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ALCOHOLIC HAND SANITIZER ON THE INCIDENT OF CONTACT DERMATITIS IN HEALTH WORKERS

Louis Rianto*, Sherren Tanzia, Priscilla Clara Agatha, Celine, Daniel Octavianus
Faculty of Medicine, Universitas Tarumanagara, Jl. Letjen S. Parman No.1, Tomang, Grogol Petamburan, Jakarta Barat, Jakarta 11440, Indonesia
*louis.rianto@rocketmail.com

ABSTRACT
The COVID-19 pandemic has increased the frequency of using alcohol-based hand sanitizers, especially among health workers. This increase in the frequency of using hand sanitizers increases the incidence of contact dermatitis. The presence of allergens and reduced fat and water content in the skin causes contact dermatitis. This research was conducted to review more deeply how much influence the use of hand sanitizers has on the incidence of contact dermatitis for health workers in the COVID-19 era and to provide advice on the use of additional materials as well as the selection of materials and procedures for using hand sanitizers to reduce the incidence of contact dermatitis. A literature search was conducted from journal articles with a time span of 2012-2022 using databases in the form of Pubmed, Ebsco, Google Scholar, Hindawi, Medline and Science Direct (65 articles). We included 65 research articles that met the inclusion and exclusion criteria by analyzing the abstract and full text through tables together. Research shows that the use of alcohol-based hand sanitizers with high frequency and contains allergenic ingredients triggers the occurrence of contact dermatitis in health workers. So the use of additional ingredients such as moisturizers and the selection of alcohol-based hand sanitizer materials must be considered to reduce the incidence of contact dermatitis.

Keywords: contact dermatitis; COVID-19; hand sanitizers; healthcare workers

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INTRODUCTION

COVID-19 is a respiratory disease caused by the SARS-CoV-2 virus which was discovered in 2019. COVID-19 can spread through droplets from infected people such as coughing, sneezing or talking. Transmission of this virus also increases with dense contact and poor ventilation. One way to prevent and slow the transmission of Covid-19 is to practice hand hygiene, namely washing your hands with soap or using an alcohol-based hand sanitizer. (Coronavirus Disease 2019 (COVID-19) | Disease or Condition of the Week | CDC, n.d.) Due to the high use of hand sanitizers, the incidence of contact dermatitis has increased in the COVID-19 pandemic era. The prevalence of contact dermatitis throughout the world varies quite widely, in Europe (19.5%) there are 18,709 individuals and in North America (20.6%) there are 1,639 individuals (Alinaghi et al., 2019). During the COVID-19 pandemic there has been an increase in the prevalence of contact dermatitis, especially in health workers. In a sociodemographic study, 175 nurses were found in September-October 2020, and the majority of 70.9% of the population experienced contact dermatitis due to the habit of washing their hands and using hand sanitizers (Aydın et al., 2021).

Among health workers in Iran, contact dermatitis that occurs due to the habit of washing hands and using alcohol-based hand sanitizers is 87.60% in nurses, 93.70% in laboratory workers and 84.60% in radiology workers (Abdi et al., 2022).Risk factors that cause a high prevalence of contact dermatitis in health workers are changes in the habit of washing hands with a frequency of more than 10 times and a duration of more than 2 minutes, as well as the use of alcohol-based hand sanitizers with an alcohol concentration of >60%. As many as 66.1% of health workers wash their hands more than 10 times per day and only 22.1% of health workers use moisturizer afterwards (Alkhalifah, 2022).

Although alcohol-based hand sanitizers have bactericidal properties that can kill normal flora on the skin and are important for maintaining the skin's defenses, the use of alcohol-based hand sanitizers can damage the protein structure in the outer layer of the skin, followed by changes in intercellular lipids, which causes the skin to become dehydrated and cause dermatitis. . The visible symptoms of dermatitis are dry, itchy, reddish skin on the hands and a burning sensation (Inder & Kumar, 2020). The recommended use of alcohol-based hand sanitizer is that it contains at least 60% alcohol, does not contain surfactants, preservatives, fragrances or dyes that cause allergies. To prevent contact dermatitis from using alcohol-based hand sanitizers, you can use moisturizer as an addition. This study aims to present the impact of using alcohol-based hand sanitizers on the incidence of contact dermatitis in health workers in the COVID-19 pandemic era thereby helping to increase awareness regarding this matter. as well as recommendations for the use of additional materials and procedures for using hand sanitizers to reduce the incidence of contact dermatitis.

