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# EFFECT OF POST - MILKING TEAT DIPPING ON HYGIENIC QUALITY OF COW'S MILK

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**Abstract:** The study aimed to investigate the effects of teat disinfection (dipping treatment) after milking on hygienic quality of row milk. The research was conducted on the farm with 30 Holstein-Friesian dairy cows. Animals were kept in a tied housing system. Milking is done by a bucket milking units using vacuum line. The research was carried out during the period of 2 months from 26.11.2012 till 25.01.2013. Results showed that milk immediately after leaving the udder was minimally contaminated with microorganisms (average of both groups with 8,933 CFU/ml). Experimental group had an average 2.668 (133,000 SCC/ml) and control group 3.524 (about 257,000 SCC/ml) ($p<0.05$). The average value of CFU in experimental group was 5,816 (729,000 CFU/ml) and in the control 5.833 (805,000 CFU/ml), ($p<0.05$). During the study period, the average value of SCC in the experimental group decreased to 2.67 (133.020/ml) and the average value of CFU to 5.82 (729.064/ml), ($p<0.05$). Treatment of teat dipping after milking is justifiable and has positive impact on row milk quality.

**Key words**: Teats dipping, dairy cow, row milk quality

## Introduction

Contamination of milk is mostly caused by the contact of milk with microorganisms from the environment (equipment for milking and cooling, air in the stable, milker's hands and clothing, the surface of the skin on udder and the teats) and it's rarer by passing milk through the *ductus papillaris*. The presence of microorganisms can be cause the inflammation of the mammary gland - mastitis and the most important pathogens are among *Streptococcus agalactiae, Staphylococcus aureus* and *Escherichia coli (Miltenburg et al., 1996).* The presence of mastitis in herds of dairy cows inflicts great economic losses because it reduces milk production and quality, increases the cost of healing and staff as well as the number of forced slaughter *(Winter, 2009).* Inflammation of the mammary

gland is accompanied by changes in the number of somatic cell count (SCC), mainly as an increase in SCC in diseased quarters of udder *(Fregonese and Leaver, 2001)*. By monitoring of SCC changes it is possible to successfully manage the health of the udder. Occurrence of diseases of the mammary gland is usually associated with low level of hygiene during the breeding and milking *(Schreiner and Ruegg, 2003)*. Therefore, it is necessary to conduct regular procedures of cleaning in order to maintain hygiene in the stable as well as procedures for the disinfection before and after milking *(Gedek, 1994)*. This reduces the possibility of contamination and adequate disinfection of teats after milking reduces the incidance of new intramammary infections *(Hristov et al., 1997; 2002)*. The greatest risk of infection of the mammary gland may be expected in the first few hours immediately after milking, becuase teat canal stays open for another 30 minutes.

The application of teat hygiene after milking comprises a sinking of teats (or splashing) in a disinfectant. This procedure replaces remains of milk with a layer of disinfectant, temporarily blocking the entrance into the teat canal and has beneficial impact on the skin of teats. These actions reduce post-secretion contamination of milk *Pavicic et al. (2003b),* decrease the number of udder infections caused by pathogens from the environment *Pankey et al. (1987),* and reduce the occurrence of subclinical mastitis *(Lam et al., 1996)*.

## Materials and Methods

The study was conducted on the farm with 30 Holstein-Friesian dairy cows. Animals were kept in tied housing system. The usual milking procedure was performed twice a day using a bucket milking unit with a vacuum line. At the beginning of the experiment, only primary udder hygiene was conducted in the herd, based on washing with water and wiping with disposable cloths. For the purpose of experiment, animals were divided into 2 groups. First was experimental group (A), which continued application of the primary hygiene and after milking teats were immerged (dipping treatment) in a special cup containing active compounds based on Pvp-iodine in accordance with EEC regulation 648/2004. The second control group (B) continued only with the primary teat and udder hygiene. Both groups of cows had approximately the same average milk yield, stage of lactation and hygienic quality of raw milk. Difference between the groups wasn't significant. The research was conducted in the period of 2 months, from 26.11.2012 till 25.01.2013. In the determination of the quality of raw milk the somatic cell count (SCC) and number of bacterial colonies (CFU - colony forming unit) were considered. The samples were taken from each individual animal and transported in sterile bottles of 40 ml.

