

A REVIEW ON COSMETICS AND THEIR ASSOCIATED ADVERSE EFFECTS

Ms. Samiksha Gupta*¹, Mrs. Deepika Kalode*², Dr. C.A Doifode*³

^{*1,2,3}Taywade College Of Pharmacy, Nagpur, India.

DOI : <https://www.doi.org/10.56726/IRJMETS33011>

ABSTRACT

The aim of this review is to understand cosmetics and their associated adverse effect. The word 'cosmetics' is taken from a Greek word "kosmetikos" which means to adorn. Since early days materials used for beautification or improvement of appearance come under the category of cosmetics. People want to look beautiful and the concept of cosmetics is as old as mankind and civilization. Historical significance of cosmetics. Some factors such as advertisement, peer pressure and social acceptance, influence the choice of skincare products applied by most women. Skin lightening agents such as hydroquinone (HQ) is found to be one of the most harmful chemicals. Black henna is the combination of red henna with p-phenylenediamine (PPD), and is used for temporary 'black henna tattoos'. Sun-screening agents used nowadays can cause irritant, allergic, phototoxic or photo-allergic reactions. The contact time of shampoos and conditioners with the skin is very less; they are only applied to the hair and as such, thus causing less adverse effects. Health hazards associated with chemicals used in formulation of Cosmetics ; BHA and BHT, Coal Tar Dyes, Di butyl Phthalate (DBP), Parabens, Perfume (Fragrance).

Keyword: Kosmetikos, Beautification, Hydroquinone[HQ], P-Phenylenediamine, Allergic Symptoms, Redness, Paraben, Carcinogenic Cosmetics, Heavy Metals, Toxicity.

I. INTRODUCTION

The word 'cosmetics' is taken from a Greek word "kosmetikos" which means to adorn. Since early days materials used for beautification or improvement of appearance come under the category of cosmetics. People want to look beautiful and the concept of cosmetics is as old as mankind and civilization.

The urge to beautify one's own body and look beautiful has been an urge in the human race since the tribal days. Assorted beauty products such as skincare products, hair products, fragrances, oral hygiene, and nail products, which may contain toxic chemicals that can be harmful to health are used especially by women. Since long time cosmetics have been known to enhance the appearance of the human body. In a society obsessed with beauty, people are lured to fake their appearance as a cure for their insecurities. The estimated value of cosmetic industry today is around 20 billion dollars globally.

Cosmetics are products applied to the body for the purpose of beautifying, cleansing or improving appearance and enhancing attractive features. ^[1] Cosmetics consist of a range of products such as tooth paste, shampoo, conditioners, mascara, after shave lotion, styling gel, creams, lotions, powders, perfumes, lipsticks, fingernail and toenail polish, eye and facial makeups, hair wavers, hair dyes, hair sprays, deodorants and antiperspirants. The word 'make up' is defined as a cosmetic which refers primarily to colored products intended to alter the user's appearance.

Schneider et al defined skincare products or cosmetics as mixtures of synthetic or natural chemical compounds used to improve the appearance or smell of the body. They are articles intended to be rubbed, poured, sprinkled or sprayed on, introduced into, or otherwise applied to the human body or any part thereof for promoting attractiveness, cleansing, beautifying or altering the appearance without affecting the body structure or functions.

As a consumer, we are constantly attracted in using beauty and personal care products. But these products, which are supposed to make us feel healthy and look beautiful, have a deep dark side. Various toxic ingredients and hazardous chemicals used in cosmetics are incorporated in beyond acceptable limits. These chemicals may cause serious ill effects on skin and may also enter skin and other organs causing carcinogenicity. Cosmetics have not only seeped into the fashion world but are also playing a prominent role in one's day-to-day life. Thus, it becomes a necessity to make people aware of various harmful effects of cosmetics and chemicals used in cosmetics.^[2]



Fig. 1. Cosmetics Products

II. LITERATURE REVIEW

1) Gabriel J- Hydroquinone: cancer - Causing, Skin Bleach, 2008, Hydroquinone is a hydroxyphenolic compound that inhibits the synthesis of melanin by inhibiting tyrosinase enzyme t may also function by interfering with the formation or degradation of melanosomes and by inhibiting the synthesis of DNA and RNA within melanocytes. [7]

2) Cosmetics Ingredient Review (CIR) (2004). CIR Information May 6, 2004.: Sun-screening agents used nowadays can cause irritant, allergic, phototoxic or photo-allergic reactions. The most common sensitizers are Benzophenones. While dibenzoyl methane, paraaminobenzoic acid (PABA) and cinnamates may cause photoallergic dermatitis. [8]

3) Rao SA. Krishnaswami Mahadick ed.- Sri Sarabhendra Vaidya Ratnavali. (Saraswati Mahal Library, Tanjore; 1952. The Science of cosmetology is believed to have originated in ancient world in countries like Egypt and India, but the earliest records of cosmetic substances and their application dates back to Circa 2500 and 1550 B.C, to the Indus valley civilization. [3]

4) Cosmetics Ingredient Review (CIR) (2004). CIR Information May 6, 2004. : Due to the presence of numerous components in the formulation of cosmetic products, such products 67 Year 2018 Global Journal of Medical Research Volume XVIII Issue II Version I () © 2018 Global Journals B Cosmetics and its Health Risks have the potential to cause side effects and their consequences can range from a simple mild hypersensitivity reaction to an anaphylactic process or even a lethal intoxication. [8]

