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# Skin Allergies Generated by Rubber Gloves and Excessive Soaps and Sterilizers due to COVID-19 Pandemic: a Review

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***SUMMARY.*** **The sanitizers and disinfectants have become widely used due to the COVID-19 global health crisis. However, as much as these household products keep us clean and prevent transmission of the virus, excessive use of these can be harmful. Recently, many kinds of disinfectants have been used with very intensive usage of the right ones, as well as the hands wearing duration, too many people developed redness of the skin some have sustained injuries with the incidence of red skin spots in addition to scratching and eyes irritation, arising question, why in which required an explanation. This article aims to demonstrate that excessive use of antiseptics and disinfectants along with the length of time in contact leading to skin allergies. Shows a significant skin irritation, whereas the skin is the first physical defense barrier against many kinds of pathogens and one of the components of the immune system against microorganisms.**

*RESUMEN.* Los sanitizantes y desinfectantes se han vuelto ampliamente utilizados debido a la crisis de salud global del COVID-19. Sin embargo, por mucho que estos productos domésticos nos mantengan limpios y eviten la transmisión del virus, el uso excesivo de estos puede ser perjudicial. Recientemente, se han utilizado muchos tipos de desinfectantes con un uso muy intensivo de los correctos, así como la duración del uso de las manos, demasiadas personas desarrollaron enrojecimiento de la piel, algunas han sufrido lesiones con la incidencia de manchas rojas en la piel además de rascarse e irritación de los ojos, pregunta que surge, que requiere una explicación. Este artículo tiene como objetivo demostrar que el uso excesivo de antisépticos y desinfectantes junto con el tiempo de contacto conduce a alergias cutáneas. Muestra una irritación cutánea significativa, mientras que la piel es la primera barrera de defensa física contra muchos tipos de patógenos y uno de los componentes del sistema inmunológico contra los microorganismos.

## INTRODUCTION

The global pandemic of the novel coronavirus in 2019 namely (COVID-19) causing extreme respiratory infection [1] syndrome (SARS-CoV-2) started in December 2019 in Wuhan, China, and has since spread all over the world. As of 1st March, 2021 more than 114,994,666 recorded cases and 2,550,287 deaths have occurred in221 countries around the world, in Iraq however a 699,088 infection cases at this date. This novel Beta-coronavirus is similar to the extreme acute respiratory coronavirus syndrome (SARS-CoV) and the Middle East respiratory coronavirus syndrome (MERS-CoV) [2] based on its genetic similarity, it is probably that coronaviruses transferred from a bat and spread to humans through an unknown intermediate mammalian host [3].

Coronaviruses is in the order of Nidovirales [4] which belongs to the family Coronaviridae. As crown-shaped with spiky Corona on the outer surface of the virus, which has been called a coronavirus [5]. These kinds of viruses are considered the largest RNA viruses are known, with genomes ranging length from 25 to 32 kb, and the entire virus particle, virions ranging 118-140 nm in diameter, while Coronaviruses are fairly smaller in size with a diameter of 65-125 nm, the nucleic segment containing a single-stranded RNA.

*KEY WORDS:* skin allergy, skin irritation, antiseptics, hand hygiene.

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Upon to structures of proteases and its functions, the hydrolyses viral polyproteins can produce a specific functional protein. This is required for replication of coronavirus and is considered an important as therapeutically targeting for causing diseases by these kinds of virus, including COVID-19 [6-8]. The virus hosted by a human is classified largely based on genome structure, size, molecular processes, physiochemical properties, and morphology. The virus hosted by humans is 26 virus families causing the disease to humans [9]. In some cases, humans may host incidentally, and linked to disease may be more tenuous. These family subgroups of coronaviruses are classified as 229E and NL63 as alpha; OC43 and HKU1 as beta other are gamma, and delta coronavirus [10].

Normally, people get infected with these alpha and beta coronaviruses. In some cases, the virus infecting animals may evolve and infecting people also and mitigated itself to become new to human coronavirus. As an example of these is three recent of these are 2019-nCoV, SARS-CoV, and MERS-CoV (Centers for Disease Control and Prevention, CDC). Sometimes coronaviruses can evolve and able to transfer from animals to human that infect and make people sick and then adopting their self to be a new human coronavirus. A typical example of these viruses is MERS-CoV, SARS-CoV, and lately 2019-nCoV. The virus (SARS-CoV), H5N1 influenza A, H1N1 2009 can cause extreme infection of the respiratory system to humans. An acute lung injury (ALI) was reported in the Middle East caused by (MERS-CoV) Coronavirus.

