

Cadmium Concentration in Different Brands of Cosmetic and their Effect on the Skin of Female Dermatitis Cosmetic Users

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Summary: Cosmetics have been a part of routine body care not only for the upper classes, but also for the middle and lower classes, since the dawn of civilization. Lightening ingredients, which were previously only used under dermatological supervision, are increasingly being introduced into cosmetic formulations as the public's interest in skin whitening grows. Contamination of cosmetics with heavy metals is a significant concern. Cosmetics containing heavy metals pose a major risk to human health. Heavy metal toxicity in humans has been linked to long-term or high-level exposure to toxins found in the atmosphere, such as air, water, food, and a variety of consumer goods such as cosmetics and toiletries. In the present study, the association between cadmium exposure via cosmetic products (Lipstick (N= 15), Face powder (N= 13), Eye Liner (N= 11) and Eye shadow (N= 15)) and dermatitis cosmetic female patients (N= 252), residing in Hyderabad city, Sindh, Pakistan, was investigated. The matrices of biological (scalp hair, blood, serum and nails) of referents and dermatitis cosmetic female patients (Seborrhoeic dermatitis, Rosacea, Allergic contact dermatitis and Irritant contact dermatitis) and cosmetic samples were oxidized with the help of HNO₃ (65%) and H₂O₂ (30%) mixture at the ratio of 2:1 with the aid of microwave oven. The oxidized biological and cosmetic samples were subjected to electrothermal atomic emission spectrophotometer after microwave-assisted acid digestion. The LOD and LOQ for Cd determination in digests samples were found to be 0.81 and 0.28 µg/L, respectively. The validity and accuracy of the methodology were checked using certified reference materials. The cosmetic products (Lipstick, Face powder, Eye Liner and Eye shadow) of different brands contain Cd, concentrations in the ranges of 1.63– 2.30 µg/g, 0.40 – 0.76 µg/g, 1.05 – 3.60 µg/g and 1.05 – 4.53 µg/g respectively. The outcome of this research significantly showed the higher level of Cadmium in biological specimen (blood and scalp hair) of different types of female dermatitis patients as compared to referent subjects (P<0.001). To ensure human safety and protection, continuous monitoring of cosmetic products, especially with regard to heavy metals adulteration, should be implemented.

Keywords: Cosmetic products, Female dermatitis patients, Electrothermal Atomic absorption spectroscopy, Cadmium, Blood, Blood serum, Scalp hair, Nail.

Introduction

Cosmetic products such as creams, beauty soaps, talcum and face powder, lotions, shampoos, hair oils, hair dyes, hair colours, perfumes, lipsticks, shaving creams, body lotions, nail vanish and polish, and so on have seen a rise in demand in recent years, resulting in huge development by the cosmetic industry [1, 2]. Cosmetics are all materials that are used to clean and care for human skin [3]. The aim of using cosmetics is to keep the body in good shape, protect it from the effects of the environment, and alter the appearance, ageing process, and body odour [3]. Any substances or cosmetic preparations proposed to come into contact with the exterior surface of a person or the mucous membrane of the oral cavity and applied to teeth with the sight solely for the purpose of protection, altering their appearance, washing, body odour, and keeping the surface in good condition [4].

A variety of cosmetics consists of lip gloss and lipstick (used for color the lips); rough and powder (used for removing the flaws and lighten the skin to make an impression of health and youth), eye liner and eye shadow used for color the eye lids; mascara (using for to enhance the eye lashes) and nail polish (used for color the fingernails and toenails) [2]. In site of better awareness of potential for toxic elements (Lead, nickel, cadmium, cobalt chromium) to cause skin sensitivity, generally the influence of sensitization to them increases, especially for cadmium [2]. Since more people are aware of the potential for toxic elements (lead, nickel, cadmium, cobalt chromium) to cause skin sensitivity, sensitization to them is becoming more common, particularly for cadmium [3].

Every season, a slew of new cosmetics are introduced to the market. Any of these items may contain carcinogenic pollutants. It is difficult to keep

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any product on the path of protection [6]. Because of the interdependence of these variables (product concentration, applied quantity of product, presence of penetration enhancers and duration of the time remain on the skin and emollients), it can be difficult to estimating the dermal absorption of a single ingredient in a cosmetic product [5].

The acceptable limits for heavy metals differ depending on the subpopulation in question (for example, children are more susceptible to heavy metal toxicity than adults). Dermal absorption of a single ingredient in a cosmetic product is complicated and depends on a variety of factors, including the concentration in the product, the amount of product applied, the amount of time the product is left on the skin, and the presence of emollients and penetration enhancers in the cosmetic product [6]. Because of this difficulty and the lack of well-conducted dermal absorption studies that take these factors into account, assessing heavy metal limits in cosmetics solely based on human health risk is difficult [6].

Since the question of heavy metals as intentional cosmetic additives has been discussed, the emphasis has moved to their existence as impurities. Lead, arsenic, cadmium, mercury, and antimony are the metals of primary toxicological concern in cosmetics [7]. Since the majority of cosmetics are applied to the skin, dermal exposure is expected to be the most effective route for cosmetic products. Heavy metal absorption through the skin is relatively low, with individual element absorption affected by a variety of factors, including the physical-chemical properties of the mixtures. Cosmetics used in and around the mouth, as well as hand-to-mouth contact after exposure to cosmetics containing heavy metal impurities, can cause oral exposure. Inhalation exposure, on the other hand, is usually thought to be insignificant [7].

Cosmetics' ingredients and production methods have previously received little publicity, but they have now become a source of concern due to the health risks associated with their heavy metal content [8]. Heavy metals are often used in cosmetics, where they are used as preservatives or pigments [8]. They are also used as essential ingredients in cosmetics for cosmetic purposes. Copper, Aluminum, Gold, and Silver, for example, are used as pigments, while Arsenic, Cadmium, Chromium, Iron, Nickel, Manganese, Zinc, and Lead are added for a brilliant metallic finish [9, 10].

Heavy metals can also be contained in the raw materials (water, dirt, and rocks) and can be

released during the manufacturing process as the ingredients break down [11]. Natural pigments derived from plants have been shown to be a possible source of heavy metals in cosmetic products when grown in polluted environments [12]. As cadmium is a heavy metal through environmental and industrial exposure it affects human health [13]. In some of natural colors and in organic pigments, cadmium is usually found because of it is golden to orange color and present in cosmetics product of cosmetic such as sunscreen, lipstick, face powder and foundation creams [14].

