نگرشی جدید در انتخاب ترکیبات ضدعفونی پس از دوشش

بابک خرمیان
دانشیار دانشگاه فردوسی مشهد

Ten-point mastitis control program

1. **<u>Udder hygiene and proper milking methods</u>**
2. Proper installation, function, and maintenance of milking equipment
3. Dry cow management and therapy
4. Appropriate therapy of mastitis cases during lactation
5. Culling of chronically infected cows.
6. Maintenance of an appropriate environment
7. Good record keeping
8. Monitoring udder health status
9. Periodic review of the udder health management program
10. Setting goals for udder health status.

Teat disinfectants
Excellent germicidal activity
Immediate action
Persistent action
Cost
Less affected by organic material
Non irritating
Effect on milker health
Residual
Color

Contagious mastitis

- Postdip

Environmental mastitis

- Predip

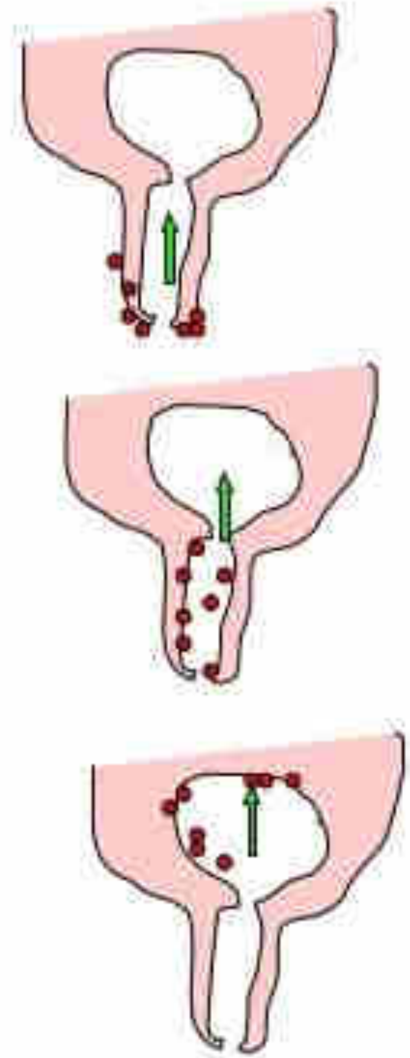
- Contagious mastitis
- Opportunistic mastitis
- Reduction of milk somatic cell counts and increased milk yields

Pathogen type	PostMTD (n=201)	NoPostMTD (n=229)	SED	p value
Staph. aureus	0.04	0.10	0.023	0.018
Strep. uberis	0.04	0.11	0.024	0.007
Strep. dysgalactiae	0.02	0.03	0.014	>0.05
CNS	0.09	0.20	0.032	0.001
Corynebacterium spp.	0.78	0.91	0.029	<0.001

Proportion of cows that developed new intramammary infections , where cows received either a post-milking teat disinfection group (n=230), that was sprayed with an iodine-based disinfectant (TeatguardPlus) for a complete lactation, or to a non-disinfected group (n=239).

Williamson et al., 2013

Process of infection



Disinfectant	Spectrum of action	Examples
Sterilants	all microorganisms, including bacterial spores	• **Heat** • **higher concentrations of hydrogen peroxide and peracetic acid, (in 6–10 h)**
High level Disinfection	almost all microorganisms, but not spores	• **hydrogen peroxide** • **peracetic acid**
Intermediate Level Disinfection	almost all vegetative bacteria, fungi, tubercle bacilli and enveloped and lipid viruses	• **Alcohols** • **Hypochlorites** • **iodophor**
Low level Disinfection	not efficient for most bacteria, tubercle bacilli, spores, fungi and viruses	• **phenolics** • **quaternary ammonium compounds**

Disinfectant resistance

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ELSEVIER

Review article

Disinfectant resistance in bacteria: Mechanisms, spread, and resolution strategies

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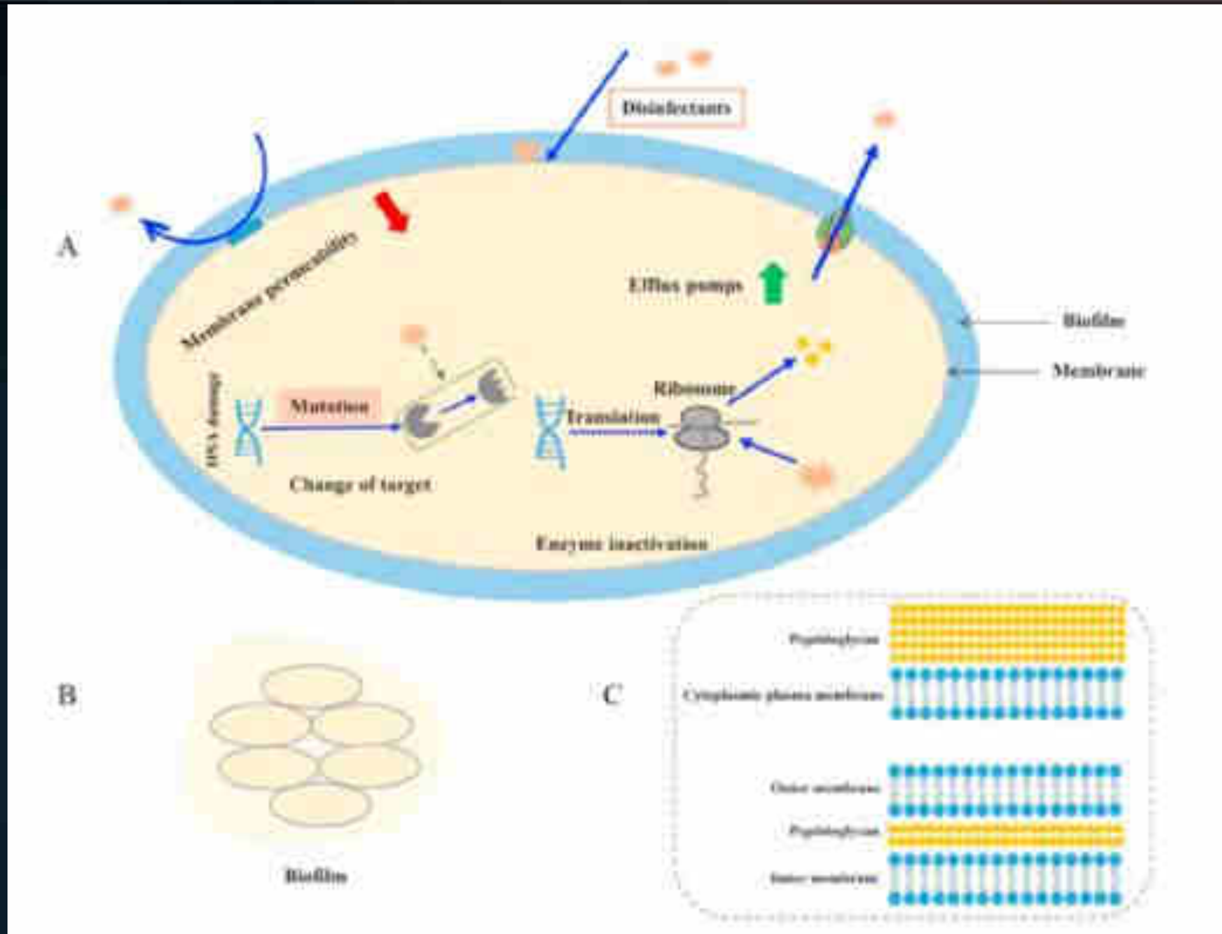
A R T I C L E I N F O

Keywords:
Disinfectants
Multidrug resistant bacteria
Resistance mechanisms
Disinfectant resistance gene
Resolution strategies

A B S T R A C T

Disinfectants are widely acknowledged for removing microorganisms from the surface of the objects and transmission media. However, the emergence of disinfectant resistance has become a severe threat to the safety of life and health and the rational allocation of resources due to the reduced disinfectant effectiveness. The horizontal gene transfer (HGT) of disinfectant resistance genes has also expanded the resistant flora, making the situation worse. This review focused on the resistance mechanisms of disinfectant resistant bacteria on biofilms, cell membrane permeability, efflux pumps, degradable enzymes, and disinfectant targets. Efflux can be the fastest and most effective resistance mechanism for bacteria to respond to stress. The *qac* genes, located on some plasmids which can transmit resistance through conjugative transfer, are the most commonly reported in the study of disinfectant resistance genes. Whether the *qac* genes can be transferred through transformation or transduction is still unclear. Studying the factors affecting the resistance of bacteria to disinfectants can find breakthrough methods to more adequately deal with the problem of reduced disinfectant effectiveness. It has been confirmed that the interaction of probiotics and bacteria or the addition of 4-oxazolidinone can inhibit the formation of biofilms. Chemicals such as eugenol and indole derivatives can increase bacterial sensitivity by reducing the expression of efflux pumps. The role of these findings in anti-disinfectant resistance has proved invaluable.



- Disinfectants diffusion is limited by biofilm
- Blocking effect of cell membrane
- Efflux pump systems
- Enzyme inactivation
- Target alterations

Table 2
Information about the disinfectant resistance genes when first reported.

Gene	Bacteria	Location	Reference
sugE(C)	*Escherichia coli*	Chromosome	Chung et al. (2002)
emrE	*Escherichia coli*	Chromosome	Paulsen et al. (1996)
ydgE/ ydgF	*Escherichia coli*	Chromosome	Drew et al. (2002)
mdfA	*Escherichia coli*	Chromosome	Edgar et al. (1997)
qacA	*Staphylococcus aureus*	Plasmid (pSK57)	Gillespie et al. (1986)
qacB	*Staphylococcus aureus*	Plasmid (pSK23)	Paulsen et al. (1996)
qacC	*Staphylococcus aureus*	Plasmid (pSK89)	Littlejohn et al. (1992)
qacD	*Staphylococcus aureus*	Plasmid (pSK41)	Littlejohn et al. (1991)
qacE	*Klebsiella pneumoniae*	plasmid (pR751)	Littlejohn et al. (1991)
qacF	*Enteroter aerogenes*	Class 1 integron (In40)	Paulsen et al. (1996)
qacG	*Staphylococci* sp.	Plasmid (pST94)	Ploy et al. (1998)
qacH	*Staphylococcus saprophyticus*	plasmid (p2H6)	Heir et al. (1999)
qacJ	*Staphylococcus intermedius*	Plasmid (pNVH01)	Heir et al. (1998)
qacZ	*Enterococcus faecalis*	Plasmid (pORI23)	Bjorland et al. (2003)
sugE(P)	*Salmonella* sp.	Plasmid (pSN254)	Braga et al. (2011)
sugE(P)	*Salmonella* sp.	Plasmid (pSN254)	Welch et al. (2007)

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DISINFECTANT-RESISTANT BACTERIA IN BUENOS AIRES CITY HOSPITAL WASTEWATER

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Submitted: December 14, 2006; Approved: September 20, 2007.