III. HISTORICAL SIGNIFICANCE OF COSMETICS

The Science of cosmetology is believed to have originated in ancient world in countries like Egypt and India, but the earliest records of cosmetic substances and their application dates back to Circa 2500 and 1550 B.C, to the Indus valley civilization. [3]

An old remedy for cracked lips is found in history. Cracked lips, besides being painful, spoil the beauty of the face. The rind of Bel fruit (Aegle marmelos Corr.) is powdered and mixed in woman's milk and the paste thus prepared is applied to the cracked lips. The cracking will stop and the cracks will heal within 10 days the Superfluous hair was considered to be a mark of disgrace and a large number of depilatory agents were recommended to get rid of it. Dried fruits of Aavakatti (Emblica officinalis Gaertn.) and dried fruits of Pimpali (Piper longum Linn.) were used. The mixture was soaked in the milky latex of Nivadunga (Cactus: Euphorbia nivulia Ham.)

This compound was applied to the desired place, the hairs from that area were found to fall off". The use of kajal has a long history in Hindu Culture. Various beauty rituals in the present-day rituals such as coloring of hair, depilation and exfoliation find their roots in ancient Egyptian culture. In earlier days, the Romans, Greeks and Egyptians used various cosmetics which contain white Lead and Mercury. Oils with essence and ointments were used to clean and soften the skin and mask body odor while dyes and natural paints were used to color the face, mainly for ceremonial and religious occasions. There was a common ancient belief that eye makeup could remove evil spirits and improve sight. [4][5]

IV. COMMON COSMETICS PRODUCTS AND ASSOCIATED TOXICITIES

Some factors such as advertisement, peer pressure and social acceptance, influence the choice of skincare products applied by most women. Robertson et al conducted a study and reached a conclusion that women who use make-up have some sense of insecurity, and are anxious and lack confidence about them. Cosmetic products contain various harmful or toxic chemicals capable of causing harmful effects to the skin. Manufacturers of Cosmetic products do not only use synthetic ingredients but also natural products, such as Shea butter, Rose extract, and cane sugar which are sustainable, cheap and less harmful to the consumer. Skincare products such as perfumes, make up, nail polish etc, remain on the skin for a longer period of time and can cause harmful effects like allergic reactions. Moisturizers increase the hygroscopic properties of the skin particularly when used in high concentration. It can cause irritation and exfoliation.^[6]

4.1 Skin Lightening agents:

Skin lightening agents such as hydroquinone (HQ) is found to be one of the most harmful chemicals. There have been found reports of ochronosis and potential mutagenicity. Ochronosis is an uncommon adverse effect of HQ, with features like progressive darkening of the area to which the cream containing high concentrations of HQ is applied for many years.

Hydroquinone is a hydroxyphenolic compound that inhibits the synthesis of melanin by inhibiting tyrosinase enzyme it may also function by interfering with the formation or degradation of melanosomes and by inhibiting the synthesis of DNA and RNA within melanocytes.^[7]

Effects of Hydroquinone in the body

Hydroquinone side effects are numerous, and there are a lot of these both in short term and in long term use. For short term side effects, the most visible problems which may occur with the use of hydroquinone are;

- Skin redness, and itching.
- Swelling and inflammation.
- Skin irritation. Scaling and other skin problems which resemble allergic reactions.
- The hydroquinone tumorigenicity review noted several studies indicating that hydroquinone, or its metabolite, benzoquinone, may inhibit microtubule assembly, impairing spindle formation and causing chromosome lagging (i.e. anaphase lag) (Whysner et al., 1995)
- Causes black spots to the skin "ochronosis".^[8]



Fig. 2. Structure of Hydroquinone

4.2 Black Henna:

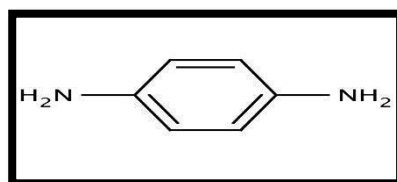


Fig.3. Structure of p-phenylenediamine

Black henna is the combination of red henna with p-phenylenediamine (PPD), and is used for temporary 'black henna tattoos. Black henna tattoo is a chemical stain due to the presence of pphenylenediamine (PPD), available in the form of commercial hair dye mixed into the henna paste.

PPD is added to henna to accelerate the dyeing and drying process (to only 30 min), to strengthen and darken the color, to enhance the design pattern of the tattoo, and to make the tattoo last longer. Negative effects of PPD include blisters, surface oozing, swelling and erythematous rashes on the skin. Studies have been done and reports given about the immediate allergic reactions on using henna dyes. Various cases involving sneezing, runny nose, cough and shortness of breath instead of skin reaction have been found. There have been some reports of

the appearance of localized hypertrichosis after black henna tattoos without allergic reactions to the tattoo. Many cases of toxicity from the black powder were noted in Sudan in early 80s which were used for body painting, some cases were found to be fatal. The initial symptoms are massive edema of the face, lips, glottis, pharynx, neck, and bronchi, occurring within hours of application of the dye mix to the skin, and sometimes requiring emergency tracheotomy for respiratory obstruction. The symptoms were found to progress on the second day to anuria and acute renal failure. Dialysis helped some patients, but others have died from renal tubular necrosis. [9]

