



HAND HYGIENE TECHNIQUE AND EFFICIENCY OF DEGERMING AGENTS IN PREVENTION OF HOSPITAL INFECTIONS

TÉCNICA DE HIGIENE DAS MÃOS E EFICIÊNCIA DE DEGERMANTES NA PREVENÇÃO DE INFECÇÕES HOSPITALARES

TÉCNICA DE HIGIENE DE LAS MANOS Y EFICIENCIA DE ELIMINADORES DE GÉRMEENES EN LA PREVENCIÓN DE INFECCIONES HOSPITALARES

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ABSTRACT

Objective: to evaluate the hand hygiene technique and the efficacy of two degerming agents, one castor oil - based agent and the other corresponding to an agent regularly used in hospitals. **Method:** descriptive study conducted from July to August 2010 with 16 volunteers including students of the Nursing course, Biology and Veterinary Medicine of the State University of Northern Paraná - UENP/Campus Luiz Meneghel. **Results:** results show that the process of handwashing held according to the correct hygiene technique had no significant difference in terms of reducing microorganisms compared to the use of degerming products, whose efficacy was higher than 90%. However, reduction was significantly lower, 35% (castor oil-based agent) and 60% (agent regularly used), when the technique of hand hygiene for reduction of microorganisms was not correctly applied. **Conclusion:** hand hygiene procedure is critical to the control and prevention of hospital infection. **Descriptors:** Hospital Infection; Hand Hygiene; Degerming Agents; Castor Bean Oil.

RESUMO

Objetivo: avaliar a técnica de higiene das mãos e a eficácia de dois degermantes, sendo um de uso regular em hospitais e outro à base de óleo de rícino. **Método:** estudo descritivo, realizado no período de julho a agosto de 2010, que teve como sujeitos de pesquisa 16 voluntários, graduandos de Enfermagem, Biologia e Medicina Veterinária da Universidade Estadual do Norte do Paraná - UENP/Campus Luiz Meneghel. **Resultados:** os resultados mostram que a lavagem das mãos realizadas na Técnica de higiene das mãos correta não apresentou diferença significativa na redução dos micro-organismos, comparado ao degermante utilizado, que foi superior a 90%. No entanto, o não emprego correto da técnica de higiene das mãos para a redução de micro-organismos foi significativamente menor, 35% (óleo de rícino) e 60% (uso regular). **Conclusão:** o procedimento de higiene das mãos é fundamental para o controle e prevenção de infecção hospitalar. **Descritores:** Infecção Hospitalar; Higiene das Mãos; Degermantes; Óleo de Mamona.

RESUMEN

Objetivo: evaluar la técnica de higiene de las manos y la eficacia de dos eliminadores de gérmenes, siendo uno de uso regular en hospitales y otro a la base de aceite de ricino. **Método:** estudio descriptivo, realizado en el período de julio a agosto de 2010, que tuvo como sujetos de investigación 16 voluntarios, graduandos de Enfermería, Biología y Medicina Veterinaria de la Universidad Estadual del Norte de Paraná - UENP/Campus Luiz Meneghel. **Resultados:** los resultados muestran que el lavado de las manos realizadas en la Técnica de higiene de las manos correcta no presentó diferencia significativa en la reducción de los micro-organismos, comparado al eliminador de gérmenes utilizado, que fue superior a 90%. Sin embargo, el no empleo correcto de la técnica de higiene de las manos para la reducción de micro-organismos fue significativamente menor, 35% (aceite de ricino) y 60% (uso regular). **Conclusión:** el procedimiento de higiene de las manos es fundamental para el control y prevención de infección hospitalaria. **Descriptores:** Infección Hospitalaria; Higiene de las Manos; Eliminador de Gérmenes; Aceite de Mamona.

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INTRODUCTION

Health care-associated infections (HAIs) are a major public health problem and they challenge the technological advances achieved in health. This scenario mobilizes researchers and national and international organizations in the search for preventive measures and more effective control that may ensure safety in care processes.

