

THE EFFECT OF USING WHITENING CREAMS THAT CONTAIN MERCURY IN THE COMMUNITY

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Abstract. Mercury is usually added to skin lightening products because of its whitening effect. However, many cosmetics contain mercury above 1000 ppm to enhance the whitening effect. This research aimed to determine the effects of mercury use in whitening creams for the general public. This research used descriptive-qualitative approach, the method that used in this research is literature study which implemented by recording the previous findings regarding to the variables of conflict. Skin lightening products that contain mercury are available for sale via the Internet, promoted online on social media sites, and for sale via mobile applications. WHO states that more than 90 creams from 15 countries have detectable mercury concentrations below 1 ppm. Thirty-four creams (10% of the sample) were found to have high mercury levels, that is, above 1 ppm, in four of the 13 samples from Indonesia, overall, mercury concentrations in this particular product ranged from 93 ppm to over 16,000 ppm. Long-term adverse effects of using mercury cream on health include kidney damage, skin rashes, skin discoloration, and scarring, decreased skin resistance to bacterial and fungal infections, anxiety, and depression.

Keywords: health effects, cosmetics, mercury, whitening cream, skin.

INTRODUCTION

Advertising and marketing reinforce the bias that lighter skin tones are desirable over darker skin tones (WHO, 2011) by the Beauty standards promoted by the media. Mercury is a common but dangerous ingredient found in skin lightening creams and soaps. Mercury is commonly added to the whitening product because it can be resulted lighter effect skin tone. Nevertheless, many cosmetics contain mercury up to 1000 ppm to improve the lightening effects (Sun et al., 2017). Mercury exists in 3 forms, elemental, organic, and inorganic, the liquid metal used in thermometers, which is known as Elemental mercury. Thiomersal, methylmercury, and ethylmercury as a preservative are also used with organic mercury compounds. Mercury of chloride or ammoniated mercury, mercuric chloride, and mercuric chloride or calomel is mercury salts, especially the form of mercury that is commonly added to brightening products (Hamann et al.,).

Fitri F Ramli referred that mercury is a poisonous substance commonly used in the lightening cream product. Mercury use applies especially when used in very high amounts it can produce a dramatic whitening effect. According to the WHO, Mercury levels in skin lightening products should be less than one part per million (ppm). Although, the strict regulations in many countries, many whitening products contains over thousands of acceptable levels of mercury. The whitening product is produced in many countries, such as England, Mexico, Lebanon, Taiwan, Indonesia, China, Japanese, Thailand, Philippines, and Jamaica, Both online and physical stores such as beauty store, store, and flea market, family, friends who contributed to the availability and widespread use of skin lightening products (Ramli, 2020).

J, Rhee stated that International Agency for Research on Cancer explained that Methylmercury (MeHg) compounds classified as 2 B Groups (i.e. 'possibly carcinogenic to humans') and the inorganic mercury (iHg) compound as Group 3 (i.e. 'not classified as carcinogenic to humans'). Occupations involving potential exposure to mercury (Hg) vapors among workers in chloralkali plants and the nuclear weapons industry, 9 Epidemiological studies have reported an increased incidence or mortality of cancer (Rhee et al., 2020).

Inorganic mercury occurs in the mercury form (or Hg²⁺) and 2 Mercury (or Hg₂). Salt like mercurous chloride (calomel), mercurous oxide, mercuric chloride and ammoniated mercury used in the cosmetic product to the whitening effect and anti freckles. Mercury replaces copper which is needed for tyrosinase activity and thus inactivates the melanocyte enzyme which is responsible for melanin production. If the stratum corneum is hydrated, mercury poisoning may occur after use of this cosmetic product. Tyrosinase inhibitors and skin lightening agents due to the well-known toxicity of mercury, this compound is prohibited for use. (Chan, 2020).

This Non commercial is used to brightening the skin; freckles is faded, blemishes and age spots; and acne treatment. The product is usually comes in the plastic container which does not have the label or handmade label. California Department of Public Health Food and Drug Laboratory found the cream contain

the highest mercury level, until 210.000 part per million (ppm) or 21 percent. Selling skin cream products in the US that contain 1 ppm or more of mercury is illegal (Health Alert, 2019).