Before the start of the experiment, one specific milk sample from each cow was taken, directly from the teats (udder) in a sterile bottle and thereafter from the milking bucket unit. The aim was to determine the level of contamination of milk before coming into contact with environment, equipment etc. After that, samples were collected as follows: in the first week two samples from each cow in order to determine the initial milk quality (zero day) and then each week one sample until the end of the experiment.

Milk samples were preserved using Asidiol (preservative) in accordance with ISO 13366-2:2006 and IDF 148-2:2006. Analysis of milk samples was performed on automatic analyzers using method of FTIR and flow cytometry. Data were analysed by using the software Statistics 10 *(stat. Soft. Inc. 2012)*. General variability of observed traits was analysed by using the descriptive statistical analysis. The Student t-test was used to determine the significance of differences between the experimental and control group of cows. For the purpose of proper data handling and comparability, the data were transformed logarithmically as:

1) $SCC = Log_2 (SCC /100000) +3$
2) $CFU = Log_{10} (CFU)$

## Results and Discussion

The results of the analysis of specific milk samples (directly from the teats in a sterile bottle) showed that the milk immediately after leaving the udder was minimally contaminated by microorganisms (average of both groups amounted 8,933 CFU/ml) and then after milking, the milk samples collected from the bucket milking unit were contaminated on average with about 900,000 CFU/ml (Figure 1).

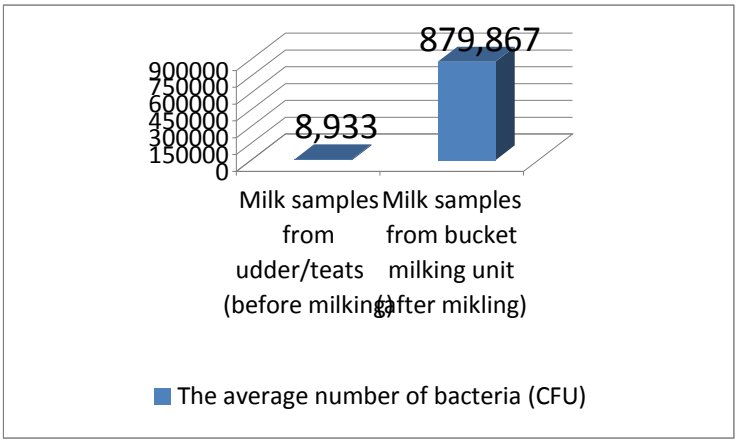


**Figure 1. The average number of bacteria (CFU) in milk at start of research**

Immediately after leaving the udder, the milk of healthy cows, kept in adequate conditions, is almost sterile and contains the minimum number of microorganisms. To contamination comes mainly during and after milking *(Saran, 1995).* The obtained results indicate the occurrence of contamination after milking (after leaving the udder) due to activity of microorganisms from the environment.

Before the start of the experiment (day zero), the average SCC of 152,400/ml was determined in the experimental group of cows, while the control group had 249,466 SCC/ml. The average number of CFU in the experimental group was 901,946 / ml, whereas in the experimental group it was 950,693/ml. This difference between the groups for both of observed parameters wasn't significant ($p>0.05$).

**Table 1. Average values of observed parameters for both groups at the beginning of the experiment (day zero)**

| Parameters | Cow group | X | SD | $SE_x$ | Min | Max |
|---|---|---|---|---|---|---|
| SCC | Experimental group (A) | 152,400.0 | 221,311.6 | 57,142.4 | 33,000 | 883,000 |
| | Control group (B) | 249,466.6 | 247,865.7 | 63,998.6 | 55,000 | 860,000 |
| Log - SCC | Experimental group (A) | 2.878 | 1.292 | 0.33 | 1.40 | 6.14 |
| | Control group (B) | 3.799 | 1.206 | 0.31 | 2.14 | 6.10 |
| CFU | Experimental group (A) | 901,946.6 | 473,929.1 | 122,367.9 | 136,800 | 1,420,400 |
| | Control group (B) | 950,693.3 | 506,897.6 | 130,880.4 | 114,800 | 1,585,600 |
| Log - CFU | Experimental group (A) | 5.853 | 0.359 | 0.092 | 5.14 | 6.15 |
| | Control group (B) | 5.887 | 0.332 | 0.085 | 5.06 | 6.20 |

After 2 months of dipping treatment the following results were obtained (Table 2,3).