ABSTRACT

Large quantities of disinfectants are used in hospitals, externally on human skin or to eliminate microorganisms from inanimate objects. After use, residual quantities of these products reach the wastewater, exposing the bacteria that survive in hospital wastewaters to a wide range of biocides that could act as a selective pressure for the development of resistance. Increasing attention has been directed recently to the resistance of bacteria to disinfectants. The aim of this paper was to determine the disinfectant bacterial resistance pattern of the microflora released to the urban sewer system by hospital effluents. The characterization of the waste water microflora was performed by determination of the CFU of heterotrophic bacteria, fecal indicator bacteria, *Pseudomonas* sp. and *Staphylococcus sp.*, in a Buenos Aires hospital effluent. The bacterial resistance to the disinfectants more frequently used in the hospital practice, glutaraldehyde, chlorhexidine and povidone-iodine, was then evaluated. Disinfectant resistant bacterial strains were isolated and typified. Between 10^3 and 10^6 chlorexidine resistant bacteria/100 mL were isolated from the samples. Bacteria resistant to other disinfectants ranged between 10^2 and 10^4 /100 mL. The bacterial population resistant to desinfectants to was mainly composed by *Enterobacteriaceae, Staphylococcus* spp. and *Bacillus* spp, which are highly associated to nosocomial infections. The results obtained show that the hospital effluents are of importance in the bacterial resistance selection process, particularly in the case of disinfectants.

Key words: disinfectant, resistance, hospital effluent

Table 2. Bacterial resistance to disinfectant.

	Povidone-iodine UFC/100 mL	Glutaraldehyde UFC/100 mL	Chlorhexidine UFC/100 mL
Mean	7.7×10^3	5.0×10^3	6.8×10^5
Minimum	2.0×10^3	2.0×10^3	1.0×10^3
Maximum	2.0×10^4	2.4×10^4	6.0×10^6

microorganisms

MDPI

Review

Reduced Susceptibility and Increased Resistance of Bacteria against Disinfectants: A Systematic Review

Urška Rozman [1,*], Marko Pušnik [1], Sergej Kmetec [1], Darja Duh [2] and Sonja Šostar Turk [1]

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Abstract: Disinfectants are used to reduce the concentration of pathogenic microorganisms to a safe level and help to prevent the transmission of infectious diseases. However, bacteria have a tremendous ability to respond to chemical stress caused by biocides, where overuse and improper use of disinfectants can be reflected in a reduced susceptibility of microorganisms. This review aims to describe whether mutations and thus decreased susceptibility to disinfectants occur in bacteria during disinfectant exposure. A systematic literature review following PRISMA guidelines was conducted with the databases PubMed, Science Direct and Web of Science. For the final analysis, 28 sources that remained of interest were included. Articles describing reduced susceptibility or the resistance of bacteria against seven different disinfectants were identified. The important deviation of the minimum inhibitory concentration was observed in multiple studies for disinfectants based on triclosan and chlorhexidine. A reduced susceptibility to disinfectants and potentially related problems with antibiotic resistance in clinically important bacterial strains are increasing. Since the use of disinfectants in the community is rising, it is clear that reasonable use of available and effective disinfectants is needed. It is necessary to develop and adopt strategies to control disinfectant resistance.

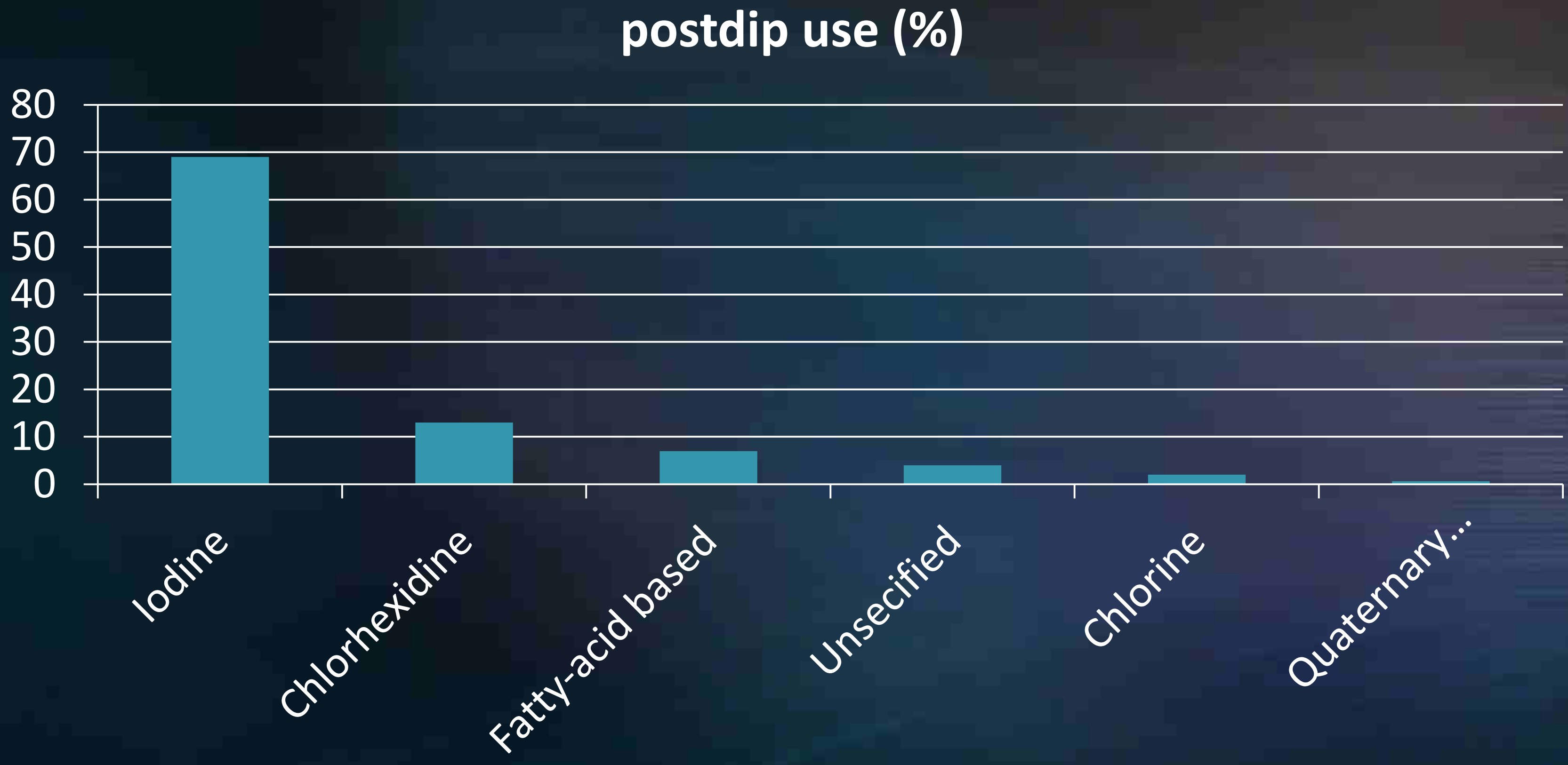
Keywords: antimicrobial resistance; susceptibility; disinfectants; bacteria

check for updates

Citation: Rozman, U.; Pušnik, M.; Kmetec, S.; Duh, D.; Šostar Turk, S. Reduced Susceptibility and Increased Resistance of Bacteria against Disinfectants: A Systematic Review. *Microorganisms* **2021**, *9*, 2550. https://doi.org/10.3390/microorganisms9122550

- A reduced susceptibility to disinfectants and potentially related problems with antibiotic resistance in clinically important bacterial strains are increasing.
- Since the use of disinfectants in the community is rising, it is clear that reasonable use of available and effective disinfectants is needed. It is necessary to develop and adopt strategies to control disinfectant resistance.

Most commonly used postdip in USA



United States (2008)

List of Approved Teat Dips, Solutions, Wipes, Udder Washes And Other Topical Udder/Teat Products

July 5, 2019

Dairy Farmers of Canada would like to thank the Veterinary Drugs Directorate for their collaboration in developing this list of approved teat dips, antiseptic teat solutions, wipes, udder washes and other topical udder/teat products.

This list now also includes Veterinary Health Products (VHPs) which can be used topically on udders and teats. VHPs are veterinary drugs in dosage form that are considered low-risk. VHPs cannot be sold or represented for the use in the diagnosis, treatment, mitigation of a disease, disorder or abnormal physical state, or its symptoms but instead promote or maintain overall good health and wellbeing. Veterinary Health Products which have been notified are issued a Notification Number (NN).

This list is not intended to be all-encompassing and is subject to change, and it is only considered current as of the date above.

The list is alphabetical and not in any order of priority or recommendation.

For additional information:

- Health Canada's Drug Product Database: https://health-products.canada.ca/dpd-bdpp/index-eng.jsp
- List of Notified Veterinary Health Products (VHP): https://health-products.canada.ca/vhp-psa/en/product-list
- Drug Statuses of products below are 'Marketed' unless stated otherwise:
    - **Marketed**: refers to an active DIN that is currently being sold in Canada.
    - **Approved**: refers to an active DIN that has been reviewed and authorized for sale in Canada but has not yet been marketed in Canada.
    - **Dormant**: refers to an active DIN that was previously marketed in Canada but for which there have been no sales for period of at least 12 months.

