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A REVIEW ON ALCOHOL BASED HAND SANITIZER (ABHS) POISONING DURING COVID-19 PANDEMIC AMONG YOUNG CHILDREN

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ABSTRACT

Hand sanitizers are everywhere because of the Coronavirus, but that has led to an unexpected side effects. Non recommended use of alcohol-based (alcohol) hand sanitizers, including intentional or unintentional ingestion, might be associated with greater health risks in young children than similar use of non-alcohol-based (non-alcohol) hand sanitizers.Hand sanitizer products are 60–70% ethyl alcohol, which can be toxic to young children even in small amounts.After the outbreak of COVID-19 in December 2019 usage of hand sanitizers have increased and the reason for this immense usage of hand sanitizer was suggested by WHO as a preventive measure to control this pandemic, which leads to significantly increased usage of alcohol based hand sanitizers as hand hygiene.Number of cases reported to NPDS about exposure to alcohol and non-alcohol hand sanitizer in children ≤12 years old in the year 2011–14significantly increased.Initial five months of 2020, American Association of Poison Control Center reported 9504 alcoholic hand sanitizer exposure cases in children under the age of 12 years and recognized that even a small amount of alcohol can cause alcohol poisoning in children. In this rising issue, it is very important to pay attention towards Alcohol Based Hand Sanitizer (ABHS) poisoning in order to reduce the risk of sanitizer poisoning especially in young population.

INTRODUCTION:

The COVID-19 pandemic, declared by the World Health Organization (WHO) on 11th March 2020[1]. The use of alcohol based hand sanitizer is globally practiced in an effort to prevent rapid spread of the virus. Many countries have relaxed legislation to make it easier for local businesses to rapidly produce ABHRs and this era of unprecedented demand for sanitizers may also carry some potential risks.[2]. Experts believe that a few squirts of a hand sanitizer are equal to a couple of alcohol shots. Now this can be dangerous, especially for kids where there is a chances of poisoning[2] and other effects of include antibiotic resistance, alcoholstrip away the natural oils of the skin and also cause irritation and the acid present in hand sanitizers dehydrate skin cells and may also lead to contact dermatitis and aging of hands skin.[3].

The major route of exposure to both alcohol and non-alcohol-based hand sanitizers was ingestion. The majority of intentional exposures to alcohol hand sanitizers occurred inchildren aged 6–12 years Alcohol hand sanitizer exposures were associated with worse outcomes than were non-alcohol hand sanitizer exposures[4]. In early five months of 2020, American Association of Poison Control Center reported 9504 alcoholic hand sanitizer exposure cases in children under the age of 12 years and recognized that even a small amount of alcohol can cause alcohol poisoning in children that is responsible for confusion, vomiting and drowsiness, and in severe cases, respiratory arrest and death[5] Young children, including infants, are more likely to develop complications from alcohol intoxication than are older children and teens. Younger children have decreased liver glycogen stores, which increase their risk of developing hypoglycemia, and have various pharmacokinetic factors, which make them more susceptible to developing toxicity from alcohol[6]

1. Active ingredients in ABHS:

The active ingredient in ABHS is aqueous alcohol in optimized concentrations. Alcohols areknown to possess broad-spectrum antimicrobial activity against bacteria, fungi and viruses.[7].

Three alcohol homologs are utilized in ABHS namely, ethanol, isopropanol and n- propanol. The US Food and Drug Administration (FDA), however, does not approve the use of n-propanol in ABHS [8].

Commonly used ingredients in ABHS[7,8]

INGREDIENT	ACTION	EXAMPLE
Active (alcohol)	Inactivate susceptible microorganisms	Ethanol, isopropanol n-propanol 2
Solvent/Cosolvent	• Facilitate alcohol protein denaturation • Reduce product volatility	Water
Humectant	Facilitate skin hydration	Glycerol, Propylene glycol
Emollient	Maintain skinsoftness,smoothness, pliability	Caprylyl glycol, Isopropyl myristate
Thickener	Increase viscosity; reduce spillage/runoff	Carbomer, Acrylates/C10-30 alkyl acrylate crosspolymer
pH adjusting agent	Neutralization of acrylic acid based polymers to enhance viscosity	Aminomethyl propanol, Triethanolamine
Fragrance	Enhance aesthetic appeal; ameliorate/mask alcohol odour	Linalool, Limonene
Other: • Antioxidant • Multifunctional	Ameliorate adverse effects of alcohols on the skin	• Tocopheryl acetate • Aloe vera