4.3 Sunscreen products:

Sun-screening agents used nowadays can cause irritant, allergic, phototoxic or photo-allergic reactions. The most common sensitizers are Benzophenones. While dibenzoyl methane, paraaminobenzoic acid (PABA) and cinnamates may cause photoallergic dermatitis.[8]

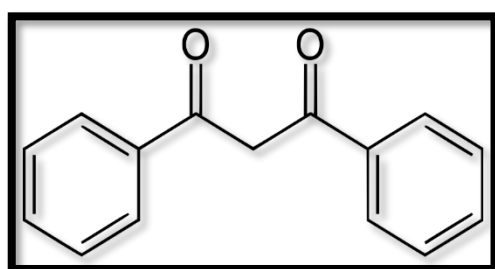


Fig.4. Structure of Dibenzoyl methane

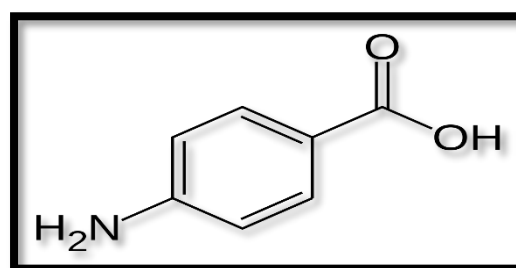


Fig.5. Structure of Para-amino benzoic acid

The allergic reactions which are related with deodorant/anti perspirants and fragrances are mostly caused by the fragrance or other ingredients. Fragrances may enter the body through skin(adsorption), lungs, air ways, ingestion and through pathways from the nose directly to the brain and can cause headaches, dizziness, fatigue, irritation to eyes, nose and throat, forgetfulness and other symptoms. When used the fragrances are sprayed in the air or found in air can cause airborne contact dermatitis. Coumarins, phethleugenol which are usually found in fragrances are suspected carcinogens, while phthalates are suspected hormones disrupters.

4.4 Shampoos:

The contact time of shampoos and conditioners with the skin is very less; they are only applied to the hair and as such, thus causing less adverse effects. However, the problem arises when they come in contact with the eyes during washing of the hair. The most common effect of using shampoo is the matting of the scalp hair also referred to as tangling of hair.

Another factor to be considered is pH of the shampoo. Most of the shampoos have an alkaline pH, which causes hair shaft swelling, making the hair liable to damage. A shampoo with neutral pH is the best choice for chemically treated hair from either permanent dyeing or permanent waving. When the critical assessment of validated data on the frequency of contact allergies to shampoo was done, it showed their low risk. Given that shampoos are diluted by water, have a short contact time, and are rinsed off, the risk of sensitization is highly unlikely. Active ingredients in hair bleaching product such as Hydrogen peroxide solutions, and Ammonium persulfate, may cause Types I and IV allergic contact reactions.[10]

4.5. (TABLE NO. 1)[11]

Some common cosmetics containing toxic chemical ingredients and their associated effects to the body:

Name of a product (cosmetics)	Chemical ingredients	Applic-ation time (years)	Effects to the body
1. Caro light Cream. -Caro light Lightening oil.	-mineral oil. -Petrolatum, Aqua -Stearic acid -Hydroquinone. -Cetearyl alcohol -Isopropyl myristate -Glycerine,	1-3	- Burning sensation of the skin. - Dryness of the skin after application. - Skin and Eye irritation when exposed to direct sunlight. -Black and large pimples on the skin. - Skin bleaching to brown in

	methyl, Propyl paraben, Huile de Carrote, Vitamin E, Fragrance.		appearance & decoloration. - Pimples.
2.Top Lemon Cream, lemon water,	-Hydroquinone (2%), sodium metabisulphite, cetosteryl alcohol, p-hydroxybenzoates, p-chloro-mcresol, lemon extract, EDTA Disodium	4-7	- Skin bleaching to verybrown in color. - Eye and skin irritation tosunlight exposure. - Black spots around the facewhere applied. - Burning sensation and wounds. - Rashes which appears and disappears. - Body tiredness - Blurred visions.
3. Jaribu soap,Mekako soap, Amira, Rico,Asante soap.	-2% w/w mercuric Iodide,sensitivity to mercuric iodide	1-3	- Wounds around the appliedparts. - Burning sensation of the skin. - Skin weakening and becomeso thin to blood capillaries visibility. - Blurred visions
4.DiprosoneCream, Diprosone (oil/water), Lemonvate Cream	-Dipropionate de Betamethasone, Clobetasol, Excipients: Propylen glycol, Titanium dioxide, Carbomer, Purified water q.s	To 8+	- Skin irritation and burning sensation leading to wounds. - Eye and body irritation when exposed to sunlight leading to difficulties to walk at day time. - Headaches and skin lesions after applying. - Failure to detect smell (sometimes). - Body becomes slightlytired.
5.Movate, Demovate, Washing Powder	-Clobetasol propionate, Propylen glycol, Titanium dioxide, PerChloride, Carbomer, Purified water.	4-7	- Burning sensation few minutesafter applying to the body. - Wounds which difficult to heal easily.
6. Mixture (Mkorogo) ofCaro light Cream, Caro light lightening oil/water, Jaribu Soap, Movate cream, Jik water, Washing	-2% Hydroquinone, Mercuric Iodide, Parchloride, Clobetasol, Propionate de Betamethasone, glycerine,	1-3	- Burning sensation of thebody. - Wounds over the parts which have applied. - Feeling very cold atsleeping (night). - Eyes and skin irritation. -Large pimples on the skin which lasts longer. General body tiredness.
powder, Diprosone Cream.			- Great risk to pregnancy and breastfeeding mothers - Skin and eye irritation when exposed tosunlight. - Not good to young children with immature skin. - Very smooth and thin skin to blood capillaries visibility.