It is known that nearly 5-10% of hospitalized patients acquire HAIs in developed countries and about two million HAIs related with iatrogenesis in health care are registered every year in the United States (US).¹

Most HAIs occur as natural complications of the disease process associated with hospitalization as a result of the imbalance between endogenous microbiota and defense mechanisms of the body. This may cause functional sequelae and poor clinical outcome with consequent death. It is, therefore, essential that HAIs prevention and control is well founded in knowledge about the chain of transmission of infections.^{2,3}

Worldwide, the hands of professionals are the main vehicle for transmission of microorganisms in the spaces intended for health care and they play a fundamental role in the development of HAIs.⁵

The present study aimed to evaluate the efficacy of two degerming solutions in eliminating microorganisms present in the hands through the application of knowledge regarding the correct technique for hand hygiene (HH).

LITERATURE REVIEW

It is believed that many HAIs are preventable and HH represents the main and most effective measure to break the chain of transmission and development of infections, since this is considered a primary mechanism for controlling the spread of potentially pathogenic microorganisms.^{4,9} However, the low adherence to this simple and yet so effective practice has been continuously documented in the scientific community, as several studies have shown compliance rates below 60% in different health care realities.^{1,10,25}

The practice of HH involves different methods and can be performed with the use of soap and water and common antiseptic solutions for elimination of potentially pathogenic microorganisms from the skin surface, by performing a rigorous and sequential friction of hands.^{6,8}

The combination of an antiseptic agent with solutions used in the hand-washing procedure aims to increase safety in reducing transient microbiota and is a potentiating measure in controlling the spread of multidrug-resistant microorganisms.¹¹

Chemical agents include various groups of substances that destroy microorganisms or restrict their growth on the surface of the skin or inanimate objects. The selection of the antiseptic agent is a critical point in the disinfection process.⁵ In this regard, some of the products that can be used for this control include phenols and phenolic compounds, biguanides, alcohol, surface agents and nonionic surfactant compounds.

The molecules that constitute the soap have polar and nonpolar characteristics. When in contact with liquid, whether polar or non-polar, these molecules dissolve interacting with the molecules of liquid. For this reason, soaps and detergents are called surfactant substances.¹²

The molecule that constitutes the soap belongs to the chemical function known as salt and has, therefore, at least one connection with typical ionic and, consequently, polar characteristic. This polarity, as well as the size of the non-polar carbon chain, allows the soap to dissolve in polar and apolar substances and even in both simultaneously. It is this property that gives the soap its cleaning power, that is, the power of mechanical removal of organic residues, minerals and microorganisms.¹³

♦ The contribution of castor oil

The text of Papyrus Ebers is dominated by formulas of drugs described in over eight hundred formulas or prescriptions and mentioning more than seven hundred different drugs. The drugs mentioned have mainly botanical origin, although there are also some with mineral and animal origin. Substances with vegetable origin such as acacia, castor seed (from which comes the castor oil) and fennel are cited with apparent references to minerals such as iron oxide, sodium carbonate, sodium chloride and sulfur.¹⁴

Ricinoleic acid is the main component of castor oil and has numerous applications. Besides its purgative function, castor oil can be used in the manufacture of inks, dyes, aniline, disinfectants, germicides, lubricant low temperature oils, adhesives and glues, nylon and plastic. It can be also used in the production of biodiesel and manufacture of cosmetics and various pharmaceutical drugs.¹⁵

From a commercial point of view, oil is the main component of castor bean (*Ricinus*

communis, L.) whose potential for the chemical industry is indispensable. This typically contains one predominant fatty acid in its composition, what does not occur with other vegetable oils, containing at least 85% of triglyceride of the ricinoleic acid. It has three highly reactive functional groups and it is the only one hydroxylated fatty acid, which makes it soluble in alcohol at low temperature and allows the synthesis of a large number of derivatives, because of its versatility.¹⁶

Although the toxicity of the Castor plant has been known since ancient times, the castor oil is not toxic, once the toxic protein present in the seed, the ricin, is not soluble in lipid and the toxic component is, thus, entirely restricted to the bagasse. Ricin inactivates specifically and irreversibly the eukaryotic ribosomes, preventing protein synthesis.¹⁷

