



Hand sanitizers: is over usage harmful ?

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ABSTRACT

Sanitizers are the substances or the fluid designated to kill germs on skin and objects. As hand hygiene plays an important role in the pandemic situations like COVID-19, the people mostly rely on hand sanitizers than the soap and water. Sanitizing effect of sanitizer depends on the ingredients such as 60-95% v/v alcohol, antiseptics, etc. The alcohol usually damages the skin by denaturation of stratum corneum proteins. The repeated or frequent use of hand sanitizers can cause the skin reactions- Irritant contact dermatitis and Allergic contact dermatitis with the symptoms such as burning, irritation, itching, etc. These effects can be reduced by using selected less irritating products, reducing skin irritation, use of moisturizing skin products. As microbial flora also plays an important role in the human health, sanitizer overuse creates an imbalance between the good and bad bacteria in the digestive system which leads to inflammatory bowel diseases, obesity, autism, etc. As a researcher reported that sanitizer also gives an unpleasant side effects of using hand sanitizer every day and also mentioned that 'we have to balance the benefit of sanitizer for preventing disease transmission and their potential misuse remains a challenge'.

Key words:

Sanitizers, soap and water, alcohol, contact dermatitis, microbial flora.

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INTRODUCTION

Sanitizers are of two groups they are Alcohol-based and alcohol free sanitizer. Alcohol-based hand sanitizer (ABHS) consists of chemicals such as 60-95% v/v alcohol (ethanol, isopropanol) hydrogen peroxide and Alcohol free based hand sanitizer consists of antiseptic (chlorhexidine , chloxlyenol , triclosan , iodine and iodophors , quaternary ammonium compounds . But Glycerine, fragrance, colourant are common in both alcohol based and alcohol free sanitizers . Alcohol denatures protein and lipid membrane of microorganism, hydrogen peroxide inactivates contaminating spores in the bulk solutions. Chlorhexidine is similar to alcohol which works by disrupting the arrangement of cytoplasmic membranes. It works mostly on gram positive bacteria and modest on gram negative bacteria . Chloroxlyenol has ability to deactivate enzyme system and can alter the cell wall synthesis . Both iodine and iodophors exhibit germicidal activity against gram positive and gram negative bacteria . Triclosan is bacteriostatic in low concentration traces [1].

EFFECTS OF ALCOHOL BASED HAND SANITIZERS

Handsanitizers can damage the skin by denaturation of stratum corneum proteins , alternation of intercellular lipids .Most reported skin reactions with the use of ABHS are irritant contact dermatitis and allergic contact dermatitis . among the alcohol base sanitizers, ethanol has the least irritant property compared to n- propanol isopropanol. ABHS also have a drying effect on hands which can cause the skin to crack or peel. Overuse of these agents can cause the development of

drug – resistant bacteria [1]. Ethanol based hand sanitizer can cause alcohol poisoning if a person swallows more than a couple of mouthful . UNITED STATES, National Poison Data System reports 65,000 incidents of ingestion between 2011 and 2014 . And ingestion of ethanol from alcohol based sanitizers induce hypoglycaemia in children [2].

WHAT HAPPENS WHEN ALCOHOL SANTIZER IS USED ON REGULAR BASIS?

Ethyl alcohol (ethanol)-based hand sanitizers are safe when used as directed, but they can be a cause for alcohol poisoning if a person swallows more than a couple of mouthfuls. In the period of 2011 – 2015, where were 85,000 calls about hand sanitizer exposures among children among children reported for US POISON CENTRES. Children may be particularly likely to swallow hand sanitizers that are scented, brightly coloured, or attractively packaged. Hand sanitizers should be stored out of the reach of young children and should be used with adult supervision. Child-resistant caps could also help reduce hand sanitizer-related poisonings among young children. Older children and adults might purposefully swallow hand sanitizers to become drunk [5] .

Enterococci, is most often found in hospitals. But this research has implications for any bacteria that may begin tolerating alcohol. C. diff, is a deadly organism which spreads its infection so rapidly that it makes difficult for alcohol to kill them; the best way to get rid of them is to wash them down the drain.