3. Isopropyl alcohol:

3.1. Mechanism of toxicity:

- Isopropyl alcohol is a potent depressant of the CNS, and intoxication by ingestion or inhalation may result in coma and respiratory arrest. It is metabolized to acetone (dimethyl ketone), which may contribute to and prolong CNS depression.
- High doses of isopropyl alcohol may cause hypotension secondary to vasodilation and possibly myocardial depression.
- Isopropyl alcohol is irritating to the GI tract and commonly causes gastritis.
- **Inhalation:** Chronic inhalation of isopropyl alcohol can cause respiratory tract irritation. Chronic exposure has also been associated with elevated hepatic transaminases, dementia, cerebellar dysfunction, and myopathy.[14]

3.2. Toxic dose:

Isopropyl alcohol is more potent than ethanol.

- **Ingestion.** The toxic oral dose is about 0.5–1 mL/kg of rubbing alcohol (70% isopropyl alcohol) but varies depending on individual tolerance.

3.3. Clinical presentation:

- Clinical manifestation of isopropyl alcohol mimics drunkenness from ethanol, with slurred speech, ataxia, and stupor followed in large ingestions by coma, hypotension, and respiratory arrest.
- Abdominal pain and vomiting are common because of the gastric irritant properties of isopropyl alcohol.
- Isopropyl alcohol is metabolized to acetone, which contributes to CNS depression and gives a distinct odor to the breath (in contrast, methanol and ethylene glycol and their toxic metabolites are odorless) [14]

3.4. Diagnosis:

- Isopropyl alcohol can be diagnosed based on a history of ingestion.
- The presence of an elevated osmol gap.
- The absence of severe acidosis, and the characteristic smell of isopropyl alcohol or its metabolite, acetone.
- Ketonemia and ketonuria may be present within 1–3 hours of ingestion.
- Isopropyl alcohol levels higher than 150 mg/dL usually cause coma, but patients with levels up to 560 mg/dL have survived with supportive care and dialysis.

Other useful laboratory studies include:

electrolytes, glucose, BUN, creatinine (may be falsely elevated), serum osmolality and osmol gap, and arterial blood gases or oximetry.

3.5. Treatment:

Emergency and supportive care:

- Maintain an open airway and assist ventilation if necessary. Administer supplemental oxygen if needed.
- Treat coma, hypotension, and hypoglycemia if they occur.
- Admit and observe symptomatic patients for at least 6–12 hours.

Specific drugs and antidotes.

There is no specific antidote. Fomepizole or ethanol therapy is not indicated because isopropyl alcohol does not produce a toxic organic acid metabolite.

3.6. Decontamination:

Isopropyl alcohol is absorbed rapidly after ingestion, gastric-emptying procedures are not likely to be useful if the ingestion is small (a swallow or two) or if more than 30 minutes has passed. For a large, recent ingestion, consider performing aspiration of gastric contents with a small, flexible tube.

3.7. Enhanced elimination:

Hemodialysis effectively removes isopropyl alcohol and acetone but is rarely indicated because the majority of patients can be managed with supportive care alone.

Hemoperfusion repeat-dose charcoal, and forced diuresis are not effective.[14]

4. Ethanol:

4.1. Mechanism of toxicity:

- **Central nervous system (CNS) depression** is the principal effect of acute ethanol intoxication. It has additive effects with other CNS depressants, such as barbiturates, benzodiazepines, opioids, antidepressants, and antipsychotics.
- **Hypoglycemia** may be caused by impaired gluconeogenesis in patients with depleted or low glycogen stores (particularly small children and poorly nourished persons).
- Ethanol intoxication and chronic alcoholism also predispose patients to trauma, exposure- induced hypothermia, injurious effects of alcohol on the GI tract and nervoussystem, and a number of nutritional disorders and metabolic derangements.[18]

4.2. Toxic dose:

Generally, 0.7 g/kg of pure ethanol (approximately 3–4 drinks) will produce a blood ethanol concentration of 100 mg/dL (0.1 g/dL). More than 300 mg/dL usually cause coma.