Human toxicity varies with the form of mercury, dose and exposure level. The target organ for inhaling mercury vapor is primarily the brain. Mercury salt and mercury damages the lining of the intestines and kidneys, while methyl mercury is widely distributed throughout the body. Toxicity varies by dose: acute large exposure to mercury vapors causes severe pneumonitis, which in extreme cases can be fatal (Bernhoft, 2012).

Zero Mercury Working Groups Mercury known by international intelligent as toxic and risk for the human health. Whitening and brightening cream or soap usage which containing mercury regularly can cause rashes, skin discoloration, and patches. Long-term exposure can have serious health consequences, including damage to the skin, eyes, lungs, kidneys, digestive system, immune system, and nerves. The 22 countries where sampling was conducted, 15 had laws or other requirements consistent with the provisions of the Minamata Convention. Of the 7 countries where high mercury samples were found, only 4 have a legal requirement that prohibits creams with a mercury content of more than 1 ppm (ZMWG, 2018).

Many people using whitening and brightening cream, some people know cause effect of long-term using mercury some people does not know it, the researcher chooses to review this topic, from the explanation above, the researcher conducted. This study aimed to know the effect of using mercury to the whitening cream product that used to general public.

METHODOLOGY

This research used descriptive-qualitative approach, the method that used in this research is literature study which implemented by recording the previous findings regarding to the variables of conflict, mutation and passion, then combining the existing findings and analyzing these findings coherently and clearly (Sugiyono, 2009).

In this study used data secondary that obtained from several previous literatures. Data collection sources from books and previous research journals. The data analysis method used in this article is a qualitative descriptive analysis technique; this technique was chosen to describe problems related to employee morale which are then reviewed in order to produce relevant input to increase the productivity of an organization.

RESULT AND DISCUSSION

Production and availability

Mercury can be eliminated from the whitening product collaboration with the Ministry of Health and Environment with improving the public awareness regarding the dangers of mercury and other harmful chemicals in skin lightening products for health. To limitation making to restrict the manufacture, import and export of skin lightening products in line with the Minamata Convention, government regulatory action - including training of customs agents - as well as mainstream media and advocacy campaigns is required. Minamata convention regarding mercury set limits 1 mg/kg (1 ppm) for the whitening product, but many cosmetic product that containing mercury levels higher than this amount. This review gives the update related with the patients exposed to cosmetic products containing mercury and a brief review of the assessment of these patients.

Carsten R. Hamann referred that Global whitening product, 60% contains mercury more than 1000 ppm (Hamann et al., 2014). The whitening product used by women and men. The whitening product industry is one of the fastest growing beauty industries in the world and is estimated to be worth 31.2 billion USD by 2024. In India, for example the skin lightening industry (including products with and without mercury) represents 50% of the skin care market and is estimated to be worth 450–535 million USD.

Whitening product contains mercury available sells through Internet, promoting online in the social media sites, and sell through cellular application. According to the United States Food and Drug Administration (FDA), the product is often produced in overseas and selling illegally in US often in small shops and informal markets serving in Latin, Asian, African, or Middle Eastern communities. Consumers also buy them in other countries and bring them back to their countries. Toxic trade from the whitening product which added mercury illegally is the global crisis that is estimated only making worse with demand is skyrocketing, especially in Africa, Asia and Middle East.

Beauty standards promoted by the media, advertising and marketing reinforce the bias that lighter skin tones are desirable over darker skin tones. Some cream are duplicate although collected in several country, shows Prevalence Company which selling in several continent. In the first round of sampling in

2017, the majority creams contains no detectable mercury, and provides a complete analysis of Milestone DMA-80 cream with detectable mercury levels.