Mineral pigments are widely used in the production of coloured cosmetics, resulting in the contamination of cosmetics with heavy metals (HMs) such as Copper, Nickel, Cobalt, Lead, Chromium, Cadmium, and other components. These HMs are purposely applied to cosmetic products as pigments, preservatives, UV filters, antiperspirant, antifungal, and antibacterial agents [15]. Human exposure to UV radiation has been shown to have both chronic and acute health effects on the skin, eyes, and immune system. As a result, UV filters are used as essential ingredients in sunscreens and other everyday cosmetic items. UV filters are made for cosmetic items that are meant to be applied to the surface of the skin, but they are derivatives of the sun. Though UV filters are designed for cosmetic products that are applied to the skin's surface, their derivatives may attach to plasma proteins and circulate in the bloodstream, where they are metabolised in the liver through phase I and II biotransformation reactions. They may either be excreted by urine or bio-accumulated within the organism after that [15]. Because of their antibacterial and antifungal qualities, certain metals, as well as parabens, are used as preservatives in cosmetics [15].

Recent research has found that metals and parabens used as preservatives are also endocrine disruptors that can be quickly absorbed through the skin, causing negative health effects [16]. Metallic compounds are often used in cosmetics because they have the ability to peel and whiten the skin [17]. However, the use of metal parts is governed by a country's regulatory rules [17]. Heavy metals are often accidentally applied to cosmetics as impurities at different stages of processing. Contamination occurs due to the type of raw material used in the manufacturing process, especially the addition of additives and colour minerals. In addition, the water used to produce them can contain metallic impurities [16, 17].

The use of cosmetics is widespread among Pakistan's female population, both young and old. Despite the fact that the majority of people agree that using cosmetics products has negative health consequences, these chemicals are still widely used for cosmetic purposes, owing to their high cost and convenient accessibility. It is self-evident that the fixed costs and effects of cosmetic product usage place a significant socioeconomic burden on the state. Furthermore, the use of various instrumentation in the cosmetics industry during the sorting, manufacturing, and packaging processes can result in HM contamination [18].

The current study's goals and objectives were to determine the levels of cadmium in biological (nail, blood, serum, and scalp hair) samples from female dermatitis (Rocacsea, Allergic contact dermatitis, Irritant contact dermatitis, and saborrhoeic dermatitis) patients who had used various brands of cosmetics products, such as face Powder, lipstick, eye Liner, and eye Shadow, age ranged (16- 50) years. Referent subjects (using cosmetics products) from the same categories of social life (age, socioeconomic status, dietary habits, and geographic location) were chosen as controls for the study. Electro thermal atomic absorption spectrometry was used to analyze cadmium in cosmetics and biological samples. Currently, we are observing and evaluating the Cd quality in a variety of cosmetics brands (Face Powder, Lipstick, Eye Liner, and Eye Shadow) that are consumed and available in Pakistan.

Experimental

Materials and Methods

Recruitment

Before starting the experimental work, the research study was approved through ethical review committee of Sindh University, Pakistan.

Chemical Reagents and glassware

Water used during process was ultra-pure transfused through Millipore (Milli-Q USA). E. Merck – Germany, analytical grade chemicals including hydrogen per oxide and nitric acid were used. All the samples were tested for metal contaminations before use. Standard solutions of 1000 ppm Cd were prepared from certified standards (Fluka kamika, Switzerland). Serial dilution of working standard (stock) solutions was made by 0.2 mol /L HNO₃ solutions. The prepared solutions were refrigerated at 4°C for further analysis in polyethylene bottles. To reach sensitive and selective method, certified reference materials (CRMs) of human

hair BCR 397 and (Brussels, Belgium), (Germany Munich, Recipe) blood and human serum Clinchek® were bought. Plastic materials and apparatus were dipped in 2 mol L⁻¹ HNO₃ for twenty-four hours followed by washing and rinsing with Milli-Q water.

Instrumentation

Double beam Perkins-Elmer Atomic Absorption Spectrometer Model 700 (Norwalk, CT was used for the determination of Cd, which was set with HGA graphite furnace, pyrocoated graphite tubes were also combined, an auto sampler AS-800 and deuterium lamp is used for the correction of background system. Hollow cathode lamp (Perkin Elmer) as radiation source was used at its recommended current operating condition. The instrumental condition is shown in Table-1. The signals measured were the heights of the absorbance peaks for the flame absorption mode, and integrated absorbance values (peak area) were used for the graphite furnace. All the modifier and standards or measured sample portion were moved into auto sampler cups, where in each case, 10 µl of the volume for sample or standard combined with 10 µl of the modifier volume were injected into electro thermal graphite atomizer (cup). A (220/60 Hz, Gallenkamp, England) horizontal flask electrical shaker was used for shaking of the samples. The time required for sample digestion & microwave power from the range 100 to 900 W was fulfilled by using (Osaka, Japan) PEL domestic microwave oven programmable for and time required samples for digestion.

Table-1: Measurement conditions of cadmium in electro atomic absorption spectrometer A.Analyst 700.

Parameters	Cadmium
Lamp current (mA)	6.0
Wave length (nm)	228.8
Slit width (nm)	0.7
Drying Temp (°C)/ramp hold (s)	140/15/5
Ashing Temp (°C)/ramp hold (s)	850/10/20
Atomization Temp (°C)/ramp hold (s)	1659/0/5.
Cleaning Temp (°C)/ramp hold (s)	2600/1/3
Chemical Modifier	5µg Pd as Pd(NO ₃)

Sample volume (10µl), Cuvette = Cup, Carrier gas = (200ml/min), Background correction (D2 Lamp)

Sampling of cosmetic products

Over a one-year period from January 2017 to December 2017, all samples were purchased from the commercial / local markets of Latifabad, Hyderabad, Pakistan, based on the availability of total 14 brands of eye shadow, 12 brands of face powder, 14 brands of lipstick, and 10 brands of eye liner. After placing samples separately in prewashed and dried plastic bags with the original packaging, they were stored at 4 °C until tested. After removing the wrappers, 5 composite samples were made by homogenising the mixture of

brands of eye shadow, face powder, lipstick, and eye liner. The preparation of these samples was done in a net and clean environment, with great care taken to avoid contamination. All samples were dried at 80 degrees Celsius. The dried samples were ground in an agate mortar and pestle, and sieving was done with nylon mesh sizes of 125 m, before sample bottles were labelled and stored.