V. POSSIBLE HEALTH COMPLICATIONS ASSOCIATED WITH THE USE OF COSMETICS

Due to the presence of numerous components in the formulation of cosmetic products, such products can cause side effects and their consequences can range from a simple mild hypersensitivity reaction to an anaphylactic process or even a lethal intoxication. [8]

There are many types of adverse reactions caused by cosmetics. Most adverse reactions are irritant, however, type IV hypersensitivity, contact urticaria, photosensitization, pigmentary disorders, damage of hair and nails, paronychia, acneiform eruptions, folliculitis, and exacerbation of an established dermatosis may also occur. Side effects of cosmetic products do occur. It is to be expected that the improvements in safety, tolerance, and skin compatibility will not prevent side effects to cosmetic products from increasing in the future because of the continuing goals to intensify their biological activity and therapeutic efficacy. [8]

The areas of the body most affected by adverse reactions attributed to the use of cosmetics are head and neck, and irritant dermatitis is the most common type of complication. The health complications associated with the use of cosmetic products can be:

5.1 Allergic reactions to cosmetics:

Allergic reactions to cosmetics constitute a small but significant portion of the complications associated with the use of cosmetics. Allergic contact dermatitis represents true delayed-type (type IV) hypersensitivity that presents eczematous dermatitis and comprises approximately 10% to 20% of all cases of contact dermatitis. Type IV is hypersensitivity reaction that is T-cell mediated, wherein circulating or resident sensitized T cells are activated by the offending allergen to release pro-inflammatory cytokines. Sensitization depends on several factors including product composition, a concentration of potential allergenic components, amount of product applied, site application, skin barrier integrity, and frequency and duration of application.

This clinical scenario can range from mild erythema and scale with a minimal itch to vesicular, bullous, indurated plaques that are intensely pruritic. Initial sensitization is required for the subsequent expansion of a reaction when exposure occurs again. Allergic contact urticaria is immediate-type hypersensitivity that represents a true allergic reaction. As the name implies, the reactions occur within minutes to hours and might be limited to the site of exposure on the skin or, in severe cases, reactions can be generalized. Contact urticaria is a rarer reaction to cosmetics and skin care products that may be an immunologic or nonimmunologic reaction. It is characterized by the development of a wheal-and-flare response to a topically applied chemical. The spectrum of clinical presentation ranges from itching and burning to generalized urticaria to anaphylaxis. In highly allergic individuals, mucosal exposures, or large exposures, the symptoms of immediate-type hypersensitivity can generalize and include conjunctivitis, cough, bronchoconstriction, hypotension, anaphylaxis, and, occasionally, death. [8]

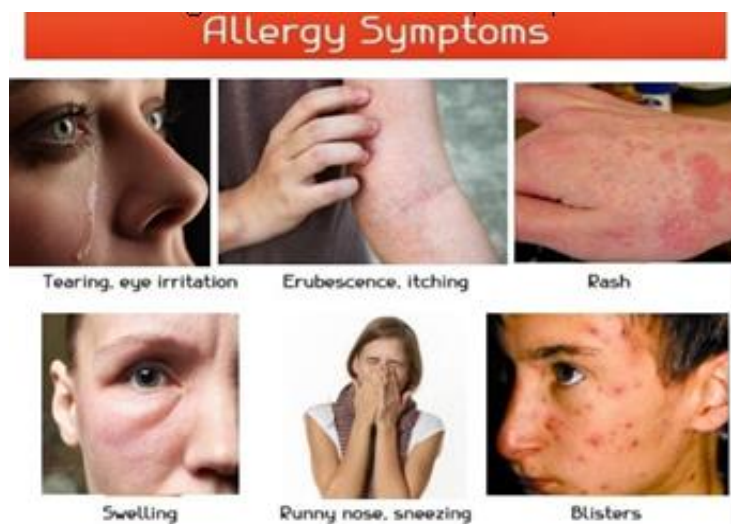


Fig. 6. Allergy Symptoms

5.2 Irritant contact dermatitis:

This is the most commonly encountered type of complication due to the use of cosmetics, especially those containing methylchloroisothiazolinone-methylisothiazolinone (MCI-MI) in its formulation. There are currently over 57.000 described irritants worldwide, ranging from weak or marginal irritants to strongly corrosive acids and bases. Then, the majority of facial problems that arise with skin care products and cosmetics are of the irritant contact dermatitis type manifesting as erythematous, burning, pruritic skin that may develop microvesiculation and later desquamation. The dermatitis is characterized by stratum corneum damage without immunologic reaction. [8]



Fig.7. Facial irritations day by day

Facial irritant dermatitis, which results mostly from cosmetics, presents as papules and plaques.