**Table 2. Average values of SCC for both groups at the end of the experiment (t-test)**

| Parameters | Cow group | X | SD | $SE_x$ | t-value | p-value |
|---|---|---|---|---|---|---|
| Log - SCC | Experimental group (A) | 2.668 | 1.335 | 0.188 | -3.00084 | 0.003* |
| | Control group (B) | 3.524 | 1.509 | 0.213 | | |

Statistically significant value between experimental and control group; *=$p<0.05$

**Table 3. Average values of CFU for both groups at the end of the experiment (t-test)**

| Parameters | Cow group | X | SD | $SE_x$ | t-value | p-value |
|---|---|---|---|---|---|---|
| Log - CFU | Experimental group (A) | 5.816 | 0.209 | 0.029 | -0.35321 | 0.724 ns |
| | Control group (B) | 5.833 | 0.257 | 0.036 | | |

Statistically significant value between experimental and control group; ns= p>0.05

In regard to SCC, the experimental group had on average 2,668 (approximately 133,000 SCC/ml) and control 3.524 (approximately 257,000 SCC/ml). This difference between the groups was significant (p<0,05). The average value of CFU in experimental group was 5.816 (approximately 729,000 CFU/ml) and in control 5.833 (approximately 805,000 CFU/ml), difference statistically wasn't significant (p>0.05).

If only the experimental group of cows is considered, from the beginning of research (day zero) till the end of experiment, the average number of SCC decreased from 2.88 (152,400/ml) to 2.67 (133.020/ml), while the average number of CFU decreased from 5.85 (901.946/ml) to 5.82 (729.064/ml). These differences couldn't be confirmed statistically (p>0,05).