Sample collection

The biological samples of different types of dermatitis patients (N- 252) were collected from Institute of Dermatology Liaquat University of Medical and Health Sciences (LUMHS) Hyderabad Pakistan during January 2017 to December 2017 (Table-2). Before the sample data and sample collections, all procedure of the study has been permitted by human ethical committee of hospitals and ethical committee of NCEAC, University of Sindh – Jamshoro. All patients and referents were interviewed individually by authors. The consents and questionnaire were also administered to them and physically granted to participate after signed on per consent. However, a detailed performa was filled by patients by signing them, i. e ethic origin, dietary habit, family history etc. This questionnaire have necessary details regarding physical data, ethnic origin, health, dietary habits, age, and consent, the type of dermatitis. The female dermatitis patients were grouped according to their sub classes. The exclusion criteria were the duration of smoking and drinking the alcohol, and any physiological disorder (hypertension, diabetic mellitus and etc. The dermatographical data is given in Table-3.

Table-2: Complete Demographic description of female referent and different types of dermatitis patients.

Age groups (years)	Healthy	Dermatitis patients			
		Rosacea	Allergic Contact Dermatitis	Irritant Contact Dermatitis	Seborrhoeic Dermatitis
16-35	56	36	31	35	29
36-50	46	32	29	33	27
Sub Total		68	60	68	56
	102	252			

However, the biological samples of 102 referents female were taken as referents. The inclusion criteria of referent subjects were that they were not suffering from any disease and they not taking any mineral from last six months, belonged to same age, living style and socioeconomic status. The exclusion criteria of referent subjects were same to female dermatitis patients criteria. Before going for biological sample collection, referents went through medical investigations.

Sampling of Biological samples

The blood was sampled (10 mL) from patients and referent by a registered nurse, with the help of venipunctures into metal-free safety vacutainer blood-collecting tubes (Becton, Dickinson and Company, Rutherford, NJ, USA) containing K₂EDTA (>1.5 mg l⁻¹). All the precautions were taken in accordance with the Clinical and Laboratory Standards Institute criteria [30] to eliminate metal contamination while collecting and storing the samples at -20° C. till further analysis. About 5 mL of blood samples was sent to the pathological laboratories of hospital for biochemical tests using standard methods.

The hair samples (0.5g about 0.5 – 2.0 cm long) were collected from the back of the head with the aid of stainless-steel scissors from female referents and dermatitis participant. The scissors were thoroughly washed and cleaned with alcohol swab before and after cutting hair of each participant. The all scalp hair samples were stored in sterile plastic bags separately and marked with confidential identifier number of each participant.

The female referents and dermatitis were required to collect nail samples. The referents and dermatitis washed their hands and toes thoroughly with medicated soap, rinsed with double deionized water to prevent contamination of metals, and dried with a clean towel or tissue to remove external contamination. Fingernails were cut with stainless steel scissors.

Microwave-assisted Acid Digestion Method

Duplicates of each sample were prepared for elemental analysis with the help of microwave oven-based digestion method. Six replicate samples of certificated reference materials (human hair and blood), and duplicate of each referent and different types of dermatitis patients were Taken directly in flasks (50 mL in capacity). Digestion was done by mixing 200 mg of hair, 100 mg of nail samples and 0.2 mL of blood and serum samples with 1 mL of freshly prepared H₂O₂ – HNO₃ mixture (1:2, v/v) in PTFE flasks. Then placed the flasks in microwave oven followed by 3 min at the power of 900 W, until complete samples digestion was achieved. The flask containing digested samples were allowed to reach room temperature and diluted with Mili-Q water to obtain final volume of 10 mL. These samples were analyzed for Cd using by ETAAS. Same procedure was followed for the preparation of blank samples.

Table-3: Biochemical parameters of female referents, and different types of skin diseased patients.

Parameters	Norma l range	Healthy Subjects	Dermatitis patients			
			Rosacea	Allergic contact dermatitis	Irritant contact dermatitis	Seborrhoeic dermatitis
16-35 years						
Weight (kg)		57.9±2.95	57.5±3.17	57.5±2.65	57.7±1.85	57.6±0.96
Height (cm)		158.6±1.62	159.3±1.50	159.0±1.71	158.8±2.54	158.3±1.55
BMI (kg/m ²)		23.0± 1.08	22.7± 2.07	22.7± 1.59	22.8± 1.92	22.9± 1.47
Hemoglobin (mg/dL)	10.5–13.2	11.7±0.49	11.5±0.60	11.9±0.44	12.0±0.35	11.6±0.30
Haematocrit (%)	35–55	45.5±1.59	46.9±1.25	44.6±1.39	44.9±1.68	44.7±1.28
Red blood count RBC (mm ³)	3.5–5.5	4.05±0.27	3.82±0.35	3.75±0.29	3.97±0.24	3.82±0.27
WBC (mm ³)	3.5–10	7.95±0.45	7.80±0.48	7.69±0.39	7.85±0.41	7.76±0.52
Platelets (K/mm ³)	100 - 400	305 ± 9.85	293 ± 10.9	289 ± 14.5	309 ± 13.8	280 ± 9.95
Creatinine (mg/dl)	0.6–1.3	0.85±0.15	0.86±0.22	0.89±0.19	0.87±0.14	0.91±0.20
36-50 years						
Weight (kg)		65.7±2.03	67.8±2.83	65.9±1.50	66.3±2.52	67.4±1.92
Height (cm)		158.7±1.09	158.9±1.50	158.6±1.71	158.9±2.54	158.7±0.85
BMI (kg/m ²)		26.1± 1.61	26.8± 1.73	26.2± 2.05	26.2± 1.73	26.8± 1.15
Hemoglobin (mg/dL)	10.5–13.2	12.6±0.86	12.8±0.54	13.0±0.72	12.9±0.82	12.7±0.95
Haematocrit (%)	35–55	44.9±2.06	43.7±2.53	45.2±1.98	44.6±2.15	45.0±2.63
Red blood count RBC (mm ³)	3.5–5.5	4.59±0.37	4.19±0.48	4.26±0.35	4.33±0.46	4.42±0.40
WBC (mm ³)	3.5–10	318 ± 12.5	299 ± 13.6	293 ± 16.2	305 ± 10.5	267 ± 10.3
Platelets (K/mm ³)	100 - 400	7.59±0.62	7.72±0.45	7.65±0.49	7.62±0.37	7.69±0.59
Creatinine (mg/dl)	0.6–1.3	1.05±0.13	1.15±0.18	1.24±0.12	1.17±0.17	1.13±0.22

Table-4: Validation of method for Cd determination in certified reference materials (CRMs) samples.