METHOD

The author searched, sorted and analyzed scientific literature using keywords such as hand sanitizers, contact dermatitis, COVID-19, healthcare workers. The literature sources used are Pubmed, Ebsco, Google Scholar, Hindawi, Medline and science direct with a period of the last 10 years (2010-2022). From the keyword search results, journal selection was carried out using open access criteria and 51 journals met the criteria. Writing begins by reviewing the complete contents of the journal, holding group discussions, and cross-checking other primary sources. The results of the discussion are arranged in a structured form in the form of variations in the type and type of alcohol content of hand sanitizers, the impact on the skin of exposure to using alcohol hand sanitizers, the effect of exposure to alcohol hand sanitizers on the incidence of contact dermatitis, and suggestions for medical personnel who use alcohol-based hand sanitizers.

RESULTS

Frequency and Content of Alcohol-Based Hand Sanitizer on Contact Dermatitis

Allergic Contact Dermatitis will arise if there is sensitization to certain allergens. One of them is due to the high frequency of use of hand sanitizer. The incidence of contact dermatitis is followed by an inflammatory response after exposure to allergens and one of the components that triggers DKA is alcohol-based hand sanitizers which contain allergens such as propylene glycol and fragrance (Rundle et al., 2020a). Variations in the content of alcohol-based hand sanitizers can also trigger DKA. Research on 158 respondents who used alcohol-based hand sanitizers showed that 66% of subjects with a diagnosis of DKA and 34% with a diagnosis of DKI showed that the variations in the ingredients that caused this incident were nickel (27%), fragrance (11%), and methylchloroisothiazolinone or methylisothiazolinone (7.5%) (Quenan & Piletta, 2021). The incidence of contact dermatitis in health workers in the COVID-19 era has also increased significantly (97%) due to the use of hand sanitizers which causes a decrease in HRQoL (health-related quality of life) (Chernyshov & Kolodzinska, 2020). A

good concentration of alcohol-based hand sanitizer for bactericidal effects is 60-95%. One of the ingredients in hand sanitizer is methanol which can cause erythema and dermatitis on the skin (Alcohol-Based Hand Sanitizer - Composition, Proper Use and Precautions. | EBSCO Essentials, n.d.).

WHO recommends a concentration of 99.8% for isopropyl alcohol and 96% for ethanol to eradicate the corona virus. Several studies have also recommended that to achieve an effective bactericidal effect, hand sanitizer applications should be in volumes ranging from 1.1-3 mL, while the FDA recommends 2.4 mL as an effective hand sanitizer volume in one use (Saha et al., 2021). However, using hand sanitizer every day can be harmful to the surface of the skin. Isopropyl doses of 0.5-1 ml/kg tend to be toxic depending on each individual's tolerance level. Acute toxic response to skin exposure will occur from LD-50 (mid lethal dose) >2000 mg/kg. Absorption of Isopropanolol through the skin can cause skin irritation, dry skin, itching, and reddish rashes on the skin (Hussein, 2022). Ethanol tends to have less irritation than isopropyl alcohol. Based on Wicaksono and Ummu's research, respondents who used hand sanitizer > 20x/day could experience skin irritation and damage to the skin of their fingers. (View of The Effects Of Handwashing Habits On Health Protocols On Skin Hydration Levels And Incidence Of Irritant Contact Dermatitis, N.D.).