Dairy Farmers of Canada

List-of-Approved-Post-Dips (2019)	Number
Iodine	57
Chlorhexidine	25
Sodium chlorite+Lactic acid	6+1
Hydrogen peroxide	4
Lactic acid	1
Glycolic acid	1

Fitzpatrick *et al. Irish Veterinary Journal* (2021) 74:1
https://doi.org/10.1186/s13620-020-00179-7

Irish Veterinary Journal

RESEARCH Open Access

The effect of disinfectant ingredients on teat skin bacteria associated with mastitis in Irish dairy herds

Sarah Rose Fitzpatrick[1,2], Mary Garvey[2], Jim Flynn[1], Bernadette O'Brien[1] and David Gleeson[1*]

Abstract

Background: Teat disinfection is an important step in the control of mastitis within a dairy herd. The objective of this study was to evaluate the effectiveness of 96 commercially available teat disinfectant products in Ireland against bacterial isolates on teat skin. Teat disinfection products were applied to the teats of seventeen Holstein-Friesian cows. A split-udder model was used where one cow received two different teat disinfection products on each day. A composite swab sample was taken of the left teats and the right teats before and after teat disinfectant application. Swab samples were plated onto 3 different selective agars to enumerate bacterial counts of streptococcal, staphylococcal and coliform isolates.

Results: Streptococcal isolates were the most prominent bacterial group recovered on teat swabs taken before the application of a teat disinfection product (55.0%), followed by staphylococcal isolates (41.3%) and coliform isolates (3.7%). Products were reclassified by active ingredients (n = 9) for analysis. These ingredient groups included; chlorhexidine, chlorine dioxide, diamine, iodine, iodine and lactic acid, lactic acid, lactic acid and chlorhexidine, lactic acid and hydrogen peroxide, and lactic acid and salicylic acid. The ingredient group, chlorine dioxide, resulted in comparable reductions to the iodine group for streptococcal isolates. The ingredient group, iodine combined with lactic acid, resulted in the greatest reduction of staphylococcal isolates. When observing products individually, a product containing 1.6% w/w lactic acid combined with hydrogen peroxide was the most effective at reducing streptococcal isolates on the teat skin, whereas a product containing lactic acid combined with 0.6% w/w chlorhexidine was the most effective against staphylococcal isolates. Minor differences were observed regarding the relationship between effectiveness and active ingredient concentration between products.

Conclusions: This study suggests that some teat disinfectant products achieve a higher reduction in bacterial levels against different specific bacterial groups on teat skin than other products. Therefore, when choosing a teat disinfectant product, the bacteria in the dairy herds' environment should be considered. Further studies are necessary to evaluate products efficacy against new IMIs and any possible effects on teat skin condition.

Keywords: Teat disinfection, mastitis, teat swabbing, bacterial load

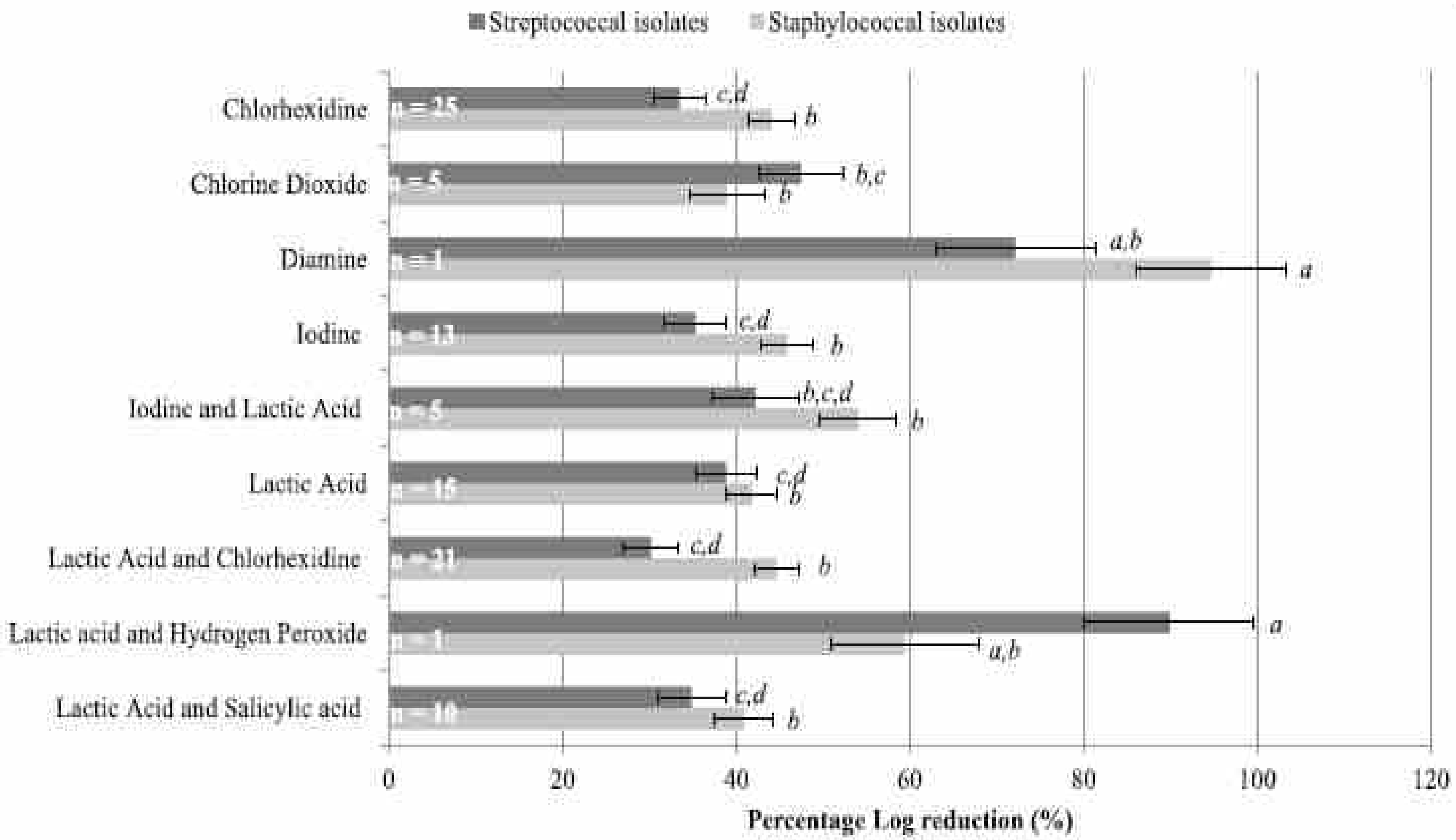
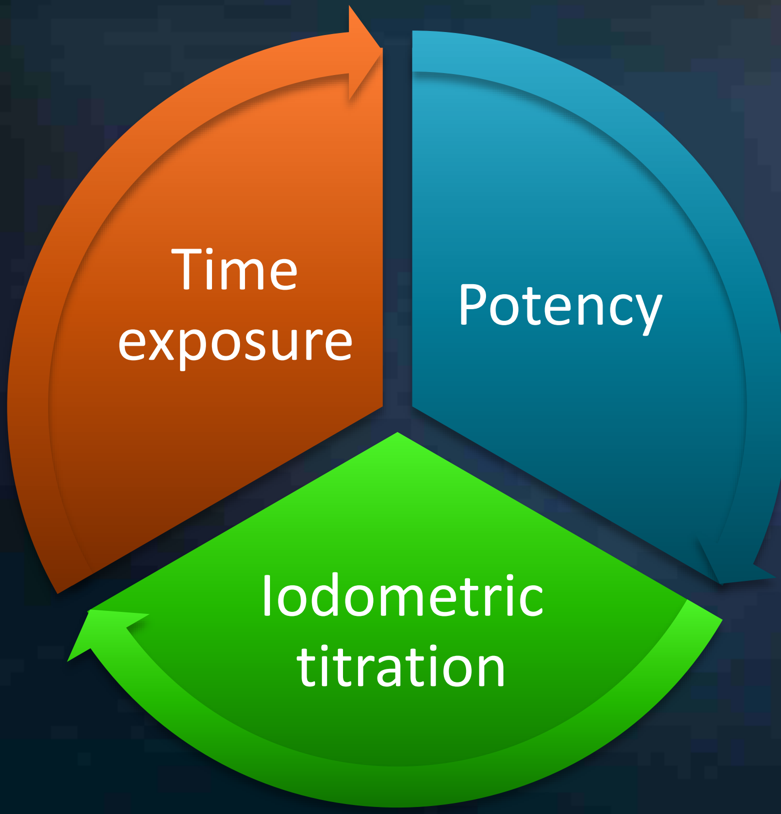


Fig. 2 LS-means of the percentage Log_{10} reduction (%) of streptococcal and staphylococcal isolates across all active ingredients tested on the teat skin. Error bars indicates SEM. Percentage log reduction (%) determined from Log_{10} PRE swab values.[a-d]Means with different letters differ significantly

Tests



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Iran National Standards Organization

استاندارد ملی ایران

۱۷۷۱۳

تجدیدنظر اول

۱۴۰۱

ضدعفونی‌کننده‌ها و گندزداهای شیمیایی – آزمون سوسپانسیون کمّی برای ارزیابی فعالیت باکتری‌کشی ضدعفونی‌کننده‌ها و گندزداهای شیمیایی مورد استفاده در مکان‌های دامپزشکی – روش آزمون و الزامات (فاز ۲، مرحله ۱)

Chemical disinfectants and antiseptics— Quantitative suspension test for the evaluation of bactericidal activity of chemical disinfectants and antiseptics used in the veterinary area— Test method and requirements (phase 2, step 1)