Elements	Certified values	Microwave Digestion method (MWD)	T _{calculated} ^a	% Recovery ^b
Cadmium	1.2± 0. 4	CRM of whole blood (µg /l) 1.16±0.10 (8.62)	0.859	96.7
Cadmium	0.52±0.024 ^d	CRM of human hair (µg/ g) 0.517±0.023 (4.45)	0.837	99.4
Cadmium	1.53 ± 0.11	CRM of serum (µg /l) 1.52 ± 0.08 (5.26)	0.521	99.3

^aPaired t-test between Certified Value and MWD, Degree of freedom (DF) = n-1= 6-1= 5,

T (critical) at 95 % CI = 2.57, p < 0.50

Values in () are % RSD

^b % recovery was calculated according to : ((MWD)/((Certified Value)) x 100

Statistical analysis

The whole statistical data was used to perform with the help of different statistical softwares (Minitab and Excel X state). Each composite samples and data of their triplicate samples were represents as means ±standard deviations. The values of Cd and its significant difference were found experimentally by assessing the student's t-test. The significant difference was monitored in different biological specimen of referents & dermatitis patients, calculated by unpaired two-sample t-test. A major difference was considered as P<0.05.

Analytical figures of merit

Calibration was performed with a series of Cd standards. Sensitivity (m) was the slope value obtained by least-square regression analysis of

calibration curves based on absorbance signals. The equation (n=5) for the calibration curves was as follows

$$Y = 1.15 \times 10^{-3} (\text{Cd}) + 1.02 \times 10^{-4}, r = 0.999$$

where Y is the integrated absorbance, r is the regression and the concentration range of Cd for calibration curve reached from the detection limits up to 100 µg/L. The LOD = $3 \times s/m$ and LOQ = $10 \times s/m$ were given for the limits of detection and quantification respectively. Where for the ten measurements of a blank reagent s is standard deviation and m is considered for calibration graph the slope is being calculated for electro thermal atomic absorption spectrometer determination. For cadmium, LOQ & LOD values were calculated as 0.81 & 0.28 µg/g, respectively.

Table-5: Cadmium concentrations in different types of cosmetic samples.

Eye Shadow	Face powder Brands	Lipstick	Eye Linear
Morphei	L'Oreal pairs	Medora	M.A.C cake
Sweat Touch	New York	LOreal	Botanic cake
Maybelline eye shadow high pearls	Coour	Rivaj	Maybelline Gel
E.L.F eye shadow	D Ganish	Nars	E.L.Ff cream
Urban Decay	Glamours	Lakme	kryolan
L'Oreal eye shadow	Etude	Becute	Medora pencil
Cover Girl Eye shadow	ELF	Revlon	Body shop carbon eye definer
Lancome eye shadow	sweat touch twin cake face powder	MAC cosmetics	Rivaj pencil linear
Dior eye shadow	Clinique	Yeves sain lausehia	sweat touch pencil
Mac	Maybelline matifying powder	Dior	Christin cake
Etude	Rimmel London	Clinique	Glamours cake
Revlon	Diana of London	Maybelline	
Maybelline	CoverGirl face powder	Orifalme	
Oriflme	Makeup Revolution London	Etude	
Clinique		Guerlain	

The validity of our method was checked by human hair CRM 397 and Clincheck® control lyophilized human whole blood and serum (Table-4). The time required to complete digestion of samples was less than 10 minutes and it was less time consuming. The mean values for cadmium was differed from the certified values below than 1–2%. By comparing the values obtained by microwave digestion method with certified values, the difference was non-significant (paired t-test) ($p>0.05$).

Result and Discussion

Cadmium concentration in different cosmetics products

Each different cosmetic brands and their multiple samples analysis were performed. The results are shown in Table-5. The range of cadmium levels was found to be 1.37- 4.83 $\mu\text{g g}^{-1}$ in eye shadow. These results were similar to the findings of these reports (Volpe et al., 2012, Omolaoye et al., 2010, Faruruwa et al., 2014) [10, 19, 20], whilst these findings were lower than [21] Nourmoradi et al., 2013 finding, and higher than Jihad, 2011 [22] (Table-6). Whilst the cadmium levels in nail polish samples were found to be in the 0.57- 0.82 $\mu\text{g/ g}$. The cadmium levels in Lipstick brands and face powder were observed up to the range of 1.60- 2.56 $\mu\text{g/ g}$, and 0.37-0.78 $\mu\text{g/ g}$ correspondingly (Table-5).

The results of Cd concentration in lipstick brands were similar to the findings of Nnorom et al., 2005 finding [23], whilst these findings were lower than Nourmoradi et al., 2013 [21] and Rahil et al., 2019 [24] findings, and higher than Jihad, 2011 [22]. and Ullah et al.,2017 finding [25]. The results of Cd concentration in face powder brands were similar to the findings of Ullah et al.,2017 finding [25] (Table-6). While the range of Cadmium in the multiple products of Eye Liner was found to be 1.02-3.79 $\mu\text{g/g}$ (Table-5). Our findings are comparable with the results of Jihad, 2011 [22], Nnorom et al.,2005 [23], Rahil et al., 2016 [24], Ullah et al., 2017 [25] studies (Table-6).

Demographic characteristic of study population

The food habits, socioeconomic status and residential areas of female dermatitis patients and healthy referents were same. The healthy and different types of dermatitis patients informed that they used these different types of cosmetic products (Face powder, Lipstick, Eye Liner and Eye Shadow) for beautification since $\geq 12.4\pm 1.65$ years. The referents were family members of patients. With the collaboration of paramedical staff, Clinical characteristics were obtained from medical records together with basic medical data. The work-related history incorporated (jobs held in lifetime for more than one year), 68 % of the study subjects of

Dermatitis patients and referents were typically house wives, 22% working women in school and college as teachers whilst 10% were working in private sectors. Among the 252 female dermatitis patients, the 80% patients used Face powder, Lipstick, Eye Liner, whilst 20 % used Face powder, Lipstick, Eye Liner and Eye Shadow. For the exclusion criteria for both referents & dermatitis patients were smokers or consumer of alcoholic products.

Table-6: Reported literature of cadmium concentrations in different types of cosmetic samples in different countries.

Authors et., al	Cosmetic products	Concentration	Unit
Faruruwa et al., 2014 (10)	Eye Shadows	1.20±0.10	µg/g
Volpe et al., 2012 [19]	China eye shadow	1.53- 33.04	ng/g
	Italy eye shadow	1.60- 6.85	ng/g
	USA eye shadow	0.60- 5.15	ng/g
Omolaoye et al., 2010 [20]	Eye Shadows	1.7-6.8	µg/g
Nourmoradi et al., 2013 [21]	Lipstick	12.99- 37.96	µg/g
	Eye shadow	21.23-33.72	µg/g
Jihad, 2011 [22]	Eye shadow	0.25-0.31	mg/Kg
	lipsticks	0.49-0.51	mg/Kg
Nnorom et al., 2005 [23]	Lipstick	0.5-2.4 (0.9)	µg/g
	Lipstick	21.25±1.768	mg/Kg
Rahil et al., 2019 [24]	Lipsticks		
Ullah et al., 2017 (25)	Ponds detox (Tokyo-Japan)	0.21 ± 0.000	µg/g
	ADS Lipstick (China)	0.200 ± 0.001	µg/g
	Medora matte (Swat – Pakistan)	0.430 ± 0.005	µg/g

Cadmium level in biological samples of referents & different types of dermatitis patients

The levels of Cadmium in female dermatitis patients (Irritant contact dermatitis, Rosacea, Seborrhoeic dermatitis and Allergic contact dermatitis) versus in obtained values of biological specimen of healthy referents are mentioned in Table-7.