Contact Dermatitis in the Use of Alcohol-Based Hand Sanitizers in Health Workers

During the COVID-19 pandemic, hand hygiene is one of the important things to do. Good hand hygiene is done by washing your hands with soap. However, if soap and water are not available, you can use an alcohol-based hand sanitizer with a minimum alcohol content of 60% according to CDC recommendations. The alcohols commonly used in hand sanitizers are ethanol, isopropanol and n-propanol. The increasing use of alcohol-based hand sanitizers during the COVID-19 pandemic among health workers increases the incidence of contact dermatitis. The high prevalence of contact dermatitis due to the use of hand sanitizers is due to a history of eczema (OR, 3.68; 95% CI, 2.37-5.72; P <.001), rhinitis and/or conjunctivitis (OR, 1.64; 95% CI, 1.07- 2.5 ; P = .022), washing hands with soap / hand sanitizer > 5 times a day (OR, 3.32; 95% CI, 1.79-6.14; P < .001), and using gloves every day (OR, 3.57; 95% CI, 1.75-7.27; P <.001) (Alkhalifah, 2022). The high frequency of use of hand sanitizers and changes in the skin of health workers are highly correlated. This is shown by 31.47% of health workers who used hand sanitizer >10x/day experiencing changes in their skin. The skin symptoms most commonly found in this study were dry and itchy (Dash et al., 2023).

The same thing was shown in research (Roy1 et al., 2022), as many as 88.37% of respondents who used alcohol-based hand sanitizers more than 20 times per day were 3.5 times more at risk of experiencing skin problems. In addition, users of alcohol-based hand sanitizers are 40% more at risk of experiencing skin problems. One factor that influences this is the high frequency of use of hand hygiene products. The most frequently experienced symptom of skin problems is dry skin, followed by peeling, itchy and red skin. Research in Hubei, China on a sample of 434 health workers of which 321 people (74%) use hand sanitizer 10x/day. A total of 246 people (76.6%) experienced symptoms of irritant contact dermatitis (MacGibeny & Wassef, 2021). Research in India, in the form of a survey of 143 doctors, found that there was a 77% incidence of contact dermatitis symptoms due to the use of hand sanitizers in the sample in the form of redness, hardened skin, dry skin and pain. Shows a significant relationship between the use of alcohol-based hand sanitizers and the incidence of contact dermatitis (p value < 0.05) (Dash et al., 2023).

A study of health workers at National Jewish Health in Denver by (Jessica et al.) looked at giving hand sanitizer containing ethyl alcohol, water, and polydimethylsiloxane to 36 subjects aged 18-60 years, 17 of whom were health workers (8 subjects had a history of Atopic Dermatitis) where the frequency of using hand sanitizer was 9-18 times per day, it was found that all subjects experienced increased dryness and irritation since the pandemic. Measurement of TEWL levels increased after using hand sanitizers (p value < 0.1) so that long-term use of hand sanitizers increased the incidence of irritant contact dermatitis in health workers in the pandemic era (Hui-Beckman et al., 2022). This shows that the incidence of contact dermatitis in health workers is 3.5 times higher than in non-health workers (Roy1 et al., 2022).

According to research conducted (Indirect Consequences of Coronavirus Disease 2019: Skin Lesions Caused by the Frequent Hand Sanitation and Use of Personal Protective Equipment and Strategies for Their Prevention, 2022) there are 80% of cases of contact dermatitis that occur in health workers. This occurs due to an increase in the frequency of using hand sanitizer more than 10 times a day. Symptoms include burning, stinging and skin pain. Discomfort occurs over a short period of time and peaks several minutes or hours after exposure. Symptoms are more frequently reported for iodophor products, but products containing chlorhexidine, chloroxylenol, triclosan, quaternary ammonium compounds, detergents, alcohol-based products and other additives used in hand sanitizer products, have also been reported to cause contact dermatitis. Research in Saudi Arabia found a prevalence of contact dermatitis of 58.3% which occurred in 95 out of 163 health workers. This happens due to the use of hand sanitizer for a long period of time. (Abdi et al., 2022). The recommended duration for hand hygiene is 20 seconds. Hand sanitizer can be allowed to dry and it is recommended to use hypoallergenic hand cream/moisturizer. The habit of washing hands before and after using cleaning applications should be avoided because it can increase the permeability of the cleaner/detergent which leads to the incidence of contact dermatitis (Lan et al., 2020).