"If you're washing your hands less because that alcohol-based hand sanitizer makes you feel confident that your hands are clean," Price says, "all of a sudden you can become a vehicle for alcohol-resistant organisms."

The research is still clear that alcohol-based hand sanitizers are more effective at battling some bacteria, like those causing staph infections. However, this study indicates that other bacteria are best cleaned off with simple soap. Drinking alcohol-based hand sanitizers can cause intoxication and coma. Particularly ethanol-based products can cause low blood sugar which can lead to seizure in children. Until now, the risk of hand sanitizer exposure was not considered more dangerous than exposure to other sources of alcohol in a child's environment. All alcohol-containing products such as: beer, wine, liquor, rubbing alcohol, mouthwash, facial toner, or hair tonics that contain alcohol should be stored out of sight and out of reach of children. However, in June 2020, the FDA announced that some popular hand sanitizers are contaminated with methanol (methyl alcohol). This news has prompted health care providers to be more cautious.

Methanol has a much narrower range of safety when compared to ethanol and isopropanol. High concentration of methanol can cause permanent blindness and death secondary to severe changes in body chemistry that happen as our bodies metabolize it. Even if your hand sanitizer label says it contains alcohol, ethanol, isopropyl alcohol, or benzalkonium chloride, it is important to check here to make sure it is not one of the contaminated products. Methanol will not be mentioned on the label.

EFFECTS OF SANITIZER ON SKIN AND BIOLOGICAL SYSTEM:

There are two major types of skin reaction associated with hand hygiene. The symptoms that cause skin reactions include dryness, irritation, itching and even cracking and bleeding which vary from mild to debilitating. These symptoms are referred to as irritant contact dermatitis. Allergic contact dermatitis is the second type of skin reaction which is observed rarely and represents an allergy to some of the constituent in a hand hygiene product. Symptoms of allergic contact dermatitis can also range from mild and localized to severe and generalized. In its most serious form allergic contact dermatitis may be associated with respiratory distress and other symptoms of anaphylaxis. Hence it is sometimes difficult to differentiate between the two conditions.

IRRITANT CONTACT DERMATITIS

Repeated use of hand hygiene products, particularly soaps and other detergents, is an important cause for the development of chronic irritant contact dermatitis among health care workers. The potential of detergents varies considerably to cause skin irritation which may be reduced by the addition of humectants. Affected Health care workers often complain of a feeling of dryness or burning, skin that feels "rough" and erythema, scaling or fissures. The damage which is caused by hand hygiene products to the skin are causing denaturation of stratum corneum proteins, changes in intercellular lipids, decreased corneocyte cohesion and decreased stratum corneum water binding capacity. Damage to the skin also changes skin flora, resulting in more frequent colonization by staphylococci and gram negative bacilli

ALLERGIC CONTACT DERMATITIS

The products when applied to the skin can cause allergic reactions (contact allergy) may present as delayed type reactions (allergic contact dermatitis) or less commonly as immediate reactions (contact urticaria). The most common causes of contact allergies are fragrances and preservatives, and the less with emulsifiers.

METHODS TO REDUCE ADVERSE EFFECTS OF AGENTS

There are three primary strategies for minimizing hand hygiene related irritant contact dermatitis among health care workers :

1.SELECTING LESS IRRITATING PRODUCTS :

Cleaning of hands frequently by the health care workers as it is important for health care facilities to provide products that are both efficacious and as safe as possible for the skin. For example, concern about the drying effects of alcohol was a major cause of poor acceptance of alcohol based hand rubs in hospitals. Although many hospitals have providing health care workers with plain soaps in the hope of minimizing dermatitis, frequent use of such product has been associated with even greater skin damage, dryness, and irritation than some antiseptic preparations. Humectants containing alcohol based hand rubs reduce the exposure of health care workers to irritating soaps and detergents.

2.REDUCING SKIN IRRITATION

Risk of skin irritation may be increased by certain hand hygiene practices and it should be avoided. For example, washing hands regularly with soap and water immediately before or after using an alcohol-based product is not only unnecessary, but may lead to dermatitis. According to these reasons, health care workers should be reminded not to wash their hands before or after applying alcohol.