According to Carsten R. Hamann stated that from 549 product that tested, 6,0% (n=33) contain mercury above 1000 ppm. Mercury founded in the products that purchased in China (8.7%; n = 6/69), Thailand (29%; n = 15/52), and the United States (3.3%; n = 12/367). Cosmetics containing mercury were produced in China (13%; n = 10/78), Jamaica (50%; n = 1/2), Japan (6.9%; n = 2/29), Thailand (19%; n = 17/89), the Philippines (6.7%; n = 1/15), and in unspecified regions (5.6%; n = 2/36), entirely, 45% samples which contain mercury up to 10.000 ppm. Sample with highest mercury concentration is 45.622 6 322 ppm, 45,000 times higher than the FDA regulated limit. Overall, 6.1% of store-bought products contained mercury versus 5.8% of products purchased online. As much as 70% of products that contain mercury are purchased in stores compared to 30% purchased online (Hamann et al., 2014).

Zero Mercury Group in 2017 and 2018 collected 338 sample of whitening cream from 22 countries both in the formal market or informal to identify “illustration” frequency and concentration where mercury is used as active ingredients in whitening cream in around the world. Whitening product of 34 creams (10% from sample) founded has the high mercury levels. Although there are bans in a number of countries included in the study, this study shows that mercury is still a prevalent ingredient in many skin whitening creams. In total, 338 samples from 22 countries were analyzed, of which 34 in 7 (10% of the sample). The overall percentage of 10% covering multiple countries concurrently is slightly higher than other findings in the literature where sampling is, but relatively low when compared to studies that focus on one country, where the percentage of cream that exceeds 1 ppm of mercury often ranges between 20 - 60% (ZMWG, 2010).

State of California - Health and Human Services Agency referred that not only in Asia and Middle East, but in California, many creams that seen in California is light colored and turns dark gray/green after prolonged exposure to light. In almost all cases, skin creams are distributed to family and friends and are often used by teenagers to treat acne (Health Alert, 2019).

A new study related with whitening cream in Kamboja found 16% from cream that contains 20 until 35.000 ppm mercury. 25 other study in Mexico shows that 6 from 16 (37%) whitening product contains mercury in the range 878 to 36,000 ppm. The highest sample mercury is found in the 7 from 22 countries. Entirely, mercury concentration in the special product is ranged from 93 ppm until up to 16.000 ppm (Hamann et al., 2014).

Robin A bernhoft stated that the mercury compound in the atmosphere settles in the water, where it changed by microorganism become organic mercury (methyl or ethyl), which is swallowed up by the smaller creatures which the larger fish end up consuming. Human sources of atmospheric mercury include coal burning and mining (mercury and gold in particular). Fish at the top of the food chain (for example, tuna, swordfish, or shark) may concentrate a significant amount of mercury in their network (Bernhoft, 2012).

From those several study, minamata convention about Mercury sets a limit of 1 mg / kg (1 ppm) for skin lightening products however many cosmetic products contain higher levels of mercury than this. Mercury can be deleted from whitening product with collaboration of Ministry of Health and Environment with improving the public awareness related to the mercury danger and other chemical ingredient danger to the whitening product for health. To stop produce, import and export whitening product In line with the Minamata Convention, regulatory action by governments - including training of customs agents - as well as mainstream media and advocacy campaigns is required.

Product and ingredients

Ingredients In Cosmetics Include The Following:

- Mercury
- Hg
- Mercuric Iodide
- Mercury Oxide
- Mercurous Chloride
- Ethyl Mercury
- Phenyl Mercuric Salts
- Ammoniated Mercury
- Amide Chloride Of Mercury
- Mercury Iodide

WHO stated that more than 90 creams from 15 countries have detectable mercury concentrations below 1 ppm. Twelve creams had mercury levels above the maximum detection capability of the Milestone

DMA-80 instrument. A survey of 2011 funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety noted that believe skin lightening products containing mercury are readily available (WHO, 2011).

Whitening product is served in several forms, including cream and soap. Soap contains around 1-3% mercuric iodide and cream consist of 1-10% ammoniated mercury → some soap product has been tested contains mercury at concentrations up to 31 mg / kg (31 ppm), while some cream products were found to have mercury concentrations as high as 33,000 mg / kg.

