	(before)	$2.6x10^4 \pm 6.14$		$1.7x10^5 \pm 2.44$		$3.0x10^4 \pm 8.56$		$2.5x10^4 \pm 2.29$	
	(after)	$0.8x10^3 \pm 0.4x10$	**96.92**	$6.1x10^3 \pm 0.86$	**96.41**	$0.8x10^3 \pm 0.4$	**97.33**	$0.8x10^3 \pm 0.3$	**96.80**
QACs	(before)	$3.0x10^4 \pm 5.7$		$2x10^4 \pm 3.64$		$2.8x10^4 \pm 0.6x10$		$6.1x10^4 \pm 1.4x10$	
	(after)	$0.8x10^3 \pm 0.3$	**97.33**	$0.1x10^3 \pm 0.16$	**99.5**	$0.3x10^3 \pm 0.2$	**98.92**	$1.3x10^3 \pm 0.33$	**97.86**
Iodophore	(before)	$3.1x10^4 \pm 3.07$		$3.9x10^4 \pm 1.0x10^2$		$3.0x10^4 \pm 2.58$		$5.3x10^4 \pm 8.43$	
	(after)	$1.1x10^3 \pm 0.4$	**96.45**	$1.1x10^4 \pm 3.54$	**71.79**	$0.8x10^3 \pm 0.4$	**97.33**	$2.0x10^3 \pm 0.36$	**96.22**

Table (6): Reduction percent of isolated bacteria from different parts of milking machine using different programs:

Strains	Teat cups			Pipeline			Milk jars			Bulk tank milk		
	Farm	Iodophore	QACs	Farm	Iodophore	QACs	Farm	Iodophore	QAC	Farm	Iodophore	QACs
Citrobacter spp.	75	86	75	72	91	83	76	89	88	58	88	75
E.coli	71	88	83	67	83	79	67	88	75	83	88	75
Klebsiella spp.	67	83	89	56	78	100	86	86	82	85	78	86
Proteus spp.	75	88	86	71	72	81	81	83	75	71	86	89
Shigella spp.	89	89	89	67	90	80	93	100	92	64	89	86
Ent. faecalis	88	88	88	85	83	90	79	86	86	75	100	75
Ent. facium	75	100	79	79	83.5	63	70	100	89	77	100	83
Ent. intermediate	57	100	100	67	83	82	80	100	100	92	100	100

Several reasons can account for the reduced sensitivity of the bacterial reduction within a biofilm. It may be reduced access of a disinfectant to the cells within the biofilm, chemical interaction between the disinfectant and the biofilm itself, modulation of the environment, production of derogative enzymes and neutralizing chemicals or genetic exchange between cells in a biofilm (Augustin *et al.*, 2004).

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تقييم برامج تنظيف وتطهير لإنتاج حليب عالي الجودة مستوى مزرعة الألبان

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الدراسة الحالية نُفذتْ في مزرعة ألبان في منطقةِ أبو حمّص في محافظةِ ألبحيرة في مصر، لدراسةِ تأثير التنظيف والتطهير على إنتاج الحليبِ العالي الجودةِ. هذا العمل تم تخطيطة بإستعمال ثلاثة مِنْ

برامج التنظيف والتطهير على ستّة عشرَ بقرةِ حلابة خلية من العدوى الإلتهابية موضـوعة تحـت نفـس الظروفِ. البرامج الثلاثة كَانتْ برنامجَ المزارعة farm program والتنظيف بمُركّبات الأمونيوم الربـاعي (QACs)، والتنظيف باستخدام مركبات الـ Iodophores. كفـاءة البـرامج الثلاثـة قُيّمـتْ بـالفحص البكتريولوجي لعيناتِ فرديةِ من الحليبِ وحليبِ التانكِ المجمع بالأضافة إلى المسحاتَ التي أُخِذت مِنْ مواقع مختلفةِ مِنْ آلةِ الحلب متضمنا كؤوس الحلمةِ وخطوط الأنابيب وأحواض الحليبِ وتنكات الحليبِ قَبلَ وبَعـد تطبيق برامج التطهير. متوسط العدد الكلي الحي (cfu / مليلتر) في العيناتِ الفرديةِ من حليبِ البقر بتطبيق برنامج المزارع والـ QACs والـ Iodophores كَانـت ١,٨ x ١٠^{٤} ± ٣,٠٨ و ١,٨ x ١٠^{٤} ± ٢,٨ و ١,٧ x ١٠^{٤} ± ١,٥٣ على التوالي بينما كان المتوسط المقابل الخاص بالحليب المجمع هو ٨,٠ x ١٠^{٦} ± ٢,٣٣ x ١٠^{٢} و ١,٣ x ١٠^{٦} ± ٧,١x ١٠ و ٢,٧٢ x ١٠^{٦} ± ١,٢٤ x ١٠^{٢} بتطبيـق برنـامج المزارع والـ QACs والـ Iodophores فإن العدد الكلي الحـي انخفـض بنسـبة ل٩٦,٤٥، ٩٨,٣٣ ، ٩٤,٥٨ و ٩٤,٣٤، ٩٧,٠٢ ، ٩٥,١٤ و٩٤,٤٦، ٩٧,٥٠ ، ٩٥,٥٨ و ٩٤,٥٠، ٩٧,٨٦، ٩٧,٥٠ % على التوالي في كؤوس الحلمات وخطوط أنابيب الحليب وأحواض الحليبِ وتنكات الحليبِ.