3.USE OF MOISTURIZING SKIN CARE PRODUCTS

The hand hygiene products effects the skin variably, depending upon factors such as the weather and environmental conditions. For example, the skin remains more moisturized in cold, dry environments in topical countries during the summer months in temperate climates. In one recent study, by their own self-assessment of nurses as well as by observe rating darker skin are having significant healthier skin and less skin irritation than nurses with light skin. The need for moisturizing products will thus vary across health-care settings, geographical locations and respective climate conditions. For Health care workers having a risk of irritant contact dermatitis or other adverse reactions to hand hygiene products, additional skin moisturizing may be needed. Importantly, a trial conducted by McCormick and colleagues reports that skin condition of health care workers is improved by the frequent and scheduled use of an oil containing lotion, which has increased hand cleansing frequency to 50%. Recently, barrier creams have been marketed for the prevention of hand hygiene-related irritant contact dermatitis. Such products get absorbed into the superficial layers of the epidermis and forms a protective layer. Furthermore, as that products are expensive, so their use in health-care settings, particularly when resources are limited, cannot be recommended at present [8].

EFFECT OF SANITIZER ON BIOLOGICAL SYSTEM

A concern regarding the use of Alcohol-based hand sanitizers (ABHS) is unintended paediatric ingestions. Ethanol-based hand sanitizers can cause alcohol poisoning if a person swallows more than a couple of mouthfuls. United states, National poison data system reports 65,000 incidences of ingestion between 2011 and 2014. Several studies have found that, due to the ingestion of ethanol from hand sanitizers can induce intoxication and hypoglycemia in children. Older children have been known to swallow hand sanitizers to become drunk purposefully as well [9]. alcohol-based hand sanitizers are also associated with a small but measurable risk for fires and burns. Vapour from the alcohol is easily flammable and care must be taken while using alcohol based hand sanitizers to prevent the risk of fires and burns. As there is a risk of skin burning personnel applying alcohol -based hand sanitizers should keep a safe distance from fire applications [10].

MICROBIOTA

Microbiota refers to the entire population of microorganisms that colonizes a particular location; and includes not just bacteria, but also other microbes such as fungi, viruses and protozoans [11].

IMPORTANCE OF MICROBIAL FLORA

It has been noticed since long that gut microbiota plays a significant role in normal individual and human health [12].

FUNCTIONAL ASPECTS OF NORMAL GUT MICROBIOTA

The nutrients required for the gut microbiota are derived from the host dietary components [13]. Enzymes produced by the intestinal flora synthesizes Vitamin K which is a necessary co-factor in production of pro-thrombin and other blood clotting factors [14]. Antibacterial substances such as bacteriocins are produced by the microflora itself which stabilizes normal population and prevents the implantation of pathogens and also stimulation of cell maturation [15].

PROTECTIVE ACTIVITIES OF FLORA

New organisms that enter the system through contaminated food and water are suppressed by established flora. Production by members of the resident flora of anti microbial substances such as bacteriocins causes the suppression which means the inhibition of the growth of alien micro organisms [16]. One of the simplest mechanisms of antimicrobial protection is the presence of two tiered mucus layer keeps luminal microbes away from epithelial contact, predominantly in the large intestine [17]. Antimicrobial proteins are synthesized by the microbiota via its structural components which plays a larger role in small intestine [18].

IMMUNOMODULATION

Microbial flora contribute to gut immunomodulation, both the innate and adaptive immune systems. Components from immune system participated in immunomodulation are Gut associated lymphoid tissue (GALT), effector and regulatory T cells [19].

METABOLIC ACTIVITIES

The intestinal flora is a crucial component of entero hepatic circulation. In this circulation, the metabolites which are

conjugated in liver and excreted in bile have been de conjugated by the bacterial enzymes in the intestine [20]. Flora also plays a role in fiber digestion and also been shown to impart a positive impact on lipid metabolism by suppressing the inhibition of lipoprotein lipase activity in adipocytes [21]. It is also enriched with an efficient protein metabolizing machinery that function via microbial proteinases and peptidases [22].