Acute respiratory distress syndrome (ARDS) leads to a fatality due to lung failure. These viruses were thought to affect animals only, until the world witnessed a major outbreak of acute respiratory syndrome (SARS) caused by SARS-CoV in Guangdong, China in 2002 [11]. The rapid spread of the COVID-19 whereas the virus has caused great concern around the world. This rapidly spreading coronavirus epidemic has been declared a pandemic by the World Health Organization (WHO), and many countries around the world are dealing with a huge systematic daily case as reported. Social distancing and restriction of mobility in order to control coronavirus spread have produced a new trend among the society. Meanwhile, scientists are researching alternative cures, and clinical trials are starting to test new drugs and vaccines. Hospitals are increasing their capacity to accommodate and take care of increasing numbers of infected people [12].

Most of the micro-organisms that cause severe health infections are transmitted by individuals' acts. The usage of hygiene agents for disinfection is a typical way of reducing infectious transmission disease especially in hospitals [13,14]. There are two main categories of hand hygiene that cause skin reactions. The first most common type of symptoms is ranged from mild to worsening, namely discomfort, scratching, dryness, and worsen to cracking and even bleeding. This spectrum of allergic symptoms is called annoying dermatitis in touch. The second form of skin reaction is allergic contact dermatitis, which is less common in a hand hygiene product and indicates an allergy to any ingredient. Allergic contact dermatitis symptoms may vary from localized to generalized and from moderate to extreme. Allergic contact dermatitis in its most extreme form can be associated with respiratory distress and other anaphylaxis symptoms [15]. In this article, we focus on the role of the excessive use of hand washes, disinfectant, and antiseptic substances as well as the effect of rubber gloves on the skin that as the physical barrier of the immune system to defenses against microorganism [16].

**Hand Sanitizer**

During the spreading of coronavirus started, All the health authorities worldwide advised people to wash their hands carefully and frequently to get rid of any germs and to control virus transmission. Most nations were advised to use 60 to 70% ethanol/water base hand sanitizers as well recommended alternative, especially when running errands. But too excessive alcohol use can have adverse effects on the skin and body. Excessive use of hand sanitizers, containing chemicals rather than alcohol such as chloroxylenol (chloroxylenol4-Chloro-3,5-dimethylphenol) "Dettol", triclosane (5-chloro-2-(2,4-dichlorophenoxy)phenol), and chlorhexidine (1,6-bis(4-chloro-phenylbiguanido)hexane), can irritate as it eroded the natural. oils of the skin. As the skin natural moisture barrier is washed away, the exposed skin becomes more susceptible to bacteria. When the skin getting dry and then broken, the ethanol present in the hand can further dry the skin and causing cells to damage the skin. At this stage, the risk of getting contact dermatitis is higher.

**Resistance to antibiotic**

Some of the active ingredients in hand sanitizers such as triclosane, which is an active ingredient as antibiotics to-resist bacteria in many healthcare materials such as antibacterial soaps and body washes, kinds of toothpaste, and some cosmetics, when this sensitizer is used too often to control bacteria and other pathogens. The bacteria start to develop a resistance to these antibiotics, exposing the skin to the risk of more infections. Moreover, some sanitizer contains other unknown materials and fragrances is not revealed in the ingredient can irritate sensitive skin

when used extensively as has been the practice to prevent COVID-19 from spreading. The expose of the human body to an extra clean environment can reduce its immune system later on. The high concentration of triclosane in use as a hygiene agent for children and teens cause them vulnerable to allergies.

**The skin contact allergy**

Often known as contact dermatitis, it which considered an allergic response due to direct contact with an allergen material that can affect the skin to a certain degree from localized redness and open sores in a variety of conditions. Common sources include alkaline and acidic media and products. These are several kinds of detergents and hand soaps, others as such solvents, cleaning agents, adhesives, deodorants and other synthetic chemicals, oil resin of urushiol, sumac, and oak. Other metals such as nickel and other metals used in jewelry; topical drugs cover some anesthetics and antibiotics, others such as perfumes aerosol, some polymer sheets and rubber; or cosmetics; fabrics such as wool and garments made from synthetic fabrics [17].