The contents of cadmium were significantly higher in biological (scalp hair, nail, blood, serum) samples of female dermatitis patients than healthy referents (P< 0.001).

The Cd range in the scalp hair samples of female referents of two age groups (16-35) & (36-50) were found to be at 95% confidence intervals (CI: 1.22-1.43 & CI: 1.43-1.60) ug g⁻¹ were extensively lower in dermatitis patients as compared to those who consumed different products of cosmetic (p<0.001) (Table-7). The levels of Cd in the serum samples of

different types of dermatitis patients (Rosacea, Allergic contact dermatitis, Irritant contact dermatitis and Seborrhoeic dermatitis) of two age groups (16-35) and (36- 50) were found to be higher in the range of 2.28- 3.46 and 2.83- 4.15µg l⁻¹, respectively as compared to healthy females (1.03- 1.50 and 1.18- 1.80µg l⁻¹) of two age groups (16-35) and (36- 50) , respectively (p<0.001). The Cd concentrations in nail samples of female referents of both age groups (16-35) and (36-50) were observed to be lower at 95% (CI: 2.32- 2.75) and (CI: 2.58- 2.95) µgg⁻¹ respectively than Cd concentration found in different types of dermatitis patients (Table-7).

The correlation (r) between toxic elemental (Cd) concentration in biological samples (scalp hair, blood, serum and nail) vs. biochemical parameters (Hb & RBC) of referents and different types of dermatitis patients was observed from resulted data that correlation (r) of Cd in biological samples concentration vs. biochemical parameter (Hb & RBC) of referents shows (r= 0.11-0.24), while in the different types of dermatitis patients, the correlation were found to be in the range of (r=0.41- 0.53) (Table-8). This indicated that the imbalances in toxic elemental concentration of essential elements are highly related with biochemical parameters (Hb and RBC) and the resulted data showed weak correlation with Cd in referents but in the case of dermatitis patients this correlation is strong.

The aim of this case controlled study was to determine the amount of cadmium exposure from different types of makeup cosmetics and their impact on biological specimens such as scalp hair, serum, blood, and nails of female dermatitis patients compared to a healthy female referent.

Health risk assessment

Human health risk models were generated in this study, which included carcinogenic and non-carcinogenic risks mentioned by the United States Environmental Protection Agency (USEPA). The USEPA's proposed threshold values of Cd were used to assess the potential health risks to consumers.

Estimated Chronic Daily Intake of Cadmium

Health risk assessment is observed through dermal contact by cosmetic particles. Three main routes

Dermal interaction with cosmetic particles is used to determine health risks. When target analytes are exposed to humans, three primary routes can occur. These are (i) ingestion by means of foods or water (direct), (ii) inhalation from air through the nose and mouth, and (iii) dermal absorption.

Table-7: Cadmium concentrations in the biological samples of female referents and different types of dermatitis patients.

Biological specimens	Age Groups	Referent	Dermatitis patients			
			Seborrhoeic dermatitis	Rosacea	Allergic contact dermatitis	Irritant contact dermatitis
Scalp hair	16-35	1.32±0.21	3.65±0.32	3.75±0.42	4.09±0.35	44.79±0.42
	36-50	1.52±0.17	4.90±0.51	4.59±0.51	5.15±0.29	5.37±0.30
Blood	16-35	3.29±0.33	4.82±0.49	5.03±0.39	4.92±0.30	4.97±0.25
	36-50	3.65±0.41	5.99±0.62	5.45±0.52	5.63±0.42	5.52±0.42
Serum	16-35	1.29±0.27	2.85±0.50	2.95±0.44	2.77±0.30	3.05±0.42
	36-50	1.46±0.30	3.50±0.27	3.62±0.50	3.75±0.40	3.62±0.49
Nails	16-35	2.52±0.41	4.82±0.39	4.62±0.60	4.75±0.62	5.29±0.37
	36-50	2.75±0.35	5.30±0.42	5.15±0.45	5.30±0.42	5.99±0.52

Table-8: Linear regression and Pearson’s coefficient for Cd versus different biochemical parameters Hb and RBCs in referents and different types of dermatitis patients