Mercury Skin Lightening Cream: Available, Cheap and Toxic stated that from 98 samples collected in 9 countries in 2018, including part including most of the countries where a cream with a mercury content of at least 1 ppm was found during the first sampling round, including Bangladesh, and the Philippines. Except it, moreover sample is collected from India, Indonesia, Kenya, Nepal, Nigeria, and Thailand. Whitening product bought in India, Indonesia, and Philippines using Olympus Innov-X Delta Professional DS 2000 XRF. Four of 13 samples from Indonesia, and four of 20 samples from Philippines contained mercury levels above 1 ppm. The sample analysis results with mercury were detected, and samples with mercury above 1 ppm including in the table above (ZMWG, 2018):

Table 1.

Creams Purchased in 2018 exceeding 1 ppm mercury content

Country of purchase	Country of manufacture	Manufacturer	Brand name	Innov-X Delta Professional DS 2000 XRF THg (ppm)	QACS (ppm)
Indonesia	Not indicated		Collagen Plus Vit E Night Cream	7,276±80	7,111
Indonesia	Philippines		RDL Whitening Treatment Night Cream 8 Days Treatment	3,319±37	5,958
Indonesia	Malaysia		Temulawak Cream (Night Cream)	3,892±71	3,059
Indonesia	Not indicated		Natural 99 Vitamin E Plus	1,000±19	2,018
Philippines	Pakistan		Goree Beauty Cream	22,133±0.1	10,576
Philippines	China		Jiaoli Day Cream	3,156±56	1,693
Philippines	Hong Kong		Gemli Glutathione Grapeseed Extract (Day Cream)	6,52±18	1,565
Philippines	China		Jiaoli Night Cream	269±11	365
Bangladesh	Pakistan	H Pharmacy	Goree Beauty Cream with Lycopene	9,356±62	16,353
Bangladesh	Pakistan	Kreative Cosmetics Private LTD	Due Beauty Cream	8,185±112	11,940
Bangladesh	Taiwan	Bird's Nest Cosmetology	Huayenong - Bird's Nest Cosmetology	6,515±42	10,749
Bangladesh	Pakistan	Golden Pearl Cosmetics	Golden Pearl Beauty Cream	10,567±107	9,648
Bangladesh	Pakistan	Poonia Brothers	Faiza Beauty Cream	4,636±43	9,053
Bangladesh	Taiwan	Spring International Cosmetic Group Company	Egg White and Cherry 7 Days Specific Eliminating Freckle Whitening Cream	4,371±31	5,271
Bangladesh	Taiwan	Hua Thu Li	Green Tea Whitening Anti-freckle Cream	4,870±32	5,068
Bangladesh	China, via Malaysia	Guangzhou Tengzhang International Trade Co. Ltd	Temulawak New Beauty White Cream (Night Cream)	12,73±13	1,884
Bangladesh	Pakistan	Hamza Company	Hoor! Whitening Cream	16,72±18	1,083
Bangladesh	China	Hearben Gelidai Jiabao Cosmetics	Jiaulihuc Hunsu Jioli Miraculous Day and Night Cream	732±9	711

Note: Creams analyzed in 2018 with the Innov-X Delta Professional DS 2000 XRF, and Niton XL3t-970 GOLDD+ Analyser SDD, as well as by QACS using cold vapor atomic absorption spectroscopy.

Mercury also can be found in cosmetics such as mascara, and eye makeup cleaning product, which is used as a preservative. Mercury in cosmetics in the two forms: inorganic and organic. Inorganic Mercury used in whitening cream and soap. Inorganic mercury compound (example: thiomersal, which contains ethyl mercury, and phenyl mercury salts) is used as a cosmetic preservative in eye makeup, including cream products.

Health effects

Melanin is a pigment produced by melanocytes from polymerization and oxidation in the process of melanogenesis and its formation requires the presence of the enzyme tyrosinase. The process of melanogenesis produces the pigments eumelanin and feomelanin. Eumelanin and feomelanin are both tyrosine derivatives through several stages. Melanocytes are an important component in the skin pigmentation system through their ability to produce and distribute melanin. Skin pigmentation involves melanocytes, melanosomes, melanin, enzyme tyrosinase and the process of melanogenesis. Melanocytes are cells that can synthesize the tyrosinase enzyme, this enzyme, when combined in melanosomes, can start the synthesis and deposit of melanin besides producing several cytokines, including IL-1 (Interleukin-1), IL-6

(Interleukin-6) and TNF – α (Tumor Necrotic Factor – alpha) which works to inhibit the process of melanogenesis by decreasing tyrosinase enzyme activity and melanocyte proliferation.