OVER USAGE OF HAND SANITIZER

Repeated use of anything, including hand sanitizer can cause chronic irritation, skin breakdown, and damage. Good bacteria are the bacteria that live on your body and are the first line of defence against diseases and germs. Due to excessive use also kills beneficial bacteria on the skin and also in the digestive system. As it kills the beneficial bacteria there is an imbalance between the good and bad bacteria in the digestive system which is associated with intestinal symptoms, such as abdominal pain and diarrhoea and results in other diseases such as inflammatory bowel diseases, obesity, diabetes, liver diseases, chronic heart diseases, cancers etc.

GUT BACTERIA AND OBESITY

High fat diet induced obesity is associated with inflammation that contributes to the development of insulin resistance, which may cause type 2 diabetes. All over the world it has been a big problem and has been shown to be strongly associated with gut bacteria, changes in gut bacteria contribute to diabetes [23].

GUT BACTERIA AND LIVER DISEASE

The gut and liver have close interplay-beneficial substances that are produced by the liver are absorbed by gut. The liver receives approximately 70% of its blood supply from the intestinal venous outflow. Gut microbiota is associated with liver damage. The co-factors for the development of alcoholic liver disease are gut derived endotoxin and other luminal bacterial products [24].

GUT BACTERIA AND CHRONIC HEART DISEASES

Gut bacteria have a direct link with the risk of cardiovascular diseases. They form trimethylamine from dietary choline after its conversion into TMA N-oxide in the liver. TMC act as a pro-atherogenic compound [25].

GUT BACTERIA AND AUTISM

Gut bacteria influences brain function by communication with central nervous system through neural, endocrine and immune pathways. Pathogenesis of autism involves several intestinal bacteria [26].

INFLAMMATORY BOWEL DISEASES

Reciprocal interaction between gut bacteria and host may induce allergies and inflammatory bowel diseases [27]. Ulcerative colitis is one of the two major idiopathic inflammatory bowel diseases [28].

ADVERSE EFFECTS OF HAND SANITIZER

1. Hand sanitizer can be a culprit in potentially dangerous conditions. So if is used every day, hand sanitizer may also contribute to the development of antibiotic resistant bacteria.

2. The most commonly reported skin reactions with the use of alcohol based hand sanitizers are irritant contact dermatitis(ICD) and allergic contact dermatitis(ACD) [29,30].Symptoms of ICD are dryness, bleeding, purities. ACD being manifested as respiratory distress or other anaphylactic symptoms [31,32].
3. Sanitizer can damage the skin through the mechanisms-denaturation of the stratum corneum proteins, alteration of intercellular lipids, decrease in corneocyte cohesion and reduction of stratum corneum water binding capacity[33,34].
4. Frequent exposure of lipid barrier of skin to alcohol leads to depletion because alcohol penetrate deeper into the skin layers and change the skin flora [35-37].
5. Due to the drying effect of hand sanitizers on the hands, they can further cause the skin to crack or peel [38-40].
6. It is generally recommended not to use the excipients such as colorants and fragrance to the sanitizer as they increase the risk of allergic reactions [41-43].
7. Hand sanitizers used by health care employees for routine hand washing has become cases of acute gastroenteritis.
8. If hand sanitizer contains any scented material, then it's likely loaded with toxic chemicals. Synthetic fragrances contain phthalates, which are endocrine disrupters that mimic hormones and could alter genital development.

RECOMMENDATIONS TO MINIMIZE CUTANEOUS ADVERSE EFFECTS

Adverse effects caused by sanitizer can be easily prevented by taking appropriate measures using following methods-

- a) Selecting products containing less irritating agent, moisturizing skin after hand sanitization [41,43,44,45].
- b) Alcohol based hand sanitizer containing humectants or emollients can be used in order to reduce irritant effects [46].

WHAT ARE THE PATHOGENS THAT ARE NOT EVEN PREVENTED / KILLED BY SANITIZER ?