Biochemical parameters	Stages	Scalp Hair	Blood	Serum	Nail
Cd Vs.					
16-35					
Hb	Controls	y = 0.076x + 0.387	y = -0.066x + 4.11	y = -0.0636x + 1.99	y = 0.128x + 0.949
		r=0.20	r=0.11	r=0.14	r=0.14
RBC	Controls	y = -0.2125x + 2.13	y = -0.155x + 3.96	y = 0.156x + 0.62	y = -0.097x + 3.57
		r=0.24	r=0.11	r=0.15	r=0.11
Hb	Rosacea	y = 0.243x + 0.82	y = 0.333x + 1.10	y = 0.316x - 0.752	y = 0.305x + 1.34
		r=0.44	r=0.41	r=0.47	r=0.44
RBC	Rosacea	y = 0.358x + 2.25	y = 0.59x + 2.65	y = 0.472x + 1.06	y = 0.529x + 2.82
		r=0.43	r=0.48	r=0.46	r=0.50
Hb	Seborrhoeic dermatitis	y = 0.59x - 1.97	y = 0.41x + 0.18	y = 0.872x - 6.978	y = 0.467x - 0.038
		r=0.44	r=0.49	r=0.52	r=0.47
RBC	Seborrhoeic dermatitis	y = 0.65x + 2.44	y = 0.40x + 3.43	y = 0.817x + 0.059	y = 0.422x + 3.79
		r=0.49	r=0.48	r=0.50	r=0.43
Hb	Allergic contact dermatitis	y = 0.443x - 1.56	y = 0.58x - 1.97	y = 0.599x - 4.28	y = 1.04x - 7.79
		r=0.45	r=0.51	r=0.50	r=0.47
RBC	Allergic contact dermatitis	y = 0.89x + 0.37	y = 0.937x + 1.38	y = 0.952x - 0.72	y = 1.77x - 2.11
		r=0.51	r=0.47	r=0.45	r=0.46
Hb	Irritant contact dermatitis	y = 0.56x - 2.7	y = 0.483x - 0.91	y = 0.427x - 2.38	y = 0.743x - 4.217
		r=0.52	r=0.47	r=0.48	r=0.46
RBC	Irritant contact dermatitis	y = 0.67x + 1.42	y = 0.683x + 2.15	y = 0.55x + 0.55	y = 0.891x + 1.15
		r=0.49	r=0.52	r=0.49	r=0.44
36- 50 years					
Hb	Controls	y = 0.036x + 1.04	y = 0.046x + 3.1	y = -0.046x + 2.023	y = 0.0649x + 1.95
		r=0.21	r=0.12	r=0.18	r=0.14
RBC	Controls	y = 0.101x + 1.04	y = 0.142x + 3.0	y = 0.0966x + 1.005	y = -0.239x + 3.85
		r=0.21	r=0.13	r=0.13	r=0.18
Hb	Rosacea	y = 0.341x + 0.617	y = 0.34x + 1.8	y = 0.1825x + 1.23	y = 0.303x + 1.53
		r=0.44	r=0.48	r=0.48	r=0.51
RBC	Rosacea	y = 0.494x + 2.83	y = 0.547x + 3.78	y = 0.256x + 2.45	y = 0.417x + 3.59
		r=0.45	r=0.52	r=0.47	r=0.50
Hb	Seborrhoeic dermatitis	y = 0.129x + 3.63	y = 0.178x + 3.13	y = 0.221x + 0.76	y = 0.183x + 3.464
		r=0.51	r=0.51	r=0.46	r=0.49
RBC	Seborrhoeic dermatitis	y = 0.281x + 4.09	y = 0.366x + 3.84	y = 0.495x + 1.456	y = 0.382x + 4.17
		r=0.49	r=0.46	r=0.46	r=0.45
Hb	Allergic contact dermatitis	y = 8.83x + 108.97	y = 0.197x + 2.78	y = 0.252x + 0.373	y = 0.215x + 2.40
		r=0.39	r=0.47	r=0.47	r=0.47
RBC	Allergic contact dermatitis	y = -22.7x + 231.2	y = 0.48x + 3.24	y = 0.635x + 0.891	y = 0.570x + 2.72
		r=0.43	r=0.48	r=0.48	r=0.51
Hb	Irritant contact dermatitis	y = 0.201x + 2.57	y = 0.262x + 2.23	y = 0.251x + 0.437	y = 0.235x + 2.17
		r=0.51	r=0.53	r=0.51	r=0.50
RBC	Irritant contact dermatitis	y = 0.258x + 4.07	y = 0.343x + 4.16	y = 0.315x + 2.35	y = 0.322x + 3.84
		r=0.48	r=0.51	r=0.46	r=0.50

Abbreviations:- Hb= heamoglobin, RBC= red blood cells

For toxic elements in cosmetics environment, absorption through cosmetic products has the most critical function in skin care cream absorption.

Therefore, the expose dose, chronic daily intake (CDI) was calculated using the equation given as follows

Formula for calculating dermal absorption

$$CDI = \frac{CS \times SA \times AF \times ABS \times EF \times ED \times CF}{BW \times AT}$$

where, CS for Exposure-point concentration, EF for Exposure frequency, ED for Exposure duration, AT for Average time for non-carcinogens, BW for body weight, SA for Exposed skin area, AF for Adherence factor, ABS for Dermal absorption fraction, CF for Units conversion factor. The detailed explanation for all the parameters is listed in Table-9. The equation is adapted from the USEPA [26, 27].

Table-9: Parameters for exposure of cadmium in different types of cosmetics samples used in different part of human body

Exposure factor	Unit	Value	Unit	Value	Unit	Value	Unit	Value	Unit	Value	
		Eye Shadow		Eye linear		facepowder		lipstick		Nail Polish	
Exposure-point concentration (CS)	µg/g	Shown in table 4	µg/g	Shown in table 4	µg/g	Shown in table 4	µg/g	Shown in table 4	µg/g	Shown in table 4	
Exposure frequency (EF)	Days/year	350	Days/year	350	Days/year	350	Days/year	350	Days/year	350	
Exposure duration (ED)	Year	20 and 15 years	Year	20 and 15 years	Year	20 and 15 years	Year	20 and 15 years	Year	20 and 15 years	
Average time for non-carcinogens (AT)	Days	7300 and 5475 days	Days	7300 and 5475 days	Days	7300 and 5475 days	Days	7300 and 5475 days	Days	7300 and 5475 days	
Body weight (BW)	kg	Shown in table 2	kg	Shown in table 2	kg	Shown in table 2	kg	Shown in table 2	kg	Shown in table 2	
Exposed skin area (SA)	cm ²	0.0036	cm ²	0.0036	cm ²	471	cm ²	0.95	cm ²	32.66	
Adherence factor (AF)	mg cm ⁻²	0.07	mg cm ⁻²	0.07	mg cm ⁻²	0.07	mg cm ⁻²	0.07	mg cm ⁻²	0.07	
Dermal absorption fraction (ABS)		0.001		0.001		0.001		0.001		0.001	
Units conversion factor (CF)	kg mg ⁻¹	10 ⁻⁶	kg mg ⁻¹	10 ⁻⁶	kg mg ⁻¹	10 ⁻⁶	kg mg ⁻¹	10 ⁻⁶	kg mg ⁻¹	10 ⁻⁶	

Non-carcinogenic risk

The hazard quotient, HQ (non-carcinogenic risk), of the different metals in the cosmetic samples was calculated. HQ is the ratio of exposure to hazardous substances to the chronic reference dose (RfD) of the toxicant (mg/kg/ day) and expressed as:

Non-carcinogenic risk, $HQ = \text{CDI dermal} / \text{RfD dermal}$.

The dermal reference dose for Cd is 0.001 mg/kg/day for cadmium. If $HQ < 1$, the exposed population is unlikely to experience obvious adverse effects. If $HQ > 1$, there is a potential health risk [28], and related interventions and protective measurements are needed to be taken.

Concentrations of toxic metals in cosmetics

The amount of cadmium in various types of eye shadow, face powder brands, lipstick, and eye linear samples ingested by various types of female referents and female dermatitis patients was determined. The cadmium concentrations in biological samples of female referents, as well as in various types of dermatitis patients, varied according to the types of cosmetology.

The Cd element has golden to orange colour, present in some natural colors and inorganic pigments of make-up cosmetics, for example, face powders, lipsticks, sunscreen and foundation creams [29, 30].