DISCUSSION

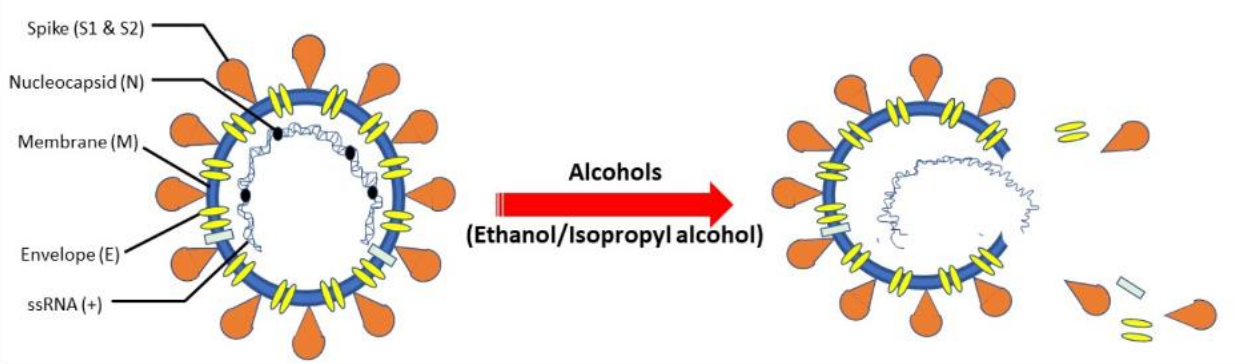
The Role of Alcohol-Based Hand Sanitizers

Hand sanitizers can be made from alcohol and non-alcohol (liquid, gel or foam) which are recommended to be applied quickly to the hands, by rubbing, to kill microorganisms. The following are some of the compositions of alcohol-based hand sanitizers, namely Ethanol, isopropyl alcohol, and n-propanolol which are the active components in ABHS with or without excipients such as hydrogen peroxide, gelling agent, humectant, fragrance, and colorants (Alcohol-Based Hand Sanitizer - Composition, Proper Use and Precautions. | EBSCO Essentials, n.d.) Alcohol has broad spectrum effectiveness against vegetative forms of bacteria, fungi, and viruses. Alcohol dissolves lipid membranes, denatures microorganism proteins and inactivates them. Absolute alcohol or alcohol containing less than 1% water, is less effective against microorganisms because water is very important in the denaturation process (Saha et al., 2021).

For optimum bactericidal activity, the desired concentration of alcohol by volume in the sanitizer preparation is 60%-95%. ABHS quality can be below standard if the alcohol content in the product is <60%. In a recent study, WHO recommended that ABHS preparations be proven effective against SARS-CoV-2, the virus that causes COVID-19. The minimum concentrations of ethanol and 2-propanol recommended for activity against SARS CoV-2 are 80% v/v and 75% v/v, respectively (Alcohol-Based Hand Sanitizer - Composition, Proper Use and Precautions. | EBSCO Essentials, n.d.). In achieving a bactericidal effect, several studies

recommend a hand sanitizer volume of 1.1-3 mL per use, while the FDA recommends a volume of 1.1-3 mL per use. use 2.4 mL at a time (Alcohol-Based Hand Sanitizer - Composition, Proper Use and Precautions. | EBSCO Essentials, n.d.). Therefore, the standard composition of hand sanitizers that are safe for use at home is as follows: ethanol (80%) volume/volume (v/v), hydrogen peroxide (0.125%) v/v and glycerol (1.45%) v/v for formulation A and isopropyl alcohol (75%) v/v, hydrogen peroxide (0.125%) v/v and glycerol (1.45%) v/v for formulation B (Khaliq et al., 2021).