Skin discomfort is caused by a diverse series of metabolic responses epidermal and dermal. Previous research found that the chemical irritants are structural causes is unrelated to the particular pattern of cell damage to the viable parts of the epidermis when topically applied on the human skin [18]. Many adverse skin reactions, including irritant contact dermatitis, allergic contact dermatitis, and contact urticaria have been reported with the use of all types of gloves. Sensitivity to natural rubber latex has been well reported by incidence ranged between 2.8% to 17% for those workers in the health and other sectors using latex gloves. These sectors are highly at risk of allergic reactions development to NRL, especially those working in the operating room, dental assistants, laboratory workers, hospital housekeepers, and ambulance attendants [19].

The allergy due to rubber gloves in contact with skin is mainly caused by an accelerating agent applied to initiate the vulcanization of rubber during glove manufacturing. These are 2-mercaptobenzothiazole (MBT). The accelerators thiuram carbonates, and 1,3-diphenylguanidine (DPG),are Instant Skin Inflammatory Reaction (ICSR) [20], is a mucous disease which occurs within minutes of contact with various substances such as chemicals, animals' tools, medicines, cosmetics, and too many other things, therefore gloves with free of 1,3-diphenylguanidine is recommended. Immediate skin contact reactions show up as itchy feeling, wheals, dermatitis, and or Eczema. These clinical manifestations describe two identified entities has different mechanisms. These are contact urticaria and protein contact dermatitis centered on the features of the allergens concerned [21].

Both diseases form part of the concept of hives syndrome [22]. It may also be induced by antioxidants, such as carbon black rubber mixed with chemicals agent (p-phenylenediamines), which prevent rubber deterioration [23]. There are two main forms of hand hygiene-based skin reactions. The first and most common form involves symptoms ranging from mild to severe, including dryness, agitation, scratching, and even cracking and bleeding. This kind of symptom is called irritant dermatitis of touch. The second kind of skin reaction allergic is considered contact dermatitis which is uncommon in a hand hygiene product and indicates an allergy to any ingredient. Symptoms of allergic contact dermatitis can range from mild, localized to serious, and widespread [24]. The skin is the body's largest organ, covering the human body surface and containing about 15-20 percent of the total body mass. Histological, epidermis, dermis, and subcutaneous tissue make up the skin.

The epidermis layer consists of keratinized squamous, epithelia stratified from the surface into the cornfield layer (stratum corneum), translucent layers (on the palms and the soles only), the granular layers, spinouts and basal layers [25]. This dermis is consisting of fibrous connective tissue, mixed with reticular fibers and elastic, which comprises sweat glands, mast cells, hair follicles, sebaceous glands, blood vessels, nerve fibers, and lymphatic vessels. It consists of loose connective tissue and subcutaneous adipose tissue. The appendage's skin contains hair (heat loss, sensation, breathing filter for protection). The sebaceous glands (produce sebum on hair follicles that oil the hair). Sweat glands produce sweat secreted apocrine a high odor or eccrine a low odor and nails protection [26,27].The main immunological organs are the skin in which is affected by both internal and external causes, and by adaptive immune responses. Several skin conditions are immune-mediated, such as urticaria, angioedema, atopic dermatitis, touch dermatitis, autoimmune blistering psoriasis skin conditions. The majority of these diseases are infectious, chronic, and proliferative, with significant roles in both environmental influences and genetic. These immunological mechanisms may impact potential targets for future therapeutic interventions [28].

**Effect of chemical substances on skin and Immune mechanism**

The skin is the first to experience environmental chemistry and physical influences. Two main forms of dermatitis contact can be differentiated according to the mechanisms of path physiological involved. Con-

tact dermatitis irritating is due to the xenobiotics' pro-inflammatory and toxic effects capable of stimulating innate immunity in the skin [29]. Allergic contact dermatitis (ACD) requires antigen-specific activating of the required immunity leading to the effector T cells development that inflammation mediation of the skin. ACD is a response of T-cell-mediated inflammatory that occurs in sensitized individuals at the challenge site, with a contact allergen. It contains redness, papules, and vesicles [30].

Chemicals are considered as environmental irritants such as aerosols particulates and mild detergents. Particulates such as dust and smoke vehicles exhaust emissions can cause epithelium of the mucosa damage and skin, airway reflexes (coughing, sneezing, and bronchoconstriction). Scratching have an apparent defensive effect against environmental irritants. These reactions can cause allergic diseases, such as dermatitis and asthma, in susceptible individuals if they are excessively and persistently engaged [31]. Touch allergens are organic interaction with bimolecular is important for their antigen city and immunogenicity, either by complex formation or through the covalent binding formation. Contact allergens, however, are very different since they are capable of simultaneously stimulating the innate immune system and forming epitopes of T cells. The formation of T cell epitopes requires touch allergenic protein reactivity. It can be directly attributed to peptides present on the surface of the cell by MHC molecules or, as in the case with metal ions, form peptide-independent complexes with MHC molecules or MHC molecules alone.