Cadmium is a vital part of the colouring pigments used in cosmetics. Cadmium concentrations were below the 3.0 mg/kg permissible limit set by the Health Canada Draft Guidance on Heavy Metals in Cosmetics, 2011 [31]. The basic components of beauty cosmetic products commonly include the

compound of different elements, which are added in these cosmetic products to get better effect on the skin, these elements in excess amount may be present as impurities. Dermal exposure is the major route of heavy elemental toxicity, because many cosmetic products are directly applied to the Epidermis (top layer) of the skin. Conversely, oral exposure can happen from applying cosmetic products, which contain heavy elemental impurities, around the mouth or also from hand to mouth contact [32]. Malfunctioning or loss of the cells is caused when heavy metals get contact with human body such as carboxylic acid (-COOH), amine (-NH₂), and thiol (-SH) of proteins, which further lead to various diseases [32].

The Cd element has golden to orange colour, present in some natural colors and inorganic pigments of make-up cosmetics, for example, face powders, lipsticks, sunscreen and foundation creams [33]. According to the WHO, the permissible limit for cadmium is 0.3 µg/g, and unfortunately, all the cosmetic products were found to contain cadmium concentration higher than the permissible limit [34]. The permissible level for Cd, according to the WHO, is 0.3 µg/g [34]. The Cd concentration in all understudied cosmetic products were found to be higher than the permissible limit.

There are two mechanisms, which create adverse effect on the layer of the skin. First one is the binding of free Cd ions with sulfhydryl radicals of cysteine in epidermal keratins or complexing, while other is induction of Cd into the metallothionein. Studies were reported that 0.5 % absorption of cadmium could be occurred by the skin, which were very low level and it would be of arise just those conditions, where the skin would be experience for by concentrated solutions for numerous hours [35].

Table-10: Chronic daily intake (CDI) of Cadmium (mg/ day) in different types of cosmetic products (maximum tolerable daily intake (MTDI) of Cd is 0.21).

Age Groups	Cosmetic products	Referent	Dermatitis patients						
			Seborrhoeic dermatitis	Rosacea	Allergic contact dermatitis	Irritant contact dermatitis			
16-35	Eye Shadow	Morphei	1.51E-15	1.53E-15	1.53E-15	1.52E-15	1.53E-15		
		Sweat Touch	2.15E-15	2.18E-15	2.18E-15	2.16E-15	2.17E-15		
		Maybelline eye shadow high pearls	2.41E-15	2.44E-15	2.42E-15	2.42E-15	2.43E-15		
		E.L.F eye shadow	4.21 E-15	4.27E-15	4.27E-15	4.24E-15	4.25E-15		
		Urban Decay	5.22E-15	5.29E-15	5.29E-15	5.25E-15	5.27E-15		
		L'Oreal eye shadow	6.14E-15	6.18E-15	6.18E-15	6.18E-15	6.21 E-15		
		Cover Girl Eye shadow	5.13E-15	5.17E-15	5.17E-15	5.17E-15	5.19E-15		
		Lancome eye shadow	5.87E-15	5.91 E-15	5.91 E-15	5.91 E-15	5.91 E-15		
		Dior eye shadow	5.18E-15	5.21E-15	5.21E-15	5.21E-15	5.23E-15		
		Mac	6.53E-15	6.58E-15	6.58E-15	6.58E-15	6.60E-15		
		Etude	3.59E-15	3.61 E-15	3.61 E-15	3.61 E-15	3.63E-15		
		Revlon	2.72E-15	2.76E-15	2.76E-15	2.74E-15	2.75E-15		
		Maybelline	3.78E-15	3.78E-15	3.78E-15	3.80E-15	3.82E-15		
		Oriflme	4.70E-15	4.70E-15	4.70E-15	4.73E-15	4.75E-15		
		Clinque	3.82E-15	3.82E-15	3.82E-15	3.85E-15	3.86E-15		
		Morphei	8.82E-16	8.88E-16	8.86E-16	8.66 E-16	8.38E-16		
		Sweat Touch	1.25E-15	1.17E-15	1.25E-15	1.23E-15	1.19E-15		
		Maybelline eye shadow high pearls	1.40E-15	1.32E-15	1.39E-15	1.38E-15	1.33E-15		
		E.L.F eye shadow	3.16E-15	2.31E-15	2.44 E-15	2.41 E-15	2.33E-15		
		Urban Decay	3.04E-15	2.85E-15	3.02E-15	2.99E-15	2.89 E-15		
L'Oreal eye shadow	3.58E-15	3.36E-15	3.56E-15	3.51E-15	3.41E-15				
36-50	Eye Shadow	Cover Girl Eye shadow	2.99E-15	2.81E-15	2.97E-15	2.94E-15	2.84E-15		
		Lancome eye shadow	3.48E-15	3.21E-15	3.40E-15	3.36E-15	3.25E-15		
		Dior eye shadow	3.01E-15	2.83E-15	3.00E-15	2.96E-15	3.02E-15		
		Mac	3.80E-15	3.57E-15	3.78E-15	3.74E-15	3.61E-15		
		Etude	2.09E-15	1.96E-15	2.08E-15	2.08E-15	2.00E-15		
		Revlon	1.59E-15	1.49E-15	1.58E-15	1.56E-15	1.51E-15		
		Maybelline	2.20E-15	2.17E-15	2.19E-15	2.16E-15	2.18E-15		
		Oriflme	2.74E-15	2.57E-15	2.72E-15	2.69E-15	2.60E-15		
		Clinque	2.23E-15	2.09E-15	2.21E-15	2.16E-15	2.11E-15		
		L'Oreal pairs	1.11E-9	1.13E-9	1.13E-9	1.12E-9	1.12E-9		
		New York Coour	1.17E-9	1.19E-9	1.19E-9	1.18E-9	1.18E-9		
		D Ganish	1.30E-9	1.32E-9	1.32E-9	1.31E-9	1.32E-9		
		Glamours	1.43E-9	1.45E-9	1.45E-9	1.44E-9	1.45E-9		
		Etude	9.62E-11	9.75E-11	9.75E-11	9.69E-11	9.72E-11		
		ELF	9.05E-11	9.12E-11	9.12E-11	9.12E-11	9.15E-11		
		sweat touch twin cake face powder	1.09E-4	1.10E-4	1.10E-4	1.10E-4	1.10E-4		
		Clinque	9.81E-11	9.88E-11	9.88E-11	9.88E-11	9.91 E-11		
		Maybelline matifying powder	8.86E-11	8.92E-11	8.92E-11	8.93E-11	8.96E-11		
		Rimmel London	7.54E-11	7.60E-11	7.60E-11	7.60E-11	7.62E-05		
		Diana of London	1.04E-4	1.04 E-4	1.04E-4	1.04E-4	1.05E-4		
CoverGirl face powder	9.62E-11	9.75E-11	9.75E-11	9.69 E-11	9.72E-11				
16-35	Face powder Brands	Makeup Revolution London	1.11E-4	1.11E-4	1.11E-4	1.11E-4	1.11E-4		
		L'Oreal pairs	6.48E-11	6.09E-11	6.14E-7	6.37E-11	6.16E-11		
		New York Coour	6.81E-11	6.4E-11	6.77E-11	6.69E-11	6.47E-11		
		D Ganish	7.58E-11	7.12E-11	7.53E-11	7.44E-11	7.2E-11		
		Glamours	8.35E-11	7.84E-11	8.30E-11	8.20E-11	7.93E-11		
		Etude	5.60E-11	5.26E-11	5.57E-11	5.50E-11	5.32E-11		
		ELF	5.27E-11	4.95E-11	5.24E-11	5.50E-11	5.32E-11		
		sweat touch twin cake face powder	6.37E-11	5.98E-11	6.33E-11	6.26E-11	6.05E-11		
		Clinque	5.71E-11	5.36E-11	5.68E-11	5.07E-11	6.73E-11		
		Maybelline matifying powder	5.16E-11	4.85E-11	5.13E-11	5.07E-11	6.73E-11		
		Rimmel London	4.39E-11	4.13E-11	4.37E-11	4.31E-11	4.18E-11		
		Diana of London	6.04E-11	5.67E-11	6.01E-11	7.82E-11	5.74E-11		
		CoverGirl face powder	5.60E-11	5.26E-11	5.57E-11	5.50E-11	5.32E-11		
		Makeup Revolution	6.48E-11	6.09E-11	6.44E-11	6.36E-11	6.16E-11		
		36-50	Face powder Brands	Makeup Revolution	6.48E-11	6.09E-11	6.44E-11	6.36E-11	6.16E-11