متوسط أعداد القولونيات (cfu / مليلتر) في العيناتِ الفرديةِ من حليبِ البقر أثناء تطبيق برنـامج المزارع والـ QACs والـ Iodophores كَانـت ٥,٥ x ١٠^{٣} ± ١,١٧ و ٨,٨ x ١٠^{٣} ± ١,٧ و ٦,٨ x ١٠^{٣} ± ٢,٣١ على التوالي بينما كان المتوسط المقابل الخاص بالحليب المجمع هو ٤,١ x ١٠^{٦} ± ٢,٦ x ١٠^{٢} و ٥,٢ x ١٠^{٥} ± ٢,٤x ١٠ و ١,٣ x ١٠^{٦} ± ٥,٩ x ١٠. تم تثبيط القولونيات بنسـبة ٩٥,٥٨، ٩٨,٩٧، ٩٣,٨١ و٩٦,٢٣، ٩٩,١٧، ٩٤,٩٣ و ٩٥,٢٨، ٩٧,٨٨، ٩٧,٢٢ و٩٤,٨٨، ٩٦,٠٥، ٩٨,٧٢ % على التوالي في كؤوس الحلمات وخطوط أنابيب الحليبِ وأحواض الحليبِ وتنكات الحليبِ بَعـد تطبيـق برامج المزارع والـ QACs والـ Iodophores كَانت.

متوسط أعداد الـ *Enterococci* الحية (cfu / مليلتر) في العيناتِ الفرديةِ مـن حليـبِ البقـر بتطبيق برنامج المزارع والـ QACs والـ Iodophores كَانت ٢,٠ x ١٠^{٣} ± ٠,٣٦ و٣,٢ x ١٠^{٢} ± ٠,٦ و ٣,٠ x ١٠^{٣} ± ٠,٥٤ على التوالي بينما كان المتوسط المقابل الخاص بالحليب المجمع هـو ١,٩ x ١٠^{٥} ± ٥,٠ x ١٠ و ٣,٣ x ١٠^{٤} ± ٠,٣x ١٠ و٢,٨ x ١٠^{٤} ± ٠,٦ x ١٠. النِسَب المئوية لتَخفـيض أعداد الـ *Enterococci* في كؤوس الحلمة وخطوطِ الأنابيب وأحواض الحليبِ وتنكات الحليبِ بَعد تطبيق برامج المزارع والـ QACs والـ Iodophores كَانت ٩٦,٤٢، ٩٦,٥٢ و٩٦,٧٣ و ٩٦,١١، ٧٣,٣٣ و ٩٤,٠٠ و٩٨,٣٨، ٩٧,٧٧، ٩٥,٥٧ و٩٦,٢٥، ٩٧,٦٤ ، ٩٥,٧٠ % على التوالي.

متوسط أعداد الـ *Staphylococcus aureus* الحية (cfu / مليلتر) في العيناتِ الفرديـةِ مـن حليبِ البقر بتطبيق برنامج المزارع والـ QACs والـ Iodophores كانت ٢,٨ x ١٠^{٣} ± ٠,٤٧ و٢,٥ x ١٠^{٣} ± ٠,٤٢ و ٣,٠ x ١٠^{٣} ± ٠,٣٦ على التوالي بينما كان المتوسـط المقابـل الخـاص بالحليـب المجمـع هـو ٢,١ x ١٠^{٤} ± ٠,٦ x ١٠ و ٣,١ x ١٠^{٤} ± ٤,٧ و٣,٨ x ١٠^{٤} ± ١,٠ x ١٠ علـى التوالي. الـ *Staphylococcus aureus* انخفضت في كؤوس الحلمات و خطوط أنابيب الحليبِ وأحواض الحليـبِ وتنكـات الحليـبِ بنسـبة ٩٦,٩٢، ٩٧,٣٣ ، ٩٦,٤٥ و ٩٦,٤١ ، ٩٩,٥٠ ، ٧١,٧٩ و٩٧,٣٣، ٩٨,٩٢ ، ٩٧,٣٣ و٩٦,٨٠، ٩٧,٨٦ ، ٩٦,٢٢ % على التوالي.

إستنتجت نَتائِجَنا أن أعلى كفاءةِ تم الحُصول عليها بتطبيق نظام الـ QACs حيث يتم إمتصاصها بسهولة إلى السطوح الخاملةِ وتلتصق بسطح الكائنات الحية الدقيقة بدرجة اكبـر مـن بـاقي المطهـرات المستخدمة في صناعاتِ الألبان. لذا يُمكِنُ أنْ يُوصي بإستخدام هذا النظام.