Additionally, extra and intracellular proteins can be modified chemically and then processed to produce touch allergen-mediated peptides on the surface of the antigen-presenting cells (APC) shown on MHC molecules [32,33]. The formation of T cell epitopes needs to touch allergenic protein reactivity. The goblet cells' hyperplasia contributes to the mucus formation and other protective molecules on mucosal surfaces. The keratinocyte hyperplasia contributes to epidermis thickening and columnar epithelium metaplasia into squamous epithelium results in increased harm resistance [34]. All these barriers are enhancing the effects come at the expense of the normal epithelial functions, such as absorption of nutrients and exchanging gas and thus only transient triggered when it's exposed to noxious stimuli. Prolonged or prolonged mucus development is a common component of allergies and asthma, such as sinusitis rhinitis, and inflammation of the airways. The best-characterized inducer is Interleukin 13 (IL-13) of mucus and hyperplasia development in goblet cells [35].

**Pathogenesis of skin contact allergy**

Epidermal barrier altered function of Patients are vulnerable to dermatitis contact irritation, and current dermatitis, regardless of form, enhances irritant reactivity at any other locations of the body [36]. Cutaneous irritant contact triggers a non-specific skin reaction. Irritants agents as such detergents cause the surface of skin lipids to emulsify, which are then washed away. More specifically, due to increases in pH skin, leads to enzymes inhibition that shows an optimum low acid pH and is essential for the synthesis of the epidermal lipid such as β-glucocerebrosidase, while enzymes with an optimum neutral pH such as KLK5 and KLK7 serine proteases are activated that play a role in desquamation [37,38]. The allergens bind to the IgEs which induce the FcπRI Cross-linking Receiver. The activates of cross-linking resulting several intracellular signaling pathways which is triggered both preformed and preformed releases of Mediators Newly Synthesized. Histamine is the most significant mediator, while others such as heparin, leukotrienes, proteases, and prostaglandins, whereas involved in the platelet-activating agent, substance P, and a wide variety of cytokines [39,40].

The release of these substances leads to increased vascular permeability, smooth muscle contraction, stimulation of mucous production, and chemotaxis of different inflammatory cells, as such basophils, eosinophil, and lymphocytes, which intensify and sustain the inflammatory process. In addition to the skin barrier dysfunction, direct cell damage and pro-inflammatory mediator activation are the ways that contribute to clinical symptoms of contact dermatitis irritant such as red, scaly, swollen, and fissured skin. Keratinocytes play a significant role in the elicitation and perpetuation of irritant dermatitis in touch. The skin barrier damages, the Complex II antigens, and cell adhesion molecules effect on keratinocytes are accompanied by up regulation of the significant histocompatibility. In turn, its endogenous activates on pro-inflammatory cytokines such as factor-alpha (TNF-α), interleukin (IL)-1α, and IL-1β tumor necrosis. The CCL21 chemokine is also upregulated and attracts to the skin T lymphocytes, which express the CLA antigen rises in epidermal Langerhans cell density, which is also accompanied by destruction barrier. Based on these results, it was suggested that the disruption of the skin barrier alone would lead to the development of cytokine and then causes inflammation. Since Filaggrin relation to genetic polymorphisms and their effect on the skin barrier, they can lead to increased sensitivity up to irritants and allergens, and dermatitis allergic contact development [41].

The disinfectants commonly used in the food,

drink, and catering industries are active surface agents (surfactants): these are detergents, and some of them have biocide properties and amphoterin properties namely (amyl alkyl glyciene based detergent), cationic (quaternary ammonium compounds) and diguanides and diguanides. Many of amphoterin and cationic are classified as irritants to the skin, eye, and breath. Biguanides and diguanides have low toxicity and irritation; they are useful for skin disinfection. Some mean way of ingredients transport and for other activity such alcohols, these are used as skin cleaners and disinfectants, but are irritating to the hair, nose, and throat [42]. The disinfectant agents as classified from low to a higher level are presented in **Table 1**.