Another common presentation is a "seborrheic-like dermatitis" with pink scaly plaques on the cheeks and chin. Less commonly, patients may develop urticarial or infiltrated plaques. [8]

5.3 Photoallergic dermatitis:

This type of allergic reaction occurs after contact with cosmetic products and subsequent exposure to light. Usually, such a reaction presents itself as sunburn that may be followed by hyperpigmentation and desquamation. This reaction is formed by chemical substances capable of absorbing radiation, especially ultraviolet A, in addition to having no definite immune mechanism. Its clinical manifestations vary from erythema, edema to vesiculation. The incidence of photoallergic dermatitis is low, and is mainly caused by fragrances methylcoumarin and muskambrette, antibacterial agents and the para-aminobenzoic acid esters as sunscreens. Photoallergy is an uncommon acquired altered reactivity dependent on an immediate antibody or a delayed cell-mediated reaction. [8]



Fig.8. Photoallergic dermatitis:

5.4 Facial stinging:

There is a group of patients who note stinging or burning within several minutes after applying a cosmetic that intensifies over 5 to 10 minutes and then resolves after 15 minutes. This effect occurs without the patient exhibiting allergic contact dermatitis or irritant contact dermatitis with the applied substance. Tests should be done on the skin of the patient before using such components.

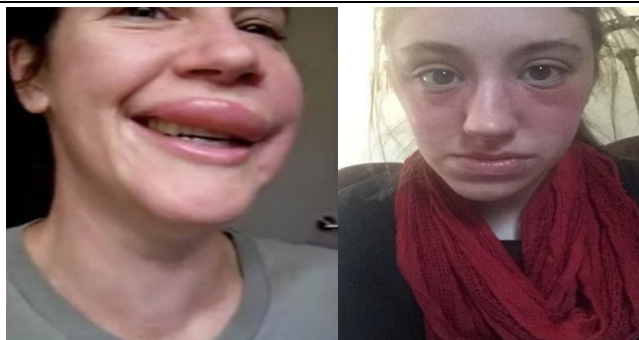


Fig.9. Facial stinging

Usually, substances such as benzene, phenol, salicylic acid, resorcinol and phosphoric acid are the main cause of facial stinging. [8]

5.5 Redness:

The redness of the skin caused by cosmetic products, especially soaps, is associated with the unbalance in cutaneous pH. Modern soap is a blend of tallow and nut oil, or the fatty acids derived from these products, in a ratio of 4:1. This fact allows the pH of these soaps to be commonly alkalized (pH 9-10), which can generate redness in the skin, which normally has a pH of 5.2-5.4. Ideally, such compounds should have neutral or slightly acidified pH [3]. Another reason redness can occur is the use of moisturizers with a greater oily proportion, allowing skin warming throughout the day. [8]



Fig.10. Redness on skin (red patches)

VI. HEALTH HAZARDS ASSOCIATED WITH CHEMICALS USED IN FORMULATION OF COSMETICS

6.1 BHA and BHT:

BHA (butylated hydroxyl anisole) and BHT (butylated hydroxyl toluene) are closely related synthetic chemicals used as preservatives in moisturizers and lipsticks, among other cosmetics. BHA and BHT can cause allergic reactions in the skin. BHA has been classified as a possible human carcinogen by the International Agency for Research on Cancer. The European Commission on Endocrine Disruption has also mentioned BHA as a Category I priority substance, based on evidence that it interferes with hormone function. BHT may act as a tumor promoter in certain situations. Little evidence suggests that high doses of BHT may mimic estrogen, the primary female sex hormone, and prevent expression of male sex hormones, resulting in adverse reproductive affects.

6.2 Coal Tar Dyes:

Coal tar is made up of many chemicals obtained from petroleum. Colors derived from coal tar are used mostly in cosmetics, generally identified by a five-digit Color Index (CI) number. The p-phenylenediamine is a common coal tar dye used in many hair dyes. Phenylenediamine is found more in darker hair dyes than lighter colours. Adverse reactions caused by p-phenylenediamine are stinging sensations, with an erythematous rash, swelling, blisters, and surface oozing. Various reports have been found in the literature of immediate allergic (and also anaphylactic) reactions on using henna dyes. Most cases have sneezing, runny nose, cough, and shortness of breath instead of skin reactions.

Coal tar may also be associated with cancer and the main concern with individual coal tar colors (whether produced from coal tar or synthetically) is the possibility of them to cause cancer. These colors may be found contaminated with low levels of heavy metals and some are combined with Aluminum substrate. Aluminum

compounds and many heavy metals may cause adverse effects to the brain. Some of these colors used to produce these dyes are not approved as food additives, yet they are used in cosmetics that may be ingested, like lipstick. P-phenylenediamine has been found to be carcinogenic. ^[12]

6.3 Di butyl Phthalate (DBP):

DBP is mainly used in cosmetics for nails as a solvent for dyes and as a plasticizer that prevents nail polishes from becoming hard and brittle. It has been shown to cause developmental defects, changes in the prostate and testes and reduces sperm counts. It has also been found that it acts as a suspected endocrine disruptor on the fact that it interferes with hormone function, and may cause harm to the unborn child and worsen infertility. Various researches reveal that exposure to phthalates may cause serious health effects such as liver and kidney failure in young children when products containing phthalates are ingested for extended periods. It has been found that phthalates reduce sperm count in men and reproductive defects in the developing male foetus (when the mother is exposed during pregnancy), among other health effects.