The castor oil obtained by pressing seeds is a precursor substance of a polymer and a solution composed of esters of ricinoleic acid, known as castor oil detergent.¹⁸

Detergents are products formulated to promote detergency phenomenon (process of soiling removal using a detergent or surfactant) comprising an active basic compound and some complementary components (supporting, synergistic, additive and auxiliary products).⁴ Non-ionic surfactants are polyoxyethylene and polyoxypropylene derivatives (compounds of alkyl phenol and alcohol, esters of fatty acids, alkyl amines, amides and mercaptans) or polyalcohols, carbohydrates esters, amides of fatty alcohols and oxides of fatty amides.¹⁹

METHODOLOGY

Descriptive study, carried out from July through August 2010. Research subjects corresponded to 16 volunteers among undergraduate students from the 7th semester of the Nursing course, 5th semester of Biology and 3rd semester of Veterinary Medicine at the State University of Northern Paraná - UENP/Campus Luiz Meneghel - CLM. Participants were divided into two groups with eight subjects: volunteers **without knowledge** of proper technique for HH (students of Veterinary Medicine and Biology) and volunteers **with knowledge** of the proper technique for HH.

For the present study, the steps recommended by ANVISA for hand washing procedure were considered as the appropriate technique to HH.⁴

Two degerming agents were tested for microbial control of the hands of volunteers. One agent is regularly used in hospitals and

contains formaldehyde in its formulation intended for antiseptics of the skin by removing debris and impurities, with fungicidal, virucidal and bactericidal properties. The second degerming agent, composed of castor oil, is a nonionic surfactant compound with surfactant action for mechanical removal of dirt.

Because castor oil is nontoxic and biodegradable, natural descaling function is also possible. The molecules found in carbon chains of *ricinus oil* potentiate the action of fatty acids, dissolving grease and other deposits. It is pH-neutral, non-corrosive, deodorant, does not release toxic gases and has beneficial environmental impact.

All volunteers used both products for the procedure of washing hands. A group had knowledge of the correct technique of HH, procedure followed in the research, and the other group had not received training regarding steps to perform the washing of hands.

Samples were obtained from the hands of participants in both groups (**without knowledge** of the correct technique and **with knowledge** of the correct technique of HH) before and after the performance of handwashing with both products tested in the Microbiology Laboratory of UENP/FALM through the use of swab soaked in saline solution in interdigital areas and the fingerprint of the tips of the middle and index fingers and the thumb.

The material was inoculated in plates containing Tryptone Soy Agar (TSA) medium and incubated in a stove at 37°C for 48 hours. Counting of colonies was performed after growth, determining the colony forming unit (CFU). Data collection was conducted using three repetitions in time lengths of 10 (ten), twenty (20) and thirty (30) days, and the results represent the average of the three collections of microbial growth.

The research project follows all guidelines of Resolution 196/96, with signed Informed Consent of participants as well as approval by the Ethics Committee for Research Involving Human Beings of the State University of Northern Paraná, recorded in the opinion nº 033/2008. Data were subjected to analysis of variance (ANOVA) and comparison of means by Tukey test ($p < 0.05$) using the STAT 7.0 (SS, Inc.) software.

RESULTS AND DISCUSSION

The results obtained by the fingerprint of the tips of middle and index fingers, and the thumb showed that the significant reduction in CFU before and after the handwashing

procedure using the castor oil (ricinus oil)-based degerming agent was 97.4%, present on the skin for the group **with knowledge** of the proper technique for HH and 35.2% for those **without knowledge** of the proper technique

degerming agent regularly used in hospitals, showing a reduction of 92.0% for the group **with knowledge** of the proper technique of HH and 60.1% for those **without knowledge** of the proper technique of HH (Table 1).

Table 1. Percentage of reduction of CFU from the hands of volunteers with and without knowledge of the technique for HH, obtained by the fingerprint of the thumb and index finger.