Tyrosine undergoes an oxidation process to become 3,4-dihydroxy-phenylalanine (DOPA) by the activity of the tyrosinase enzyme and oxidized again to form dopakuinone. After this stage, the melanogenesis pathway is divided into two parts, namely eumelanogenesis and pheomelanogenesis. In the eumelanogenesis pathway, dopakuinone compounds undergo oxidation to form leukodopaque (cyclodopa) which also rapidly changes to dopaid form. Subsequently, dopaque underwent a change in shape to become 5,6 dihydroxyindol and 5,6 dihydroxyindol 2 carboxylic acids. At the final stage of the formation of eumelanin pigments, whether it is more influenced by the polymerization of the compound 5,6 dihydroxyindol or 5,6 dihydroxyindol 2 carboxylic acid is still controversial. In the feomelano genesis pathway, the addition of sulfhydryl groups (cysteine or punglutation) to dopakuinone compounds will cause rapid non-enzymatic reactions in the metabolic melanocytes to form cysteine-dopa compounds. Then this compound undergoes oxidation to become benzotizinilalanin until the stage of the formation of the feomelanin pigment.

Although the melanin produced in the skin melanocytes provides protection from UV radiation, excessive melanin accumulation can cause cosmetic defects such as melasma, to reduce the abnormal accumulation of melanin, the use of skin lightening products has become prevalent among women worldwide. Active ingredients that are known to be effective in lightening the skin include various corticosteroids, hydroquinone, and mercury. Mercury exists mainly in three forms: inorganic, organic and metallic. Inorganic mercury compounds, including mercuric chloride, mercuric chloride, and mercuric oxide, have been used in skin lightening products since ancient times. This compound occurs in the form of mercuric (Hg II) or mercurous (Hg I) and has a toxic effect on humans. It has been found that the use of skin lightening products is one of the causes of mercury toxicity. More specifically, the use of skin lightening products containing inorganic mercury can cause central nervous, gastrointestinal and renal system toxicity. Therefore, the sale of skin lightening products containing inorganic mercury is prohibited in many countries. Mercury can replace copper which is required for tyrosinase activity, thereby deactivating enzymes and producing a skin-lightening effect.

Mercuric chloride solution 0,1% applied to the skin on the backs of healthy volunteers for 2 hours, 7 mercury migrated through the stratum corneum via the transcellular and intercellular pathways. While the mercuric chloride solution 0,01 – 0,2 % applied to the skin of the forearm of healthy volunteers, the rate at which mercury was absorbed through the skin increased with concentration. In the human skin models in vitro, two different formulations from beauty cream which contains 6-8% mercuric chloride applied after previous hydration. The initial rapid increase in mercury content in the skin and the underlying diffusion buffer is due to transappendageal absorption. Dilute preparations have a mercury absorption rate and rate improvement in real rather with formulation of gliserol. Transepidermal absorption allows mercury to pass between cells (intercellular) or through the cell membrane (intracellular) of the stratum corneum. Dermal absorption level also varies with skin integrity and the solubility of lipids from vehicles in cosmetic products (Chan, 2011).

According to Gui - Fang Sun, Side effect from cream which contains mercury from using creams containing mercury through mercury ion replacing the enzyme tyrosinase anion. Long-term use of products that not meet these requirements will result in chronic mercury poisoning. Some products are added with mercury content, which is thousands or even millions of times more than offering, to make the extraordinary lightening effect. In a particular group of patients in this study, pain, kidney damage, and neuropsychiatric symptoms were the main symptoms observed (Sun et al., 2017).

Investigations found an increase in blood and urine mercury by levels of about 1500 times and more than 120 times the reference values, respectively. The Rapid deterioration of neurologic symptoms of 47-year-old Hispanic-American patient within 2 weeks from initial presentations and requires hospitalization. Surprisingly, they also detected elevated blood levels of methylmercury, the ingredient not commonly found in skin whitening products.