6.4 Parabens:

For protecting cosmetics from microbial contamination, preservatives are used. The most commonly used preservative in cosmetics are parabens. Around 75 to 90 per cent of cosmetics contain parabens (typically at very low levels). Parabens easily permeate the skin and are suspected of interfering with hormone function (endocrine disruption). They mimic oestrogens, the primary female sex hormone. They may also interfere with male reproductive functions. Various studies indicate that methylparaben applied on the skin reacts with other chemicals, leading to increased skin aging and DNA damage. Certain foods, such as barley, strawberries, carrots, onions, currents, and vanilla, also contain Parabens. Parabens in foods are metabolized when eaten, making them less strongly estrogenic. On the other side when applied to the skin and absorbed into the body, parabens in cosmetics bypass the metabolic process and enter the blood stream and body organs intact. It has been determined that women are exposed to 50 mg per day of parabens from cosmetics. They are associated with cancer and neurotoxicity among other adverse health effects.

6.5 Perfume (Fragrance):

Perfume is found usually in liquid form and used to give a pleasant scent to an individual's body. Perfumes are also used in cosmetics. Around 3,000 chemicals are used as fragrances. Fragrance is a main ingredient in perfumes, deodorants and colognes. Almost all the cosmetic products contain perfumes. Even if these products are marketed as "fragrance-free" or "unscented" may contain fragrance ingredients in the form of masking agents that prevent the brain from perceiving their odor. ^[13]

Effects to the body.

- Headache
- Dizziness
- Allergic rashes.
- Skin discoloration.
- Violet coughing and vomiting.
- Skin irritation.
- It affects the central nervous system, causing depression, hyperactivity and irritability.
- Chest tightness and wheezing
- Infant diarrhea and vomiting
- Mucosal irritation
- Reduced pulmonary function
- Asthma and asthmatic exacerbation
- Rhinitis and airway irritation
- Sense organ irritation o Contact dermatitis ^[8]

VII. RECENT CONTROVERSIES: CARCINOGENIC COSMETICS AND PERSONAL CARE PRODUCTS

There have been numerous controversies surrounding cosmetics and their chemical constituents with carcinogenesis. Examples include associations of parabens and aluminum with breast cancer talc powder with ovarian cancer and, most recently, hair dye with breast cancer. These articles have often been covered extensively by the media and have stoked consumer concerns. Several of these initial epidemiological associations have not been reproduced in larger cohort studies, as in the case of talc powder and ovarian cancer or follow-up toxicology analyses by other scientists or regulatory agencies. Given the ubiquitous use of cosmetics, oncologists often face questions from patients concerning the possible etiology of these products in relation to a cancer diagnosis. As one indication, the American Cancer Society publishes numerous “frequently asked questions” surrounding cosmetics and carcinogenesis for the public, suggesting the inherent need for such clarification to the lay public. [15]

7.1 Where do we find those known human carcinogenic chemicals?

The International Agency for Research on Cancer (IARC) is an intergovernmental agency, and part of the World Health Organization. IARC’s mission is to enhance collaboration in cancer research internationally.

IARC consolidates scientific evidence and classifies the chemicals it reviews into five levels:

- Group 1: Carcinogenic to humans
- Group 2A: Probably carcinogenic to humans
- Group 2B: Possibly carcinogenic to humans
- Group 3: Not classifiable as to their carcinogenicity to humans □ Group 4: Probably not carcinogenic to humans.

Of the 113 agents listed by IARC as known human carcinogens (Groups 1), at least 11 have been or are currently used in personal care products: formaldehyde, phenacetin, coal tar, benzene, untreated or mildly treated mineral oils, methylene glycol, ethylene oxide, chromium, cadmium and its compounds, arsenic, and crystalline silica or quartz. [15]

7.2 Policy Implications for Cosmetics Safety and Cancer Risk

The CAERS database has the potential to become a useful cancer epidemiological tool. As it stands, there are significant limitations. The primary need is for broader participation from all stakeholders including physicians and manufacturers. Currently, manufacturers are not required by law to forward adverse events related to cosmetics. As an example, a manufacturer of a hair product had received more than 21 000 adverse event reports directly from consumers that were not forwarded to the FDA. At the time, the FDA had only received 127 reports.

As previously mentioned, the data included within the CAERS database contain considerable gaps, particularly in regard to patient demographics and cancer specifics. There are several potential improvements. First, there is a need for more specific cancer subtyping whenever possible. Second, report data would be of greater benefit if reporters were compelled to provide 1)

family history, 2) comorbid conditions, and 3) relevant personal behavioral characteristics (eg, smoking history, drug use, alcohol use, tanning bed use). Finally, to potentially control for reporter bias, consumers can be asked to note whether their reports were triggered by a media report.

The above improvements would enable CAERS to be a better surveillance tool. Emerging concerns could be identified earlier, which could facilitate follow-up scientific studies, site visits, and cross-referencing with carcinogens listed by other agencies such as the Environmental Protection Agency, National Toxicology Program, and the International Agency for Research on Cancer (68). If a potential risk is identified through CAERS, the FDA and other regulatory bodies could better focus scarce resources on further investigation. Consideration should then be given by manufacturers to add warning labels, change formulations, or alter the recommended frequency of use of cosmetic products when there is demonstration of potential risk. Such warning labels have been suggested for talc powder (69). However, the FDA’s current position is that there is insufficient evidence to warrant this.