Degerming agent	With technique of HH			Without technique of HH		
	Before	After	Reduction (%)	Before	After	Reduction (%)
	CFU			CFU		
Castor oil-based	146.63	3.75	97.4 aA	130.13	10:38	35.2 bB
Regularly used in hospitals	256.5	166.13	92.0 aA	151.36	60.36	60.1 ba

(Data: HH = Hand Hygiene; CFU = Colony Forming Unit) (1) Means followed by the same lowercase letter on the line and uppercase in the column, there is no difference according to Tukey test at the significance level $p < 0.05$. for HH. Similar results were obtained with the

The results obtained by *swab* collection show a significant reduction using both castor oil-based agent and the degerming agent regularly used in hospitals of 96.2% and 94.9%, respectively, for the group **with knowledge** of

the proper technique for HH and 32.9% and 50.8%, respectively, for volunteers **without knowledge** of the proper technique of HH (Table 2).

Table 2. Percentage of reduction of CFU from the hands of volunteers with and without knowledge of the technique for HH obtained by swab between fingers.

Degerming agent	With technique of HH			Without technique of HH		
	Before	After	Reduction (%)	Before	After	Reduction (%)
	CFU			CFU		
Castor oil-based	102.12	3.85	96.2 aA	221.23	148.38	32.9 bB
Regularly used in hospitals	91.8	4.6	94.9 aA	153.55	75.6	50.8 ba

(Data: HM = Hand Hygiene; CFU = Colony Forming Unit) (1) Means followed by the same lowercase letter on the line and uppercase in the column, there is no difference according to Tukey test at the significance level $p < 0.05$.

Results from studies that used methodology of structured observation showed that, when not done properly, the procedure of basic handwashing by professionals is an important source of spread of hospital infections.²⁰

There was a significant difference between the quantitative reduction of CFU present in the hands of the two groups evaluated in this study, thus giving evidence of the effectiveness of the use of HH technique for reducing the microbial load. There was a greater reduction of UFC after the use of both degerming agents in the hands of participants **with knowledge** of the proper technique for HH.

The HH is a very important measure of biosecurity and should be understood by health professionals as an act of self-protection.

Effective strategies to promote improved HH practices are intrinsically related to the fall in the incidence of HAIs. Study with a primary focus in practice and proper technique of HH demonstrated its effectiveness in reducing HAI rates. The use of posters containing information about the correct technique of HH were associated with daily interventions and greatly contributed to the progressive reduction of HAI rates of 13.1% in the period of pre-intervention of the study to 1.3% after intervention.⁷

Recent studies have shown a strong association between training sessions related to the practice of HH and improved adherence with consequent reduction in HAI rates, which reinforces the current recommendation that strategies for improving HH practices must be also focused on knowledge and behaviour of health care professionals.^{9,21}

The soap regularly used in hospital had a relatively better performance than castor oil-based degerming agent in reducing CFUs present in the hands of participants when used by the volunteer group **without knowledge** of the proper technique. This result may be associated with the chemical composition containing formaldehyde, a compound with confirmed bactericidal action.

Aldehydes are among the most effective antimicrobial agents, inactivating proteins and forming covalent crosslinks with various organic functional groups in proteins. Glutaraldehyde is a chemical product related to formaldehyde that is less irritating and more effective than formaldehyde. This is used to disinfect hospital instruments, including breathing equipment.²²

A study with castor oil-based detergents shows that this is a good antimicrobial agent with bactericidal activity similar to that of sodium hypochlorite.¹⁹

The action was fungistatic in the filamentous fungus *Aspergillus nidulans*, with

morphological changes in the colonies and conidiophores, delay in formation of conidia and increased mitotic recombination frequencies in the diploid generation UT448//UT196.²³

CONCLUSION

The use of the proper technique for the procedure of washing of hands, regardless of degerming agents, proved to be highly effective in reducing CFU present in the hands of study participants, since both had a decrease over 90%. The practice of HH without using the appropriate technique was less effective than when using the proper technique.

The results related to higher efficiency of the degerming agent regularly used in hospitals, which has formaldehyde in its composition, in the group of participants *without knowledge* of the proper technique of HH reinforce the need for further studies regarding the efficacy of the compound castor oil, as well as emphasize the importance of research to the development of new technologies as regards the production of supplies for the practice of Hand Hygiene.

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