Although initially the virucidal effectiveness of alcohol-based hand sanitizer formulations remained controversial, it has gradually become firmly accepted that enveloped viruses such as coronavirus can be easily inactivated by alcohol. Several types of the corona virus family including SARS, MERS or HCoV are very susceptible to 62% to 71% ethanol which can inactivate the virus in less than a minute. In contrast, two other biocide agents, namely 0.02% chlorhexidine digluconate and 0.05%-0.2% benzalkonium chloride did not provide significant beneficial effects. Protein denaturation is considered to be the main mechanism by which alcohol carries out its activity against viruses and other microorganisms, and water is indispensable for protein denaturation and that is why absolute alcohol is less effective against microbes compared to a mixture of alcohol and water.



The viral envelope is sensitive to lipid solvents and therefore, when the capsid is removed from the envelope, the virus may not be able to attach to or interact with cell surface receptors. Because the corona virus is lipophilic, the enveloped virus can be quickly inactivated by alcohol such as ethanol or isopropanol. These viruses take the envelope from the host cell during the budding stage of their life cycle and the envelope consists of a lipid bilayer. Therefore, it is very likely that even after mutation, this coronavirus still has a lipid bilayer that can be disinfected with alcohol treatment. Due to the amphiphilic nature of alcohols, they can easily interact with the viral envelope where they alter the fluidity of the membrane. The polar portion of oxygen strengthens the affinity of the membrane for water and simultaneously reduces lipophilic interactions between non-polar residues. In this way, alcohol destabilizes and denatures viral proteins. Additionally, there are plausible mechanisms by which alcohol is virucidal including pH-dependent inactivation, divalent metals, and oxidative stress for nonenveloped viruses. a study reported greater amplification in virucidal activity against coronaviruses coated with 75% isopropanol compared to an 85% ethanol-based formulation. This can be explained by the fact that isopropanol, due to having one more carbon than ethanol is likely to provide superior lipophilicity against lipophilic coronaviruses (Basak & Deb, 2021).

Alcohol-based hand sanitizer against contact dermatitis

Alcohol-based hand sanitizers themselves can cause hand dermatitis, of the two types of dermatitis. Alcohol-based hand sanitizers more often cause allergic contact dermatitis, because alcohol-based hand sanitizers can contain allergens such as propylene glycol and fragrance. Even though alcohol-based hand sanitizers have a smaller risk of irritant contact dermatitis than other hygiene products, alcohol-based hand sanitizers can still cause the loss of the fat layer on the skin, causing dry and irritated skin, and ethanol tends to be less irritating than isopropanol. Health workers often use alcohol-based hand sanitizers before and after examining patients in their daily activities, so the risk of allergic contact dermatitis increases with the use of alcohol-based hand sanitizers. Therefore, it is recommended to use moisturizer after using an alcohol-based hand sanitizer, 2 Fingertip Units on each hand and leave it for 1 to 3 minutes before continuing with other activities, and it is recommended to use an alcohol-based hand sanitizer that does not use fragrance (Rundle et al. al., 2020b).

Several studies show that the use of alcohol-based hand sanitizers produces a much lower hand dermatitis severity index than the use of soap. And alcohol-based hand sanitizers with moisturizers are recommended in preventing hand dermatitis. However, other studies show that the use of moisturizer is associated with a higher likelihood of hand dermatitis. This may be because the use of these moisturizers is used as a treatment rather than a prevention strategy. Moisturizers can help relieve or slow down the natural reaction to irritants and achieve a situation known as skin crusting, which is determined by the skin's adaptation to chronic exposure to irritants. Another study also showed that the prevalence of hand dermatitis due to high use of soap or hand sanitizer increased by 34% in a period of 6 months, compared to 1 year before the pandemic occurred, namely 9.1% (Alkhalifah, 2022c).

Contact Dermatitis due to the use of alcohol-based hand sanitizers in health workers.

During the COVID-19 pandemic, health workers are encouraged to follow protocols for preventing the transmission of COVID-19 such as using masks, gloves, eye protection and also maintaining hand hygiene. Maintaining hand hygiene can be done in various ways, whether by washing your hands with soap or using an alcohol-based hand sanitizer. However, this causes skin problems (Menon et al., n.d.). Contact dermatitis, especially in the hand area, is a skin disorder that often occurs in health workers. As many as 22% of health workers in Saudi Arabia experience dermatitis in the hand area (Alkhalifah, 2022c). Based on several studies during the COVID-19 pandemic, the majority of health workers experienced contact dermatitis due to the use of alcohol-based hand sanitizers. This is due to the increasing use of alcohol-based hand sanitizers, a history of atopic dermatitis and the rare use of hand creams containing moisturizers (Dash et al., 2023c).