جدول ۱- شرایط آزمون

شرایط آزمون	فعالیت باکتری‌کشی روی سطوح	فعالیت باکتری‌کشی برای ضدعفونی‌کننده‌های نوک پستان
کمینه طیف ارگانیسم‌های آزمون	Enterococcus hirae Proteus hauseri Pseudomonas aeruginosa Staphylococcus aureus	Escherichia coli Staphylococcus aureus Streptococcus uberis
اضافی	هر ارگانیسم آزمون مربوط	هر ارگانیسم آزمون مربوط
دمای آزمون	در فواصل ۵ °C	
کمینه بیشینه	(۵ ± ۱) °C (۴۰ ± ۱) °C	(۲۰ ± ۱) °C (۳۰ ± ۱) °C
زمان تماس	در فواصل ۳۰ s از ۳۰ s تا ۵ min و در فواصل ۵ min از ۵ min تا ۱۲۰ min	
کمینه	۱ min ± ۵ s	۱ min ± ۵ s برای ضدعفونی‌کننده‌های نوک پستان پس از شیردوشی ۳۰ s ± ۵ s برای ضدعفونی‌کننده‌های نوک پستان پیش از شیردوشی
بیشینه	۱۲۰ min ± ۱۰ s	۳۰ min ± ۱۰ s برای ضدعفونی‌کننده‌های نوک پستان پس از شیردوشی ۲ min ± ۱۰ s برای ضدعفونی‌کننده‌های نوک پستان پیش از شیردوشی
	مادهٔ مداخله‌گر	مادهٔ مداخله‌گر
آلودگی سطح پایین	۰٫۳ g/l آلبومین گاوی	پس از شیردهی: ۱۰ g/l پودر شیر
آلودگی سطح بالا	۱۰ g/l عصارهٔ مخمر به‌علاوه ۱۰ g/l آلبومین گاوی	پیش از شیردوشی: ۳ g/l آلبومین گاوی
اضافی	هر مادهٔ مربوط	هر مادهٔ مربوط

۱- بعنوان Proteus vulgaris شناخته شده بود.

Halogens react not only with living microorganisms but also with their environment, that is, dead bacteria, dissolved proteins, and amino acids.

ردیف	ویژگی/ شرح آزمون	نتیجه آزمون	واحد اندازه گیری	حد مجاز	روش آزمون
1	ارزیابی و تعیین فعالیت باکتری کشی (استافیلوکوکوس اورئوس)	7	کاهش لگاریتمی	بزرگترمساوی5	ISIRI 17713
2	ارزیابی و تعیین فعالیت باکتری کشی استرپتوکوکوس آگالاکتیکه	7	کاهش لگاریتمی	بزرگترمساوی5	ISIRI 17713
3	ارزیابی و تعیین فعالیت باکتری کشی استرپتوکوکوس اوبریس	7	کاهش لگاریتمی	بزرگترمساوی5	ISIRI 17713
4	ارزیابی و تعیین فعالیت باکتری کشی (اشرشیا کلی)	7	کاهش لگاریتمی	بزرگترمساوی5	ISIRI 17713

توضیحات

ارزیابی و تعیین فعالیت باکتری کشی اشرشیا کلی ATCC ۱۰۵۳۶ طبق ISIRI ۱۷۷۱۳ در غلظت ۱۰۰٪ فراورده، شرایط آزمون کثیف، دمای ۲۵ درجه سانتیگراد و مدت زمان ۳۰ دقیقه انجام شد. فراورده باید بتواند حداقل ۵ لگاریتم کاهش را طبق ISIRI ۱۷۷۱۳ نشان دهد این فرآورده دارای خاصیت باکتری کشی است.

ارزیابی و تعیین فعالیت باکتری کشی استافیلوکوکوس اورئوس ATCC ۶۵۳۸ طبق ISIRI ۱۷۷۱۳ در غلظت ۱۰۰٪ فراورده، شرایط آزمون کثیف، دمای ۲۵ درجه سانتیگراد و مدت زمان ۳۰ دقیقه انجام شد. فراورده باید بتواند حداقل ۵ لگاریتم کاهش را طبق ISIRI ۱۷۷۱۳ نشان دهد این فرآورده دارای خاصیت باکتری کشی است.

ارزیابی و تعیین فعالیت باکتری کشی استرپتوکوکوس یوبریس ATCC ۱۹۴۳۶ طبق ISIRI ۱۷۷۱۳ در غلظت ۱۰۰٪ فراورده، شرایط آزمون کثیف، دمای ۲۵ درجه سانتیگراد و مدت زمان ۳۰ دقیقه انجام شد. فراورده باید بتواند حداقل ۵ لگاریتم کاهش را طبق ISIRI ۱۷۷۱۳ نشان دهد این فرآورده دارای خاصیت باکتری کشی است.

ارزیابی و تعیین فعالیت باکتری کشی استرپتوکوکوس آگالاکتیه PTCC ۱۸۶۸ طبق ISIRI ۱۷۷۱۳ در غلظت ۱۰۰٪ فراورده، شرایط آزمون کثیف، دمای ۲۵ درجه سانتیگراد و مدت زمان ۳۰ دقیقه انجام شد. فراورده باید بتواند حداقل ۵ لگاریتم کاهش را طبق ISIRI ۱۷۷۱۳ نشان دهد این فرآورده دارای خاصیت باکتری کشی است.

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کد متقاضی :

ن کننده

نوع آزمایش : اثر بخشی بر روی باکتری

۰۲/۰

تاریخ پاسخ : ۰۲/۰۶/۰۸

نوع میکروارگانیسم	سوسپانسیون باکتریایی cfu/ml	شمارش تعداد میکروارگانیسم در زمان اثر ۴۰ ثانیه	
		حالت پاک cfu/ml	حالت آلوده cfu/ml
Staphylococcus aureus	۲×۱۰^{۴}	۱>	۱>
Streptococcus agalactiae	۲×۱۰^{۴}	۱>	۱>
Streptococcus dysgalactiae	۱×۱۰^{۴}	۱>	۱>

نوع میکروارگانیسم	صحه گذاري			
	سوسپانسیون باکتریایی cfu/ml	شرایط تجربي cfu/ml	کنترل سمیت خنثي کننده cfu/ml	کنترل رقیق سازي – خنثي سازي cfu/ml
Staphylococcus aureus	۲×۱۰^{۳}	۱×۱۰^{۳}	۱×۱۰^{۳}	۱×۱۰^{۳}
Streptococcus agalactiae	$۲/۵ \times ۱۰^{۳}$	۲×۱۰^{۳}	۱×۱۰^{۳}	$۱/۳ \times ۱۰^{۳}$
Streptococcus dysgalactiae	$۱/۵ \times ۱۰^{۳}$	۱×۱۰^{۳}	$۱/۵ \times ۱۰^{۳}$	۱×۱۰^{۳}

حالت پاک : غلظت نهایی آلبومین ۳ g/L
حالت آلوده : غلظت نهایی آلبومین ۱۰ g/L و غلظت نهایی مخمر ۱۰ g/L
در تعیین اثر بخشی ضد عفونی کننده از محلول تازه بدون رقیق سازي استفاده شد.

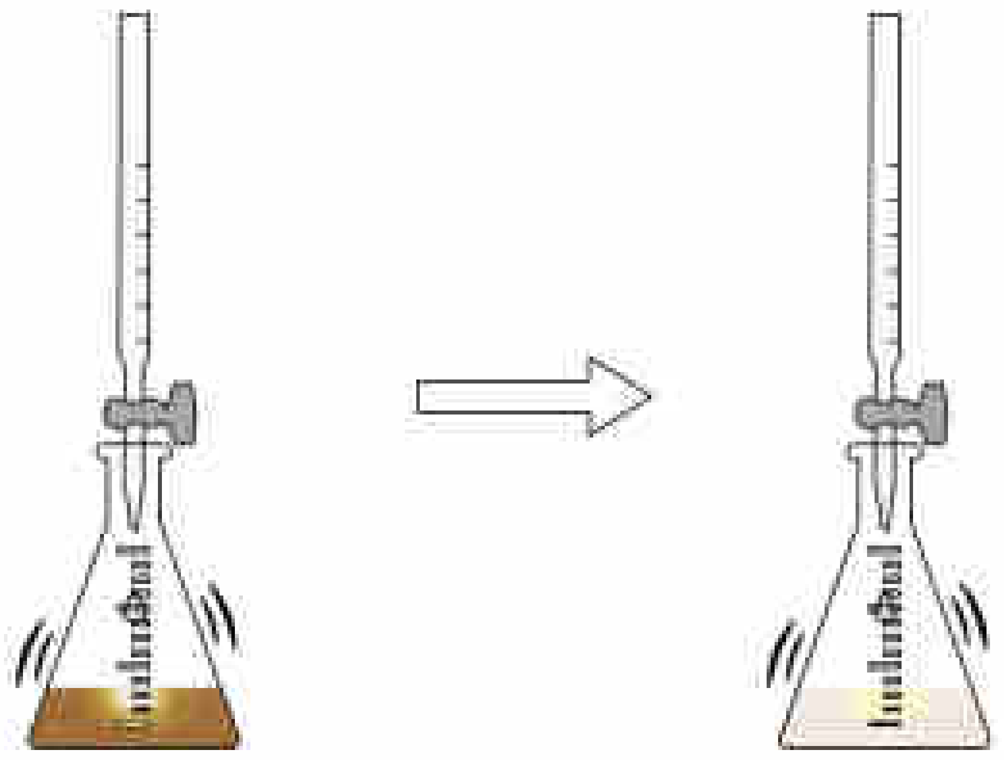


Fig 1. Iodine-Sodium Thiosulfate Titration.