4.3. Clinical presentation:

Mild-to-moderate intoxication; Euphoria, mild incoordination, ataxia, nystagmus, and impaired judgment and reflexes. Social inhibitions are loosened, and boisterous or aggressive behavior is common.

Deep intoxication: Coma, respiratory depression, and pulmonary aspiration may occur. Pulse rate, blood pressure, body temperature will be decreased.

Chronic intoxication: Hepatic toxicity includes fatty infiltration of the liver, alcoholic hepatitis, and eventually cirrhosis. Liver injury can lead to portal hypertension, ascites, bleeding from esophageal varices and hemorrhoids;[11]

4.4. Diagnosis:

Ethanol toxicity can be diagnosed based on the history of ingestion, the characteristic smell of fresh alcohol or the fetid odor of acetaldehyde and other metabolic products, and the presence of nystagmus, ataxia, and altered mental status.

Other useful laboratory studies:

Glucose, electrolytes, BUN, creatinine, liver aminotrans ferases, prothrombin time (PT/INR), magnesium, arterial blood gases or oximetry, and chest radiography (if pulmonary aspiration is suspected).

4.5. Treatment:

Emergency and supportive care:

Treatment is mainly supportive.

- Protect the airway to prevent aspiration and intubate and assist ventilationif needed.
- Give glucose and thiamine and treat coma and seizures if they occur. Glucagon is not effective for alcohol induced hypoglycemia.
- Correct hypothermia with gradual rewarming.
- Most patients will recover within 4–6 hours. Observe children untiltheir blood alcohol level is below 50 mg/dL and there is no evidence ofhypoglycemia.

Specific drugs and antidotes:

There is no available specific ethanol receptorantagonist.

4.6. Decontamination: Ethanol is rapidly absorbed; gastric decontamination is usually not indicated unless other drug ingestion is suspected. Consider aspirating gastric contents with a small, flexible tube if the alcohol ingestion was massive

and recent (within 30–45 minutes). Activated charcoal does not effectively adsorb ethanol but may be given if other drugs or toxins were ingested.

4.7. Enhanced elimination:

Hemodialysis efficiently removes ethanol, but enhanced removal is rarely needed because supportive care is usually sufficient.

Hemoperfusionand forced diuresis are not effective. [15]

5. Number of cases reported to NPDS about exposure to alcohol and non-alcohol handsanitizer in children ≤12 years old in 2011–14.[13]

Table:1

Year	Alcohol	Non-Alcohol	Total
2011	15,971 (92.5 %)	1,286 (7.5 %)	17,257
2012	16,571 (92.4 %)	1.355 (7.6%)	17,926
2013	16,423 (92.5 %)	1.338 (7.5%)	17,761
2014	16,328 (92.1 %)	1,397 (7.9 %)	17,765
Total	**65,293 (92.4 %)**	**5,376 (7.6%)**	**70,669**

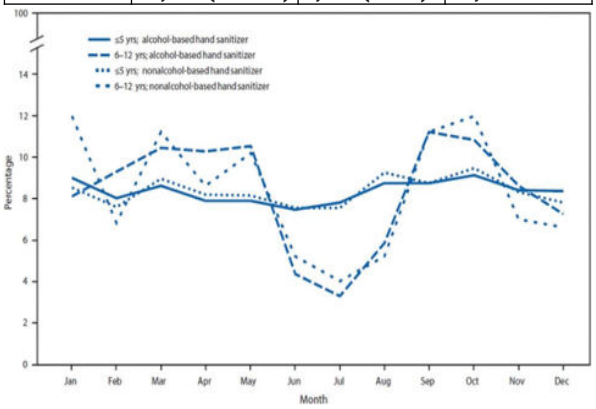

Figure1: (Note: Percentage of exposure with hand sanitizer in children. Reprinted from Reported Adverse Health Effects in Children from Ingestion of Alcohol-Based Hand Sanitizers—United States, 2011–2014 by Santos et al., 2017.Retrieved from: https:// www.cdc.gov/mmwr/ volumes/ 66/wr/pdfs/mm6608a5.pdf)