WHO recommends alcohol-based hand sanitizers made from ethanol, isopropyl alcohol and hydrogen peroxide. However, excessive use of alcohol-based hand sanitizers can increase skin permeability so that the oil and water levels in the skin are reduced, resulting in skin irritation (Mahmood et al., 2020). There are many guidelines for preventing contact dermatitis due to the use of alcohol-based hand sanitizers. One of them is using hand cream that contains moisturizer after using an alcohol-based hand sanitizer. However, only a few health workers use hand cream after using hand sanitizer (Alves et al., 2020; Dash et al., 2023c). In a systematic review study conducted by Loh and Yew in 2021, a total of 42 research studies on the frequency of use of alcohol-based hand sanitizers, showed that there was no statistically significant relationship between the risk of hand eczema and the use of alcohol handrub ($p=0.548$), alcohol handrub more than 10 times a day ($p=0.196$) or alcohol hand rub more than 20 times a day ($p=0.452$). In studies that only included qualitative analysis, Lanet al.

found that there was no statistically significant risk of hand dermatitis with alcohol use for hand rubbing more than nine times in 4 hours versus ≤9 times (p=0.2886). A prospective cohort study by Yükselet al. described that increased use of alcohol-based hand rub on wet skin by healthcare workers during the COVID-19 pandemic was associated with increased prevalence of hand eczema at 1 year of follow-up (RR: 1.78; 95% CI: 1.11–2.87) (Loh & Yew, 2022).

Multivariable analysis showed that having a history of eczema (OR, 3.68; 95% CI, 2.37-5.72; P < .001), rhinitis and/or conjunctivitis (OR, 1.64; 95% CI, 1.07- 2.5; P = .022), wash hands with soap > 5 times a day (OR, 3.32; 95% CI, 1.79-6.14; P < .001), use gloves every day (OR, 3.57; 95% CI, 1.75-7.27; P < .001) , and using moisturizer at any frequency (P < 0.05) is one of the predisposing factors for the easy occurrence of contact dermatitis when using alcohol-based hand sanitizers. Therefore, the existence of insignificant studies can be considered regarding the incidence of contact dermatitis regarding the use of alcohol-based hand sanitizers. One recommendation to prevent the incidence of contact dermatitis is to use an alcohol solution containing glycerin and fragrance-free emollients which can significantly improve HRQoL and assessment of hand skin status in health workers (doctors and nurses) (Chernyshov & Kolodzinska, 2020b). Rational hand washing for 20 seconds with a sanitizer containing ethanol is also recommended. In addition, the hand sanitizer must also be allowed to dry first, and then a hypoallergenic hand cream/moisturizer must be used to prevent the remaining cleaning agent from trapping between the fingers. The habit of washing hands before or after using a hand sanitizer should be avoided because high humidity increases the permeability of the sanitizer/detergent, leading to an increased likelihood of contact dermatitis on the hands (Lan et al., 2020).

CONCLUSION

The frequency of use of alcohol-based hand sanitizers is very high among health workers during the COVID-19 pandemic. The high use of alcohol-based hand sanitizers causes an increase in the rate of contact dermatitis. Loss of the fat layer on the skin is one of the results of using alcohol-based hand sanitizers which causes the skin to become dry and irritated. The presence of ingredients such as propylene glycol and fragrances which are allergens also increases the incidence of contact dermatitis due to the use of alcohol-based hand sanitizers. To reduce the rate of contact dermatitis, the frequency and ingredients of alcohol-based hand sanitizers used must be considered so that it can reduce the incidence of contact dermatitis on the skin. In addition, providing additional ingredients such as moisturizing cream can be used as a preventive strategy after using hand sanitizer to prevent contact dermatitis.

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