Ultimately, CAERS and other databases alone will not be enough to ensure consumer safety. Rather, they should

be viewed as an initial step in part of a larger need for greater FDA authority over the cosmetics industry (19). This includes required mandatory manufacturer registration with the FDA and the need for greater funding for regulatory activities. In 2017, the Office of Cosmetics and Colors, the division of the FDA charged with enforcing labeling of cosmetic products, operated with an annual budget of only \$13 million to regulate the \$62 billion US cosmetics industry.^[15]

7.3 How to Avoid?

Read labels and avoid cosmetics and personal care products containing formaldehyde and formaldehyde-releasing preservatives (quaternium-15, diazolidinyl urea, imidazolidinyl urea, DMDM hydantoin, and 2-bromo-2-nitropropane-1,3 diol), phenacetin, coal tar, benzene, untreated or mildly treated mineral oils, ethylene oxide, chromium, cadmium and its compounds, arsenic and crystalline silica (or quartz).^[16]

VIII. HEALTH RISKS ASSOCIATED WITH HEAVY METALS IN COSMETICS

Heavy metals have been involved in cosmetics commonly used among women. Harmful effects of heavy metals in various cosmetics products like facial make-up have been reviewed in literatures. Heavy metals which can get accumulated in the body over a period of time are known to cause various health problems. Some of the health risks associated with heavy metals in cosmetics are cancer, reproductive and developmental disorders, neurological problems, cardiovascular, skeletal, blood, immune system, kidney and renal problems, headaches, vomiting, nausea and diarrhea, lung damage. They may also cause contact dermatitis; and brittle hair and hair loss. Some heavy metals are hormone disruptors while others are respiratory toxins. They can enter the body through ingestion or absorbed through the broken skin. ^[14]

8.1 Cadmium:

Cadmium is found naturally in the environment. Cadmium present in body and hair creams are absorbed into the body through dermal contact stored in the kidney and the liver, although it can be found in almost all adult tissues. According to IARC, it is considered to be “carcinogenic to humans and its compounds, categorized as known human carcinogens by the United States Department of Health and Human Services. If ingested in high levels, it may lead to severe stomach irritation, vomiting and diarrhea, while exposure to lower levels for a long time can lead to kidney damage, deformity of bones, and weakens the bones so that they break easily. ^[14]

8.2 Lead:

Lead can be found as impurity in Lipsticks via the use of contaminated raw materials or through the use of pigments that may contain lead. Skin contact with Lead occurs daily, and some amount has been found to be absorbed through the skin. The use of leaded eye powders (e.g., Surma, Kohl) has been associated with increased blood-lead levels in children and women. Pregnant women and young children are at higher risk because it can cross the placenta with ease and enter the brain of the fetus. It can also be transferred to infants through milk of lactating mothers and stored in bones. Lead exposure has been found to cause miscarriage, hormonal changes, reduced fertility in men and women, menstrual irregularities, delays in puberty onset in girls. Lead and inorganic Lead compounds have been classified as a suspected carcinogenic to humans. ^[14]

8.3 Nickel:

Nickel is found in abundance in nature, everyone is exposed to small amounts, mostly through food, air, portable water, soil, household dust, and skin contact with products containing it, including cosmetics. High levels of exposure can lead to serious health effects depending on route and the kind of nickel exposed to. While certain types of Nickel are considered to be “toxic” because of their carcinogenic effect, metallic Nickel and alloys have been classified as possibly carcinogenic to humans. Nickel can also be found allergic is also and it can cause severe contact dermatitis. The first case of Nickel allergy caused by eye shadow has been reported; even as 1 ppm of it may trigger a pre-existing allergy. ^[14]

8.4 Mercury:

Mercury is a common ingredient present in skin-lightening soaps and creams. It is also found in various other cosmetics, such as eye make-up, cleansing products and mascara. Skin-lightening soaps and creams are widely used in certain African and Asian countries. ^[14]

The effects of Mercury in the body.

- Nervous system – developmental delays, impaired vision and hearing, motor function, brain function, IQ.
- Cardiovascular system – High blood pressure, altered heart rate, increase heart attack risk.
- Effects on the immune and reproductive systems, liver and kidneys It causes the skin dryness and spots, pimples.
- It affects the brain of unborn child.
- It affects the reproductive organs which lead to infertility. [8]

IX. CONCLUSION

The cosmetic products may present health risks and recurrent adverse effects are attributed to the toxic substances commonly found in their formulations. Although the various structures for the regulation and quality control of cosmetics around the world are quite complex and comprehensive, they should be more rigorous in the inclusion of new substances with toxic potential in the formulation of cosmetics to avoid damages to human health.

With the ongoing media attention surrounding cosmetics and carcinogenesis, oncologists will continue to face questions from concerned patients. Nonspecific cancer subtyping, lack of comorbid medical condition information, and the risk of reporter bias all limit the current FDA database for cosmetics. Better and broader data collection is necessary if the CAERS database is to become a useful cancer epidemiological tool that can highlight emerging concerns and direct scarce regulatory resources to promote public safety and allay consumer fears. Concomitant investments in toxicology, biomarker discovery, and regulatory science are needed.

To encourage improvements in the manufacture, marketing and use of cosmetic products by the population, it is necessary to apply a unified cosme-to-vigilance around the world. This public health strategy is a genuine means of obtaining information on the safety of cosmetic products and their ingredients, preventing the risks associated with the use of cosmetics become a serious public health problem.