6. Children are at high risk of (ABHS) Alcohol Based Hand Sanitizer poisoning particularly during COVID-19 pandemic:

After the outbreak of COVID-19 in December 2019 usage of hand sanitizers have increased and the reason for this immense usage of hand sanitizer was suggested by WHO as a preventive measure to control this pandemic, which leads to significantly increased usage of alcohol based hand sanitizers as hand hygiene. Initial five months of 2020, American Association of Poison Control Center reported 9504 alcoholic hand sanitizer exposure cases in children under the age of 12 years and recognized that even a small amount of alcohol can cause alcohol poisoning in children. (American Association of Poison Control Centers (AAPCC), 2020).

Table: 2 No of exposure in children (12 years or younger) with handsanitizer in 2020.[12]

Month	No. of exposures
January	1609
February	1668
March	2443
April	1873
May	1903

(Note: Adapted from Hand Sanitizer by American Association of Poison Control Centers (AAPCC), 2020. Retrieved from https:// aapcc.org/track/hand-sanitizer.)

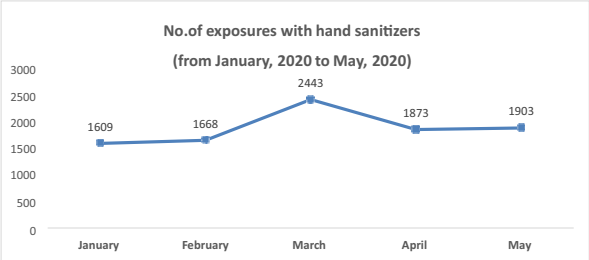

Figure:2

7. Strategies to prevent ABHS poisoning:.

Strategies to prevent ABHS poisoning (Figure:3)

8. DISCUSSION:

Caregivers and health care providers should be aware of the potential dangers associated with hand sanitizer ingestion. Children using alcohol hand sanitizers should be supervised and these products should be kept out of reach from children when not in use.[9] Alternate non- alcohol based hand sanitization is important for patients undergoing alcohol treatment[12].

Adeel Mahmood et al (2020) revealed in their study that COVID-19 and frequent use of hand sanitizers: human health and environmental hazards by exposure pathway. Children will most ordinarily get to hand sanitizer by putting their mouths on the siphon, or by licking what was siphoned out on their hands by guardians.

It is always important to remember that a hand sanitizer siphon apportions about 2.5 ml of liquid.3 If a normal 2-year-old youngster weighing 33 pounds (15 kg) ingested one pump of a 62% liquor based hand sanitizer, at that point a blood alcohol level of 17.3 mg/dL would be normal.[10] This is below toxic level of 80-100 mg/dL. A similar youngster would need to drink around 4-5 squirts of the sanitizer to cause poisonous impacts requiring clinical attention.Hand sanitizers produce a burning sensation when gulped, which can keep kidsfrom ingesting hurtful sums. Notwithstanding, a few kids will drink anything or they might be manhandling the items. Educate parents and teachers to contact the Poison Information Centre / emergency medical helpline promptly in the event that they speculate their kid has ingested hand sanitizer.

9. CONCLUSION:

Since families started purchasing more hand sanitizer during the COVID-19 pandemic, the National Poison Data System has been getting a lot more reports of accidental openings in children. Many are for children ages 5 years and younger. Health experts suggest utilizing hand sanitizer that is 60% to 95% alcohol to kill the virus that causes COVID-19.

It is very important to remember the following three things to prevent Alcohol Based Hand- Sanitizer poisoning among children:

- Apply a dime-sized amount to dry hands
- Rub hands together until completely dry
- Always monitor use by children and keep hand sanitizers out of reach of children.

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