There are important differences between washing hands with soap and water and cleaning them with hand sanitizer. For example, alcohol-based hand sanitizers don't kill ALL types of germs, such as a stomach bug called norovirus, some parasites, and Clostridium difficile, which causes severe diarrhoea. Hand sanitizers also may not remove harmful chemicals, such as pesticides and heavy metals like lead.The impact of handwashing reduces the amounts of all types of germs, pesticides, and metals on hands. The best way of preventing is knowing the right time and method of cleaning Your hand with sanitizer [50].

METHODS TO PREVENT THE OVERUSE OF HAND SANITIZER :

1. Usage should be minimized to the places where availability of water is critical.

2. There is a misconception that hands should be washed after every 4 to 5 application of alcohol based hand rub, their is no reason to do this [49].
3. Soap and water are more effective than hand sanitizers at removing certain kinds of germs, like Cryptosporidium, norovirus, and Clostridium difficile. Although alcohol-based hand sanitizers can inactivate many types of microbes very effectively when used correctly , people may not use a large enough volume of the sanitizers or may wipe it off before it has dried (says centre of disease control and prevention) [47] . So when being at home one should prefer washing hand with soap and water. So no need of sanitizer while being at home .
4. In absence of soap and water try to avoid physical contact with living and non living things if not possible then proper application of hand sanitizer should be practised.

REASON THAT TOOK SANITIZER INTO THE LIME LIGHT IN PRESENT DAY

We all are using hand sanitizers much more than ever before. Proper handwashing and using sanitizer whenever washing hands is not possible, can save all of us from bacteria and viruses. It's not always possible to use soap and water to wash hands when you are riding in a car, playing in a park or just shopping this is the right time where we all have to depend on alcohol-based hand sanitizers. Especially during times when we are combatting the COVID-19 pandemic, frequent use of sanitizer is recommended by the government itself. But there are some unpleasant side effects of using hand sanitizer every day [48].

How This Bacteria May Be Growing More Resistant To Hand Sanitizer?

The digestive tract, bladder, heart and other parts of the body started increasing their size when the bacteria such as enterococci effects them.

Even these situations where is a wide usage of hand sanitizers there is a raise of this infections in Australia and countries around the world. Globally, enterococci make up ten percent of bacterial infections acquired in the hospital.

CASE STUDY 01

Science Translational Medicine published a new research shows that several strains of these bacteria have begun adjusting to alcohol-based hand sanitizers. They're not resistant to the alcohol — at least, not yet — but they're becoming "more tolerant" of it, the authors write. So this means that the bacteria were able to survive for longer periods of time after being exposed with alcohol.

The researchers used different strengths of alcohol concentrations to combat the bacteria, starting with 23 percent. Eventually, at a 70-percent alcohol mixture, the bacteria were conquered. Typically, hand sanitizers are 60 percent alcohol.

To make the situations still worst, many of these alcohol-tolerant bacteria are resistant to multiple drugs as well. Half of the strains the researchers studied cannot be treated with vancomycin, a last-line antibiotic. That implies that the bacteria are spreading more easily within hospitals, and but we can't find options for treatment.

The particular type of bacteria, enterococci, is most often found in hospitals. But this research has implications for any bacteria that may begin tolerating alcohol [51].

CASE STUDY 02

During the period of 2005 – 2009 incidence and outcome of reported cases of unintentional and intentional ethanol containing – hand sanitizers ingestion in US. The number of new cases per year of intentional hand sanitizer ingestion significantly increased during this 5 – period which is highly noticeable [3]. A 36 year old man was admitted to emergency department with ethanol intoxication . The highlights of case was potential for significant toxicity after the ingestion of a product found throughout health care facilities. Along with balancing the benefit of hand sanitizers for preventing disease transmission and their potential misuse remains a challenge [4].

CONCLUSION

The thing that we need to understand is , usage of hand sanitizer cannot be fully avoided because there is no other better option than alcohol based hand sanitizer in the areas where soap and water are unavailable but we can put some limitations on usage of alcohol based hand sanitizer. So, in order to prevent from the adverse effects caused by them (hand sanitizers) eg : avoid usage of hand sanitizer when being at home where soap and water are available.

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