Determining Efficacy of Teat Dip Products

I. In vitro testing
II. Experimental Challenge model
III. Natural exposure model

Persistent action

KPI

- SCC
- Cell Count movement
- IMI
- Clinical Mastitis (score1&2)
- Teat condition
- Corynebacterium

Chlorhexidine

Chlorine dioxide

Iodine

Chlorhexidine

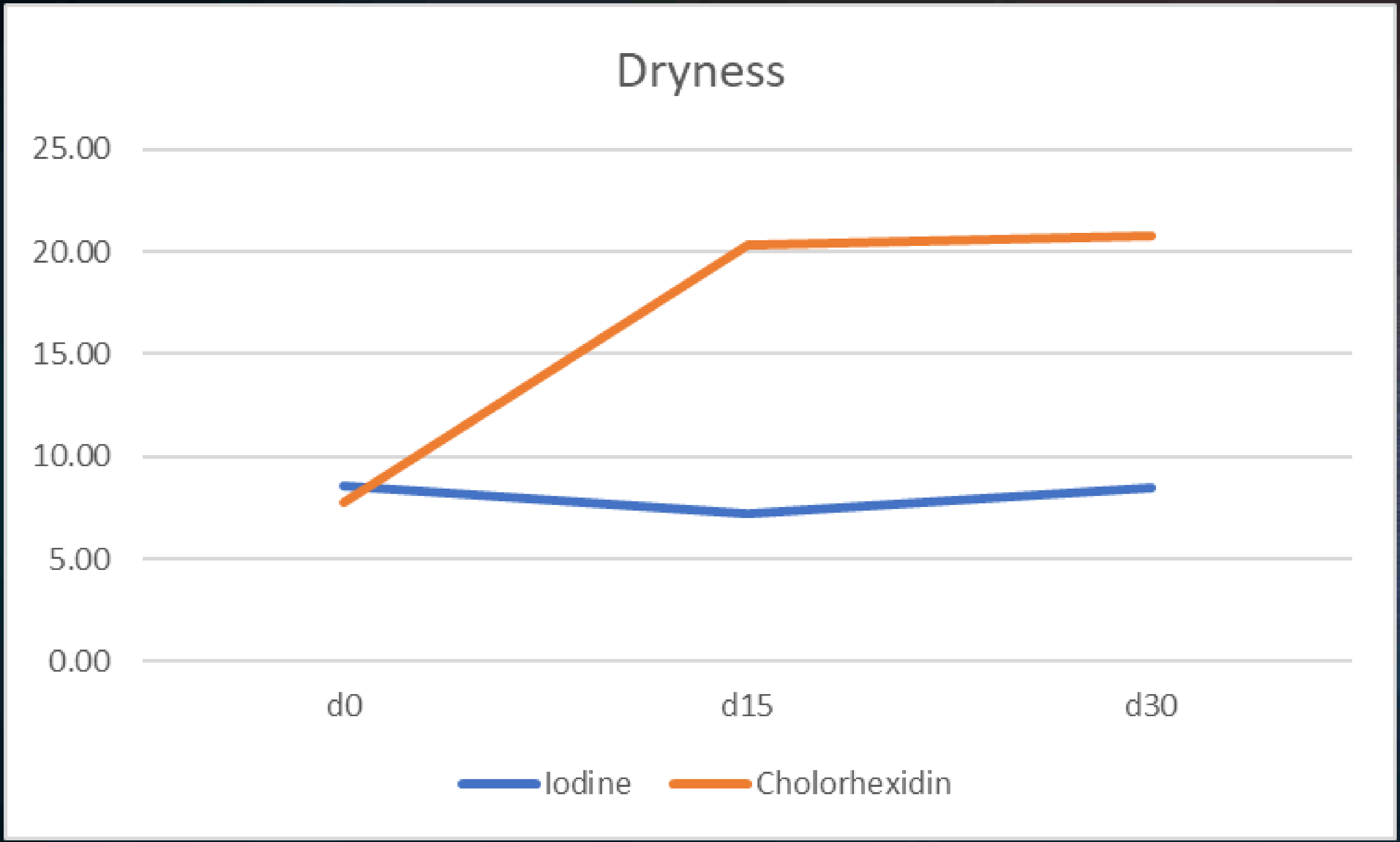
- Aim: compare the efficacy of two post-milking teat dips
- according to Hogan et al, a split-herd design was used.

120 dairy cows

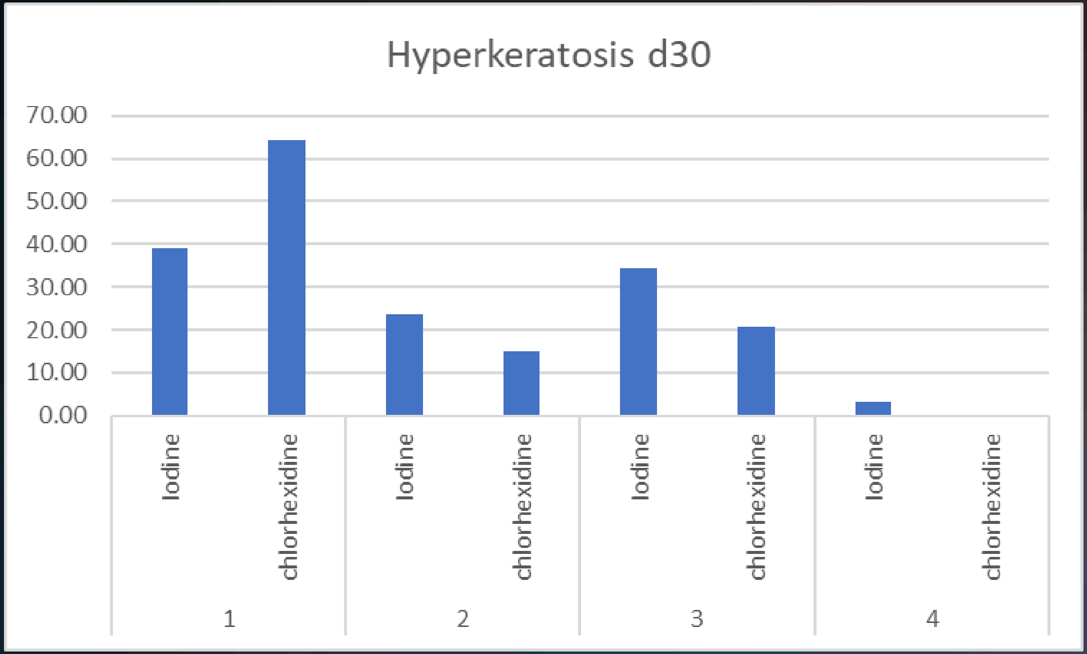
- Group 1 (n=60) iodine-formulated postdip
- Group 2 (n=60) chlorhexidine postdip. (Farmed co.)

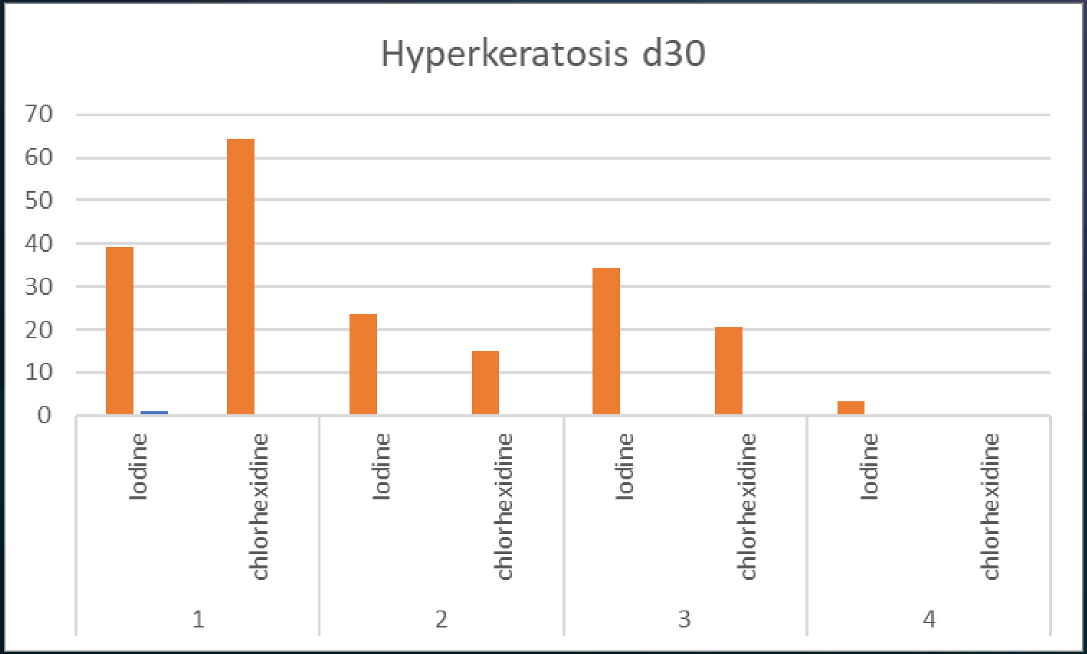
- SCC: Day 0 and 30 of the study
- Teat skin swabs on Day 0, 15 and 30.
- (BTM) samples of both treatment groups (balance tank
- Teat skin condition (normal, dry and having open lesions)
- Hyperkeratosis score

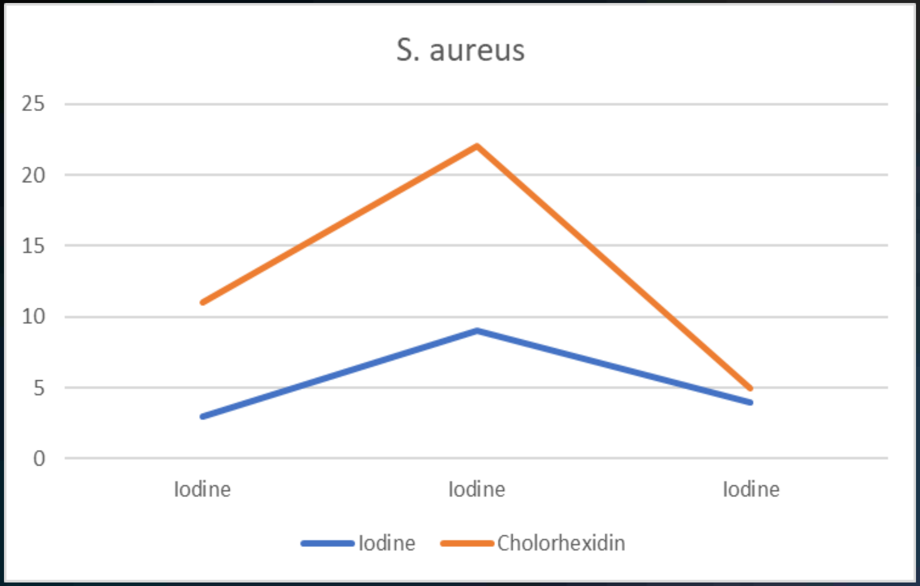
	Iodine 1%	Chlorhexidine
Milk	33.0	26.2
SCC d30	64.4	83.2
Swab count d15	35.4	10.09
Swab count d30	48.6	7.9
aureus count d15	7.74	2.16
aureus count d30	2.67	1.36
CNS d15	8.36	4.01
CNS d30	1.64	0.541
Corynebacterium d15	1.85	0.54
Corynebacterium d30	4.62	0.9