| Type and level | Typical use | Advantage | Disadvantage |
|---|---|---|---|
| Low Level<br>Iodophors<br>Ethyl alcohol<br>Isopropyl alcohol | Patient care equipment | Fast action, less than 2 min | Corrosive material<br>Deter-mental to some plastic<br>Require a longer contact time to kill |
| Low level<br>alcohol-free quaternary ammonium | hospital-level disinfectants | killed viruses rapidly mostly lipophilic virus has more resistance | not used to disinfect patient-care surfaces<br>hydrophilic virus has more resistance |
| Low to intermediate level<br>Chlorinated compound | Noncritical patient care item (blood pressure cuff) or surface (bedside table) with no visible blood | Destroys vegetative bacteria, some fungi and viruses but not mycobacterium or spores | Inactive by organic matter<br>Corrosive<br>Stain fabrics and plastic.<br>Relatively unstable |
| Intermediate Level<br>water-based phenolic<br>alcohol-based phenolic, sodium hypochlorite's | Used in dentistry as surface disinfectants. Housekeeping for walls and floors | For housekeeping use: residential activity that can be re-activated when monitor is applied | For patient care items: residual activity can harm patients.<br>Corrosive to plastics |
| Intermediate level<br>quaternary ammonium compound<br>benzyl ammonium chloride alkyldimethylethyl benzyl ammonium chloride | Surface disinfectant<br>disinfectants in restaurants, hospitals and homes | Don't damage to clothing | When mixed with organic matter it loses its effectiveness |
| alkaline glutaraldehyde | Surface disinfection | Stay active for up to 30 days | Allergic contact dermatitis |

**Table 1**. Types of low and intermediate levels of disinfectant.

**Skin repair**

The skin offers protection against many environmental hazards, mechanical damage, and bacterial invasion since the epidermis is quite dense and keratin coated. This defensive barrier benefits from sebaceous glands secretions and sweat glands. In case of injury damaging the skin protective barrier, the body triggers a response called wound healing. Upon hemostasis, the white blood cells with inflammation, including phagocytic macrophages, arrive at the injury site. When the invaded micro-organisms become under control, the skin starts repairing itself. The skin's capacity for healing proceeded even after serious damage due to the stem cell involvement [43]. When bleeding occurs and an injury spreads into the dermis through the epidermis then the inflammatory response begins. The blood coagulation pathways are started early, and then a scab clot is formed within several hours. The scab temporarily restores epidermis integrity preventing the micro-organisms entry. After the scab is established stratum basales cells start to divide by mitosis and migrating to the edges of the scab.

A week after the injury a contraction pulls the edges of the wound together. This contraction is an

important part of the healing process, when significant damage has occurred, causing a reduction in the size of the underlying contractile connective tissue that brides [44]. As epithelial cells start to move across the scab, the stem cell activity starts to cure the dermis. These active cells are generating the collagenous fibers and the ground material. Blood vessels are easy to expand into the dermis, restoring blood circulation. In case of very minor injury, after the dermis has been regenerated the epithelial cells eventually restore the epidermis. In case of severe injuries, the repair mechanisms are unable to return the skin to its original condition [45]. If the repaired area involves an abnormally large number of collagen fibers, and relatively few vessels of blood then, it is rarely replacing the damaged sweat and sebaceous glands, hair follicles, muscle cells, and nerves, they normally hard to get replaced [46]. The process of tissue formation consists of fixing the wound site by restoring the various damaged parts of the skin: epidermis, dermis, and other structures (blood vessels, nerves, pilosebaceous units, and eccrine sweat glands) [47]. The design of the wound will determine not only the cellular processes by which the process of tissue formation takes place but also the time it takes to complete it. The final stage of the wound healing reaction is the period of reformation, during all the processes that are enabled before slowly switching off this stage [48]. This process of maturation will tentatively normalize epidermal thickness, cellular material, extra-cellular matrix structure, and count blood vessels as close to a pre-wound level as possible. The result may be very similar to the unwounded skin, depending on the initial wound, to be significantly altered both cosmetically and functionally [49].

## CONCLUSION

To prevent microbial infections or reduce the risk of injury, the World Health Organization has therefore recommended the need for sterilization and following the correct foundations with the wearing of rubber masks and pads, but increasing the excessive use of sterilizers with an increase in the wearing of pads has resulted in skin sensitivity especially when a case of mass exposure, gathering, hospitals, food chain, and all means to prevent COVID-19 spreading, upon excessive disinfection using several anti-bacterial and virus agents in which adverse rise of skin irritant and increased skin allergic. Two major skin reactions are associated with excessive hygiene. First included milled dryness, irritation itching, and even skin cracking and bleeding. The second is allergic contact dermatitis due to allergy from certain material with the formula of hygiene product. This kind of allergy may have associated with the respiratory system.

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