X. REFERENCES

- [1] Malik Vijay. The Drug and Cosmetics Act, 1940, 18th Edition, New Delhi: Eastern Book Company. pp 5-6.
- [2] Draelos ZD. Cosmetics: The Medicine of Beauty. Journal of Cosmetic Dermatology. 2015;14 (2):91
- [3] Rao SA. Krishnaswami Mahadick ed.- Sri Sarabhendra Vaidya Ratnavali. (Saraswati Mahal Library, Tanjore; 1952. pp. 277-381.
- [4] A. Claeysens. The History of Cosmetics and Make up, 2009. [Online]. Available: <http://ezinearticles.com/?The-History-of-Cosmetics-&-makeup&id=1857725>. Accessed: February 28, 2018.
- [5] M. Price. Cosmetics, Styles & Beauty Concepts in Iran, 2001. [Online]. Available: http://www.iranchamber.com/culture/articles/cosmetics_beauty.php. Accessed:
- [6] Donsing P, Viyoch J. Thai Breadfruit's Heartwood Extract: A New Approach to Skin Whitening. Srinakharinwirot Science Journal. 2008; 24 (1): 9-23.
- [7] Gabriel J. Hydroquinone: Cancer-Causing Skin Bleach, 2008. [Online]. Available: <http://thegreenbeautyguide.com>. Accessed: February 20, 2018.
- [8] Cosmetics Ingredient Review (CIR) (2004). CIR Information available at <http://www.cirsafety.org>, accessed May 6, 2004.
- [9] Nigam PK, Saxena AK. Allergic contact dermatitis from henna. Contact Dermatitis, 1988;18(1):55-56.
- [10] Draelos ZD. Shampoos, conditioners, and camouflage techniques. Dermatologic Clinics. 2013; 31(1):173- 178.
- [11] Department of Trade and Industry, UK (DTI) (1998). A survey of cosmetic and certain other skin-contact products for n-nitrosamines.

- [12] Health Canada, Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures, Survey Cycle 1 (2007– 2009), Ottawa, 2010. [Online].Available:
- [13] <https://www.canada.ca/en/health-canada/services/environmental-workplacehealth/reports-publications/env ironmental-contaminants/report-humanbiomonitoringenvironmental-chemicals-canada-health-canada-2010. html>. Accessed:February 20, 2018.
- [14] Darbre PD, Aljarrah A, Miller WR, Coldham NG, Sauer MJ, Pope GS. Concentrations of Parabens in human breast tumours. *Journal of Applied Toxicology*. 2004; 24(1): 5–13.
- [15] Smith CN, Alexander BR. The relative cytotoxicity of personal care preservative systems in Balb/C 3T3 clone A31 embryonic mouse cells and the effect of selected preservative systems upon the toxicity of a standard rinse-off formulation. *Toxicology in Vitro*. 2005; 19(7):963–969.
- [16] Chauhan, SB, Chandak,A, Agrawal SS. Evaluation of Heavy Metals contamination in Marketed Lipsticks. *International Journal of Advance Research*. 2014; 2(4): 257-262.
- [17] American Cancer Society. “Cosmetics.” 2014.
<https://www.cancer.org/cancer/cancercauses/cosmetics.html>. Accessed November 21, 2017.
- [18] International Agency for Research on Cancer. Agents classified by the IARC monographs,volumes 1902. Available online. <http://monographs.igrc.fr/ENG/Classification/>. Accessed April 26, 2022.
- [19] Borowska S, Brzóska MM. Metals in cosmetics: Implications for human health. *Journal of Applied Toxicology*. 2015; 35(6): 551-572.
- [20] Chemicals Known to the State to Cause Cancer or Reproductive Toxicity. Viewed at:
<http://oehhaca.gov/prop65.prop65list/files/P65sin gle01032014.pdf>
- [21] IAR (2012). Benzophenone. Viewed at:
<http://monographs.iarc.fr/ENG/Monographs/vol101/mono101-007.pdf>
- [22] 20. European Food Safety Authority. EFSA Pannelon food contact materials, enzymes, flavouring and processing aids (CEF). The EFSA Journal. Retrieved from [www.efsa.europa. Eu/ en/efsajournalpub/1104 htm](http://www.efsa.europa.eu/en/efsajournalpub/1104 htm) (cited on October 19, 2021)
- [23] Fediuk DJ. Tissue disposition of the insect repellent DEET and the sunscreen oxybenzone following intravenous and topical administration in rats. *Biopharm Drug Dispos*. 2011; 32(7):369-79.
- [24] Labrador V, Fernández Freire P, Pérez Martín JM, Hazen MJ. Cytotoxicity of butylated hydroxyanisole in Vero cells. *Cell Biol Toxicol*. 2007;23(3):189-99.
- [25] IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Carbon Black evaluation and rationale. 2010;93:190-1.
- [26] Kim H, Oh SJ, Kwak HC, et al. The impact of intratracheally instilled carbon black on the cardiovascular system of rats: evaluation of blood homocysteine and hyperactivity of platelets. *J Toxicol Environ Health A*. 2012;75(24):1471-83.
- [27] Coal Tar and Coal-Tar Pitch. National Cancer Institute. December 28, 2018. Retrieved from:
<https://www.cancer.gov/about-cancer/causes->