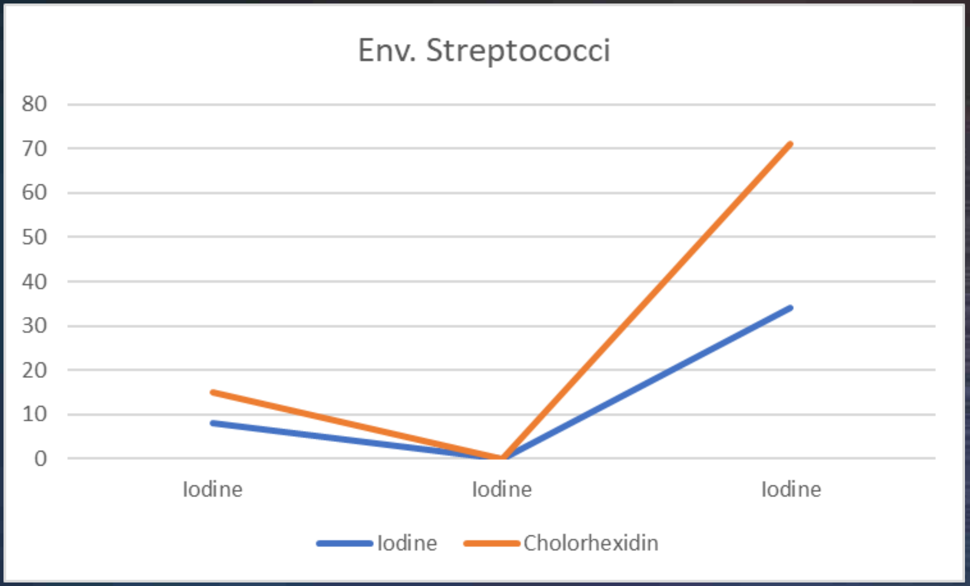
Dryness
25.00
20.00
15.00
10.00
5.00
0.00
d0
d15
d30
Iodine
Cholorhexidin


Hyperkeratosis d30
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Iodine
chlorhexidine
Iodine
chlorhexidine
Iodine
chlorhexidine
Iodine
chlorhexidine
1
2
3
4

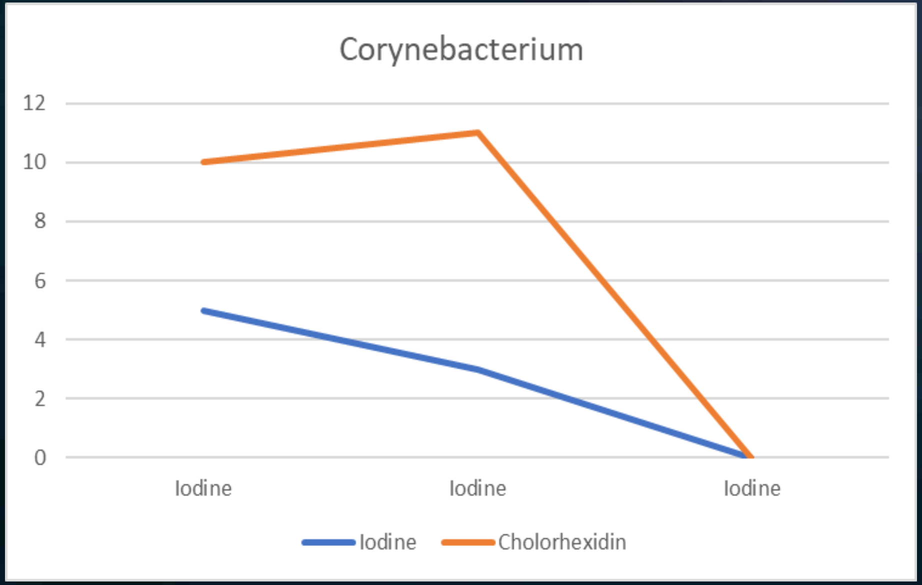

Hyperkeratosis d30
70
60
50
40
30
20
10
0
Iodine
chlorhexidine
Iodine
chlorhexidine
Iodine
chlorhexidine
Iodine
chlorhexidine
1
2
3
4



S. aureus
25
20
15
10
5
0
Iodine
Iodine
Iodine
Iodine
Cholorhexidin



Env. Streptococci
80
70
60
50
40
30
20
10
0
Iodine
Iodine
Iodine
Iodine
Cholorhexidin