Fitri Fareez Ramli referred that, girl who exposure 17 months caused by methylmercury toxic product contains mercury at a level of 27,000 ppm for 4-5 months. Mercury exposure through inhalation of mercury vapors, skin-to-skin contact with mothers and grandmothers, skin-to-skin contaminated household items, and accidental ingestion of mercury adhering to contaminated surfaces can lead to mercury poisoning. This patient received DMSA chelation therapy for more than a month. The patient's condition improved, residual neurological deficits were still recorded during the follow-up period at 7 months after admission (Ramli, 2020).

Robin A. Bernhoft found that the human mercury exposure occurs through inhalation of elemental mercury vapors through work or exposure to dental amalgam or through ingestion of mercury bound to organic parts (methyl, dimethyl, or ethyl mercury), particularly from seafood. Most of exposure to human

mercury metal came from mercury vapor that escapes from amalgam filling, at a rate of 2 to 28 micrograms per facet surface per day, where about 80% is absorbed, according to the World Health Organization. Less common sources from mercury vapor is spilled mercury, and there are reports in the Idiopathic Thrombocytopenic Purpura literature, it was caused by aspiration of spilled mercury (resulting in large acute exposure to mercury vapors) (Bernhoft, 2012).

Mercury in the soap, cream and other cosmetics product eventually discharged into wastewater. Mercury then entering environment become where it becomes methylated and can enter the food chain as methylmercury which is highly toxic to fish. Pregnant woman who consume fish which contains methylmercury can transfer mercury to the fetus, which can result in neurodevelopmental deficits in the child.

Medical literature reported the special accident from individual which who suffer from the health effects mentioned above after being exposed to mercury through skin lightening creams and soaps. One reported the cases described a Chinese woman of 34 years suffer nephrotic syndrome à a condition characterized by high levels of protein in the urine. Mercury level in the bloods and urine off the woman return normal after nine months stops using whitening cream. Other case reported describes a woman 54 years with the onset of dementia, epilepsy and peripheral polyneuropathy at age 49. After six years of daily use of the skin lightening cream, exposure was stopped immediately, after which his blood and urine mercury levels returned to levels that were not exposed. Other research found, patients for approximately 13.9 years, found relationship between mercury concentrations in hair risk of cardiovascular event or death from cardiovascular disease and other causes (Fernandes et al., 2012).

The bad effects of using mercury cream in the long term on health include kidney damage, skin rashes, skin discoloration, and scar. Skin decreased resistance to bacterial and fungal infections, anxiety, and depression. Psychosis, Peripheral Neuropathy, Nervousness, Irritability, Tremors, Weakness, Fatigue, Memory loss, Changes in hearing, vision, and taste, Nausea, Vomiting, Diarrhea, Kidney damage, Skin rashes, Skin discoloration, Scarring, Reduction in skin's resistance to bacterial and fungal infections, Anxiety, Depression, Psychosis, Nerve damage - pain or numbness in the hands, arms, legs, and feet, Brain, Liver damage, Death (My miracolo, 2019).

CONCLUSIONS

From explanations some of the experts have made cosmetics that contain mercury a dangerous toxic material for long-term use. Thirty-four creams (10% of the sample) were found to have high mercury levels, that is, above 1 ppm. The 13 samples from Indonesia, overall, mercury concentrations in this particular product ranged from 93 ppm to over 16,000 ppm. The long term bad effects of using mercury cream on health include kidney damage, skin rashes, skin discoloration, and scar tissue, decreased skin resistance to bacterial and fungal infections, anxiety, and depression. Those explanations, people can sort or think again when buying products that contain mercury, and be more careful in buying cosmetic products to avoid the bad affects that will occur. From some of these surveys and studies, it can guide doctors to investigate further, by eliminating the cause of the disease, and immediately starting treatment. Early detection has been shown to produce a good prognosis. From the public awareness and knowledge about chronic mercury poisoning due to skin lightening products that contain mercury is very important because the product is widely available.

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