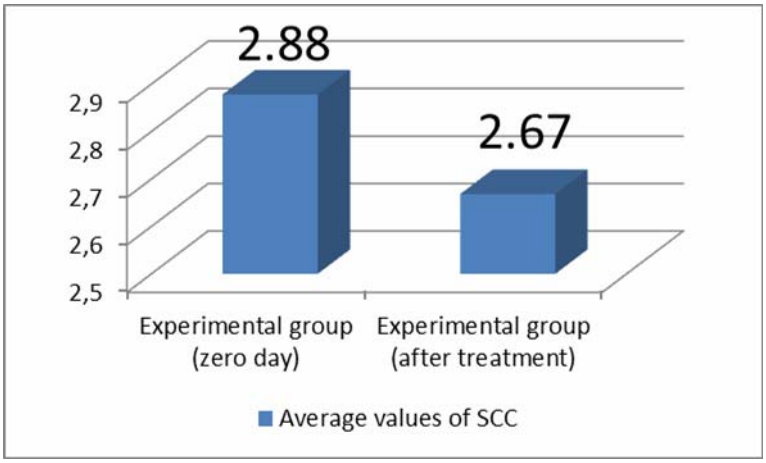


**Figure 2. The average number of SCC for experimental group at start and the end of treatment**

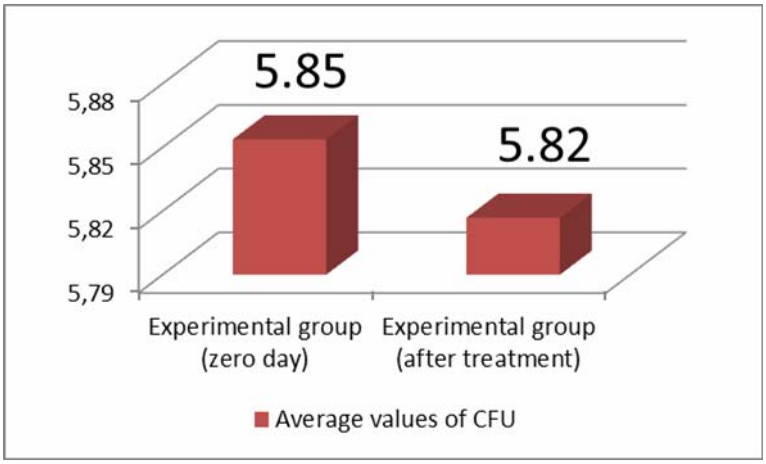


**Figure 3. The average number of CFU for Experimental group at start and the end of treatment**

*Pavicic et al. (2008)* have reported that in an experiment with disinfection of teats before and after milking, the average SCC (10.12%) decreased significantly and the total plate count decreased by 24.07%, while in cow group without treatment, the number of SCC increased by 20.97%. Almost identical effect of disinfection before and after milking on reduction of the number of microorganisms is determined by *Petrovic et al. (2006).* The authors point out that introduction of udder disinfection after milking has resulted in reduction in the average number of microorganisms up to 41.6% compared to the group of cows in which only disinfection before milking is applied.

*Islam et al. (2009)* has found that the average number of microorganisms significantly reduces if at the same time with udder disinfection the disinfection of hands and equipment for a milking is included. Additionally personal hygiene of animals (hygiene of legs, abdomen and back parts of body), significantly influences the number of SCC (decrease) in milk *(Sant'Anna and Paranhos Da Costa, 2010).*

Influence of teat dipping after milking on reduction of the average number of SCC is confirmed by *Bilal et al. (2008),* where the number of SCC in milk after 3 months of treatment was reduced by 53.49% and combined with vaccination against *Staphylococcus aureus* this decrease was more than 62.71%. The positive effect of the teat dipping after milking on reduction the number of SCC in the milk of cows and buffaloes is stated by *Singh and Singh (2002).*

## Conclusion

Treatment of teats by dipping was conducted on the farm with 30 Holstein-Friesian dairy cows during the period from 26.11.2012 till 25.01.2013. During the study period, the treatment of teat dipping in the experimental group of cows has led to a reduction in the average number of SCC and CFU compared to the control group. If only the experimental group of cows is considered, from the beginning of research (day zero) till the end of experiment, the average SCC and CFU decreased but difference wasn't statistically significant ($p > 0.05$). Results of research indicate that treatment of teats by dipping after milking has a positive impact on raw milk quality. In order to achieve significant improvement of hygienic quality of raw milk it is necessary to include treatment of dipping before milking (simultaneously with the treatment of dipping after milking), and the treatments must be peformed correctly in accordance with the manufacturer's recommendations. Dipping treatments before and after milking achieve their full effect if procedures related to personal hygiene of employees, hygiene of milking equipment, stables and animals, adequate feeding etc., are conducted regularly and in accordance to the standards and good manufacturing practices.

## Efekat tretmana papila posle muže na higijenski kvalitet kravljeg mleka

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## Rezime

Istraživanje je imalo za cilj da ispita efekte dezinfekcije papila vimena (tretman uranjanja papila) posle muže krava na higijenski kvalitet mleka. Ispitivanje je sprovedeno na gazdinstvu sa 30 mlečnih krava holštajn-frizijske rase u vezanom sistemu držanja. Muža je vršena prenosnom muznom jedinicom sa kantom (muzilicom), uz pomoć vakum voda. Ogled je trajao 2 meseca a sproveden je u periodu od 26.11.2012. do 25.01.2013. Rezultati istraživanja su pokazali da je mleko neposredno nakon napuštanja vimena bilo minimalno kontaminirano mikroorganizmima (u proseku obe grupe sa 8,933 CFU/ml). Eksperimentalna grupa je imala u proseku 2.668 (oko 133,000 SCC/ml) a kontrolna 3.524 (oko 257,000 SCC/ml), ($p<0.05$). Prosečna vrednost CFU u eksperimentalnij grupi je iznosila 5.816 (oko 729,000 CFU/ml) odnosno u kontrolnoj 5.833 (oko 805,000 CFU/ml), ($p>0.05$). Tokom perioda istraživanja u eksperimentalnoj grupi je smanjen prosečan broj SCC na 2.67 (133,020/ml) odnosno prosečan broj CFU na

5.82 (729,064/ml), ($p>0.05$). Tretman uranjanja papila posle muže je opravdan i pozitivno utiče na popravku kvaliteta mleka.

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