Corynebacterium
12
10
8
6
4
2
0
Iodine
Iodine
Iodine
Iodine
Cholorhexidin

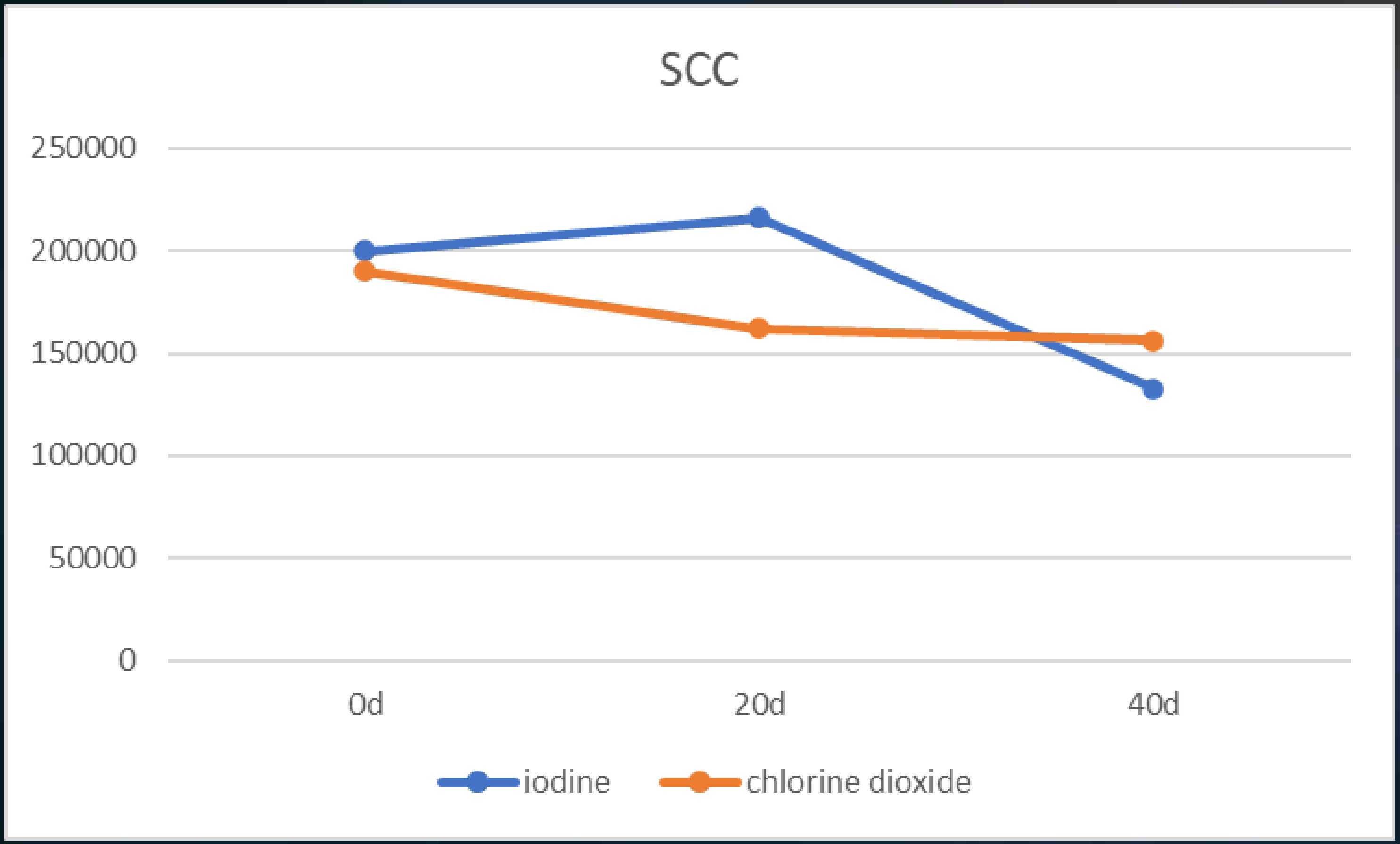
2. Chlorine dioxide + Lactic Acid

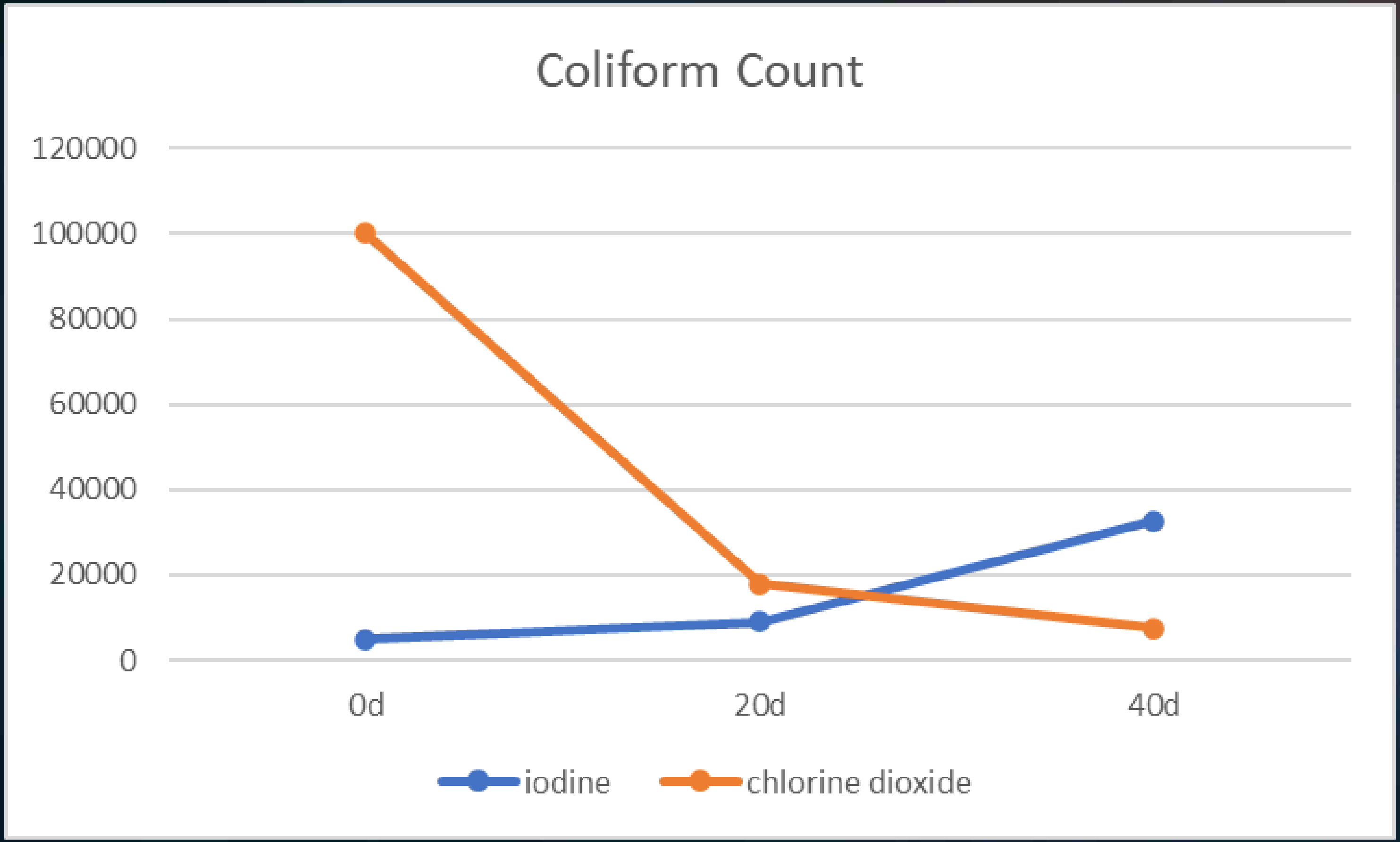
- این طرح در دامداری خزاعی از گاوداری های شیری صنعتی اطراف مشهد طی مدت ۴۰ روز از تاریخ ۲۵ آبان ۱۴۰۲ لغایت ۹ دی ۱۴۰۲ انجام گرفت.

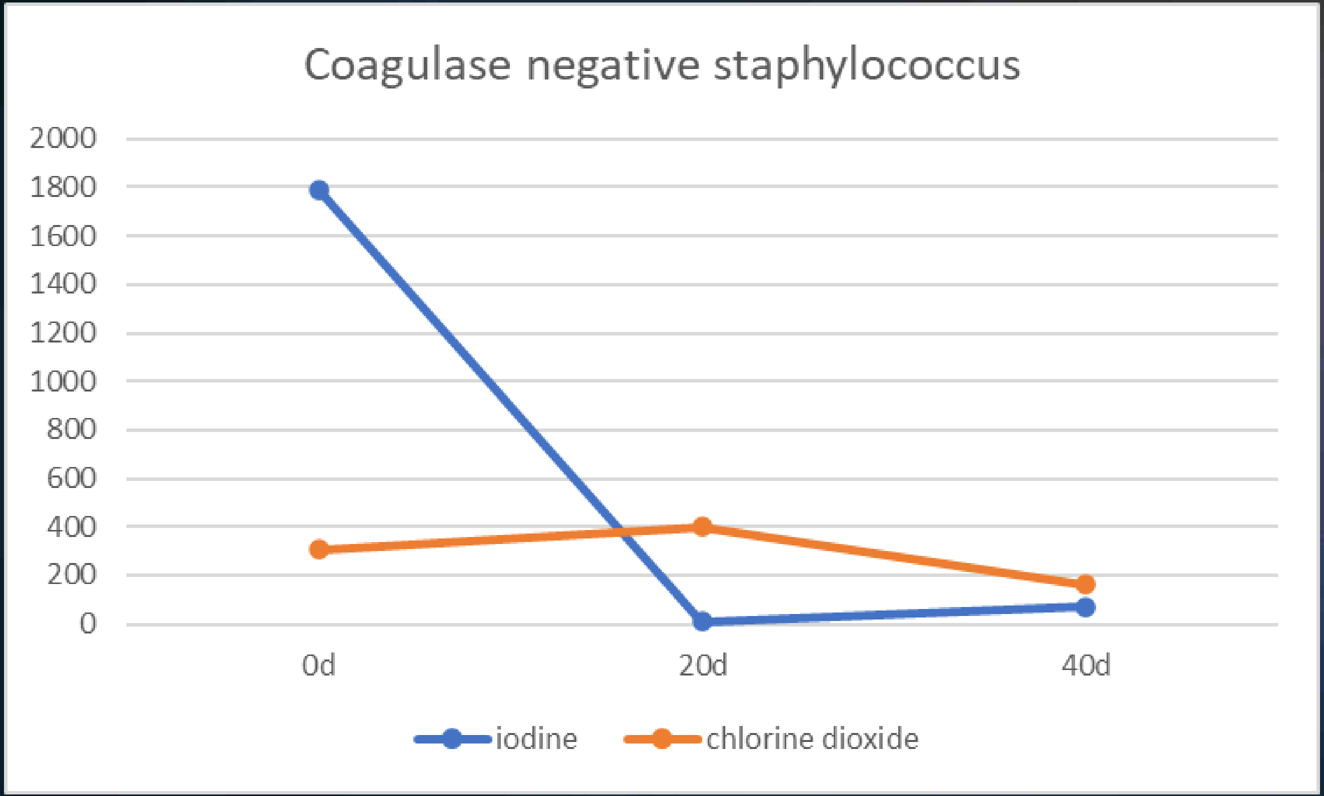
- به منظور انجام این مطالعه و مقایسه عملکرد دو محلول ضدعفونی کننده، طبق پروتکل ارائه شده توسط Hogan و همکاران از دیزاین Split-herd تعداد ۲۴۰ راس گاو هلشتاین وارد مطالعه شد.

به ۲ گروه ۱۲۰ راسی تقسیم شدند:

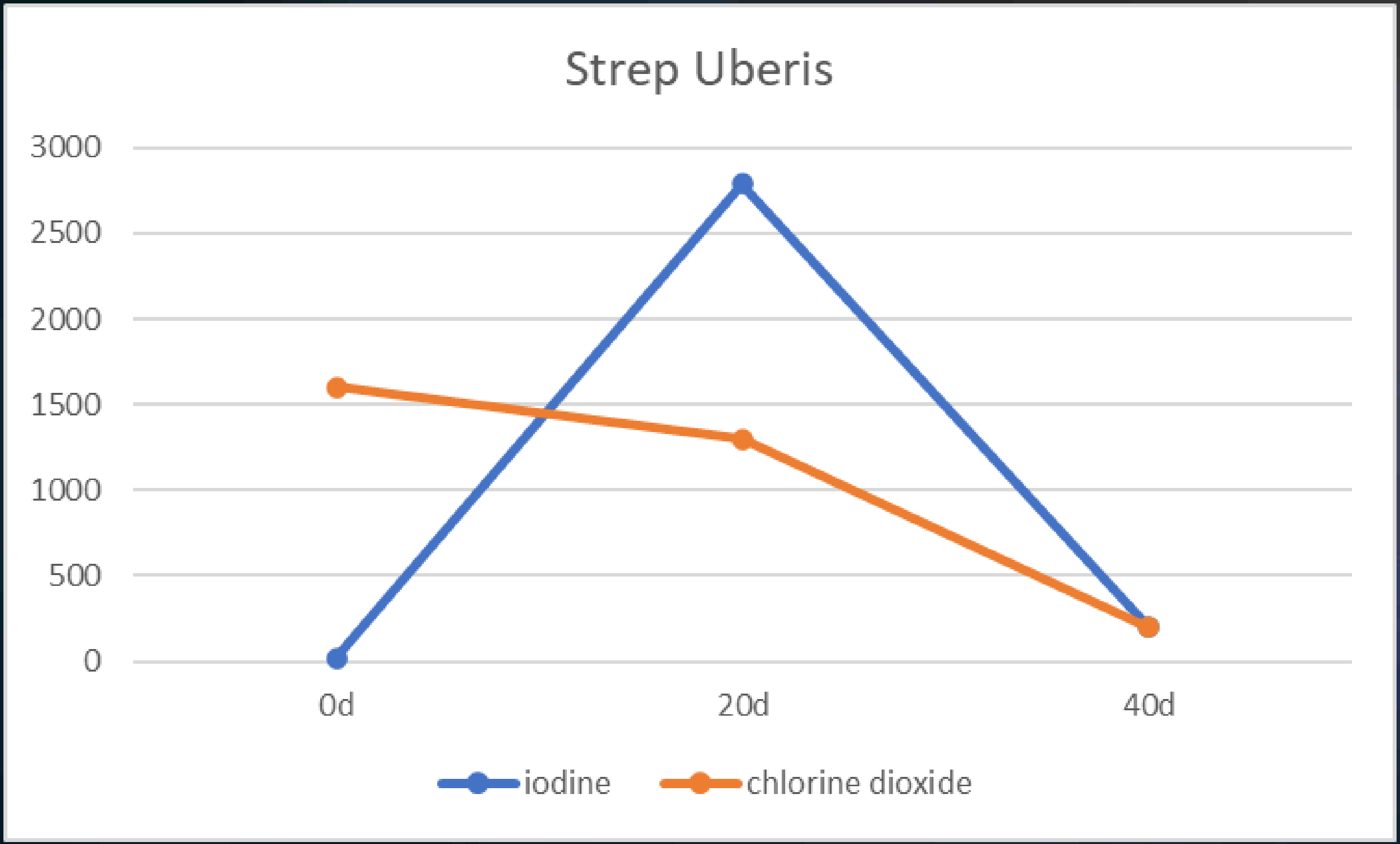
- گروه ۱ (n=120): گاوهایی که پس از شیردوشی طبق دستورالعمل NMC پست دیپ یده یک درصد دریافت می کنند
- گروه ۲ (n=120): گاوهایی که پست دیپ از نوع کلرین دی اکساید و اسید لاکتیک (راسامیکس) دریافت کردند.


SCC
250000
200000
150000
100000
50000
0
0d
20d
40d
iodine
chlorine dioxide

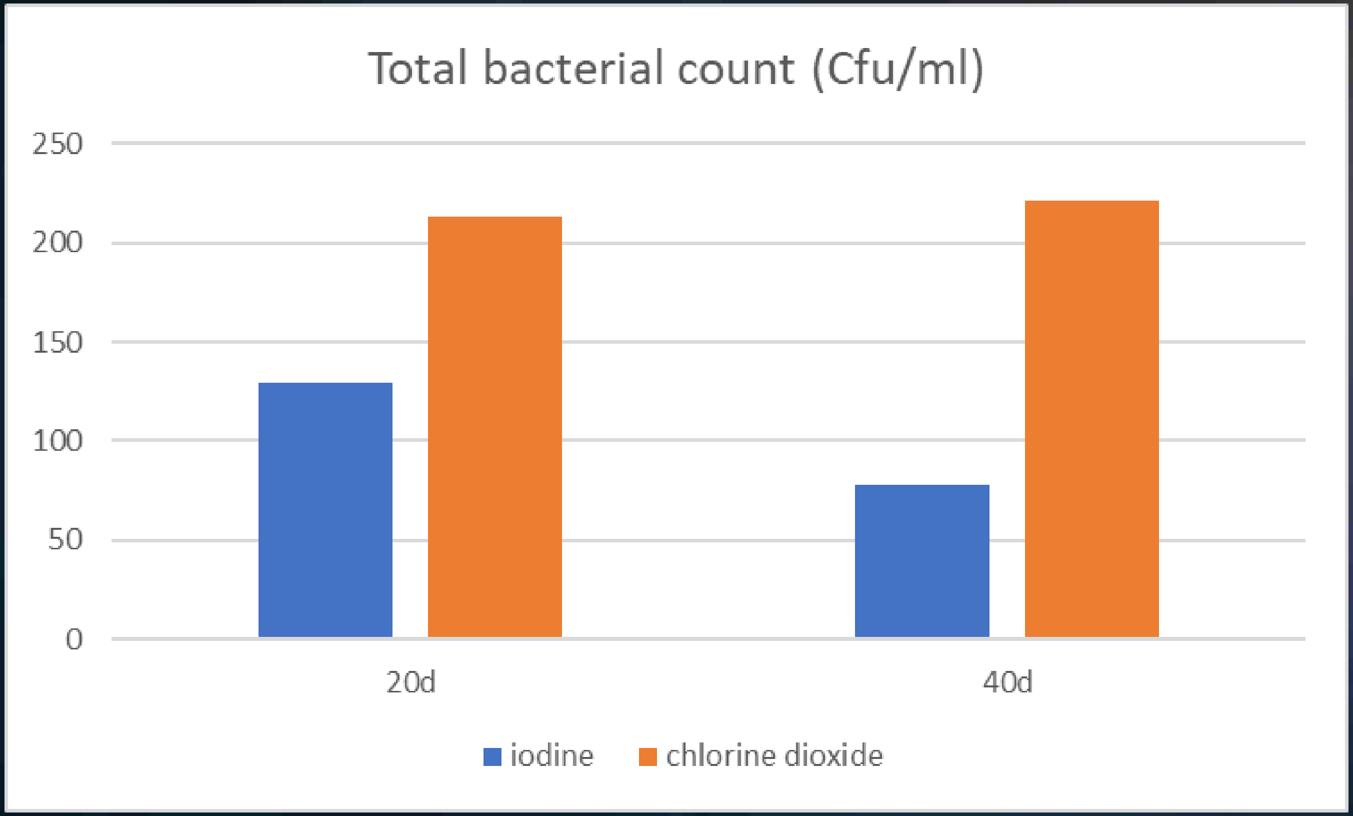

Coliform Count
120000
100000
80000
60000
40000
20000
0
0d
20d
40d
iodine
chlorine dioxide



Coagulase negative staphylococcus
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0d
20d
40d
iodine
chlorine dioxide


Strep Uberis
3000
2500
2000
1500
1000
500
0
0d
20d
40d
iodine
chlorine dioxide

Swab



Total bacterial count (Cfu/ml)
250
200
150
100
50
0
20d
40d
iodine
chlorine dioxide

Dryness: 0 Vs 0

Clinical Mastitis: 2 cases in treatment group / 3 cases in Control group

ورم پستان تحت بالینی

No.	Group	SPC	Culture
6181	Control	over	*CNS*
7226	Control	over	*CNS*
6161	Control	over	*CNS*
99157	Control	23000	*CNS*
8312	Control	40000	*Coagulase positive*
7404	Control	over	*Coagulase positive*
6181	Control	38000	*Coagulase positive*
6181	Control	1400	*Coagulase positive*
99209	Control	4500	*CNS*
4081	Control	20000	*Coagulase positive*
7204	Treatment	over	*CNS*
8287	Treatment	14000	*CNS*
8114	Treatment	21000	*Coagulase positive*
8155	Treatment	31000	*CNS*
7304	Treatment	over	*Coagulase positive*
6061	Treatment	1100	*Coagulase positive*
3113	Treatment	5000	*CNS*
5221	Treatment	800	*CNS*
8093	Treatment	3200	*CNS*
8155	Treatment	1400	*Coagulase positive*
7073	Treatment	7500	*CNS*
7297	Treatment	300	*CNS*

3. Povidone iodine

- Disinfectants on an iodine basis can be divided into three main groups according to the solvent and substances interfering (by complexing) with iodine species:

    1) **Pure aqueous solutions**
    2) **Alcoholic solutions**
    3) **Iodophoric preparations**

- Iodine + high-molcular-weight carries = iodophore → allow slow, continuous release of free iodine

Iodophors

- An iodophor is a complex of iodine with a carrier that has at least three functions:
  - To increase the solubility of iodine,
  - To provide a sustained-release reservoir of the halogen,
  - To reduce the equilibrium concentration of free molecular iodine.

- The carriers are usually neutral polymers, such as PVP, nonylphenoxy polyethoxyethanol, polyether glycols, polyvinyl alcohols, polyacrylic acid, polyamides, polyoxyalkylenes, and polysaccharides
- **Surfactant**

(NPE) nonylphenol ethoxylates / PVP

Reduced the infection rate 57.6% for major and 53.7% for minor pathogen

Foret et al., 2005

0.25% iodine

5 to 8 ppm of free iodine

0.25% iodine

12 to 16 ppm of free iodine

No significant difference in teat condition

- Available iodine:
  - iodine that can be titrated with sodium thiosulphate
- **Free iodine:**
- Total iodine:
  - iodide plus titratable iodine

The real bactericidal agent is **free molecular iodine**, because it is this species alone for which a correlation between concentration and bactericidal activity has been proved, and not for the **total iodine** or iodophor concentration

- Effectiveness of iodine germicides has little dependence on the iodine concentration. (Murdough and Pankey, 1993)
- Efficacy of iodine teat dips →concentration of free iodine (Gottardi, 1991)
- Free iodine=uncomplexed or molecular iodine

Aqueous Solution

- For the system iodine/water, nine different equilibria are specified, which produce at least 10 new iodine species:

- I-, I_2, I_3-, I_5-, I_6^{2-}, HOI, OI^-,HI_2O^-, I_2O^{2-}, H_2OI^+, and IO_3^-.

$$I_2 + H_2O \leftrightarrow HOI + I^- + H^+ \ (\textit{hydrolysis},\ K_1)$$

$$HOI \leftrightarrow OI^- + H^+ \ (\textit{dissociation of HOI},\ K_2)$$

$$I_2 + I^- \leftrightarrow I_3^- \ (\textit{triiodide formation},\ K_3)$$

$$HOI + H^+ \leftrightarrow H_2OI^+ \ (\textit{protonization of HOI},\ K_4)$$

$$I_3^- + I_2 \leftrightarrow I_5^- \ (\textit{pentaiodide formation},\ K_5)$$

$$2I_3^- \leftrightarrow I_6^- \ (\textit{dimerization of } I_3^-,\ K_6)$$

$$OI^- + I^- + H_2O \leftrightarrow HI_2O^- + OH^- \ (\textit{iodination of } OI^-,\ K_7)$$

$$HI_2O^- \leftrightarrow I_2O^- + H^+ \ (\textit{dissociation of } HI_2O^-, K_8)$$

$$3HOI \leftrightarrow IO_3^- + 2I^- + 3H^+ \ (\textit{disproportionation})$$

Seven different ions →each with different germicidal activity

- I_2
- hyoiodic acid [HOI]

PH and additional iodide are influencing equilibrium concentrations

- Iodine + high-molcular-weight carries = iodophore → allow slow, continuous release of free iodine

	Control (ناتاوست 1 درصد)	PVP-I (0.3% ایلیا شیمی)
Sample size (quarter)	372 (93cows)	368 (92cows)
CMT (N)	306	**352**
CMT (T)	20	**5**
CMT (1)	16	**3**
CMT (2)	5	**5**
CMT (3)	0	**0**
IMI	11%	**3.5%**
S.aureus	6	**3**
CNS	19	**9**
Dryness	6	**2**
Hyperkeratosis 3	29 (7.79%)	29 (7.8%)
Hyperkeratosis 4	6 (1.6)	2 (0.5%)
Clinical Mastitis	0	0

Conclusions