		London					
16-35	Eye Linear	M.A.C cake	2.19 E-15	2.22 E-15	2.22E-15	2.21 E-15	2.21 E-15
		Botanic cake	2.02 E-15	2.05 E-15	2.05E-15	2.03E-15	2.04E-15
		Maybelline Gel	1.61 E-15	1.64 E-15	1.64 E-15	1.63 E-15	1.63 E-15
		E.L.Ff cream	1.51 E-15	1.53E-15	1.53 E-15	1.52 E-15	1.53 E-15
		kryolan	1.87 E-15	1.90 E-15	1.90 E-15	1.89 E-15	1.89 E-15
		Medora pencil	2.05 E-15	2.06E-15	2.06E-15	2.06E-15	2.07 E-15
		Body shop carbon eye definer	2.41 E-15	2.42 E-15	2.42 E-15	2.42 E-15	2.43 E-15
		Rivaj pencil linear	2.59 E-15	2.61 E-15	2.61 E-15	2.61 E-15	2.62 E-15
		sweat touch pencil	2.26 E-15	2.28 E-15	2.28 E-15	2.28E-15	2.29 E-15
		Christin cake	4.54 E-15	4.57 E-15	4.57 E-15	4.57 E-15	4.59E-15
		Glamours cake	5.19 E-15	5.23 E-15	5.23 E-15	5.23 E-15	5.24 E-15
		M.A.C cake	1.18 E-15	1.10E-15	1.15 E-15	1.15 E-15	1.12 E-15
		Botanic cake	9.40E-16	8.83E-16	8.92E-16	9.24E-16	8.94E-16
		Maybelline Gel	1.14E-15	8.28E-16	8.45E-16	8.66E-16	8.38E-16
36-50	Eye Linear	E.L.Ff cream	1.09E-15	1.03E-15	1.05 E-15	1.07 E-15	1.04E-15
		kryolan	1.19E-15	1.12E-15	1.15E-15	1.17E-15	1.13E-15
		Medora pencil	1.40E-15	1.32E-15	1.35E-15	1.38E-15	1.33E-15
		Body shop carbon eye definer	1.51 E-15	1.42E-15	1.45E-15	1.48E-15	1.44E-15
		Rivaj pencil linear	1.32 E-15	1.24 E-15	1.29E-15	1.29 E-15	1.72 E-15
		sweat touch pencil	2.65 E-15	2.48 E-15	2.53E-15	2.60E-15	2.51E-15
		Christin cake	2.41E-15	2.69E-15	2.57E-15	2.73E-15	2.82E-15
		Glamours cake	3.02 E-15	2.84E-15	2.93E-15	3.91 E-15	2.87E-15
		Medora	7.11E-13	7.21E-13	7.21E-13	7.16E-13	7.19 E-13
		L'Oreal	8.18E-13	8.29E-13	8.29E-13	8.24E-13	8.26E-13
		Rivaj	6.36E-13	6.45 E-13	6.45E-13	6.41E-13	6.43E-13
		Nars	6.77E-13	6.87E-13	6.87E-13	6.82E-13	6.84E-13
		Lakme	7.95E-13	8.04E-13	8.06E-13	8.01E-13	8.03E-13
		Becute	8.75E-13	8.81E-13	8.81E-13	8.81E-13	8.84E-13
Revlon	8.22E-13	8.27E-13	8.27E-13	8.27E-13	8.30E-13		
16-35	Lipstick	MAC cosmetics	8.52E-13	8.58E-13	8.58E-13	8.58E-13	8.61E-13
		Yeves sain lausehia	7.49E-13	7.54 E-13	7.54 E-13	7.55 E-13	7.57 E-13
		Dior	7.87 E-13	7.93 E-13	7.93 E-13	7.93 E-13	7.96 E-13
		Clinique	8.14E-13	8.20 E-13	8.20 E-13	8.20 E-13	8.23 E-13
		Maybelline	8.60 E-13	8.72 E-13	8.72 E-13	8.66 E-13	8.69 E-13
		Orifalme	7.11E-13	7.11E-13	7.11E-13	7.16E-13	7.19E-13
		Etude	8.18 E-13	8.18 E-13	8.18 E-13	8.24 E-13	8.26 E-13
		Guerlain	6.20 E-13	6.20 E-13	6.20 E-13	6.24 E-13	6.27 E-13
		Medora	4.14E-13	3.89E-13	4.12E-13	4.07E-13	3.94E-13
		L'Oreal	4.76 E-13	4.47E-13	4.74 E-13	4.68 E-13	4.53 E-13
		Rivaj	3.71E-13	3.48E-13	3.68E-13	3.64E-13	3.52E-13
		Nars	5.08E-13	3.70E-13	3.92E-13	3.87E-13	3.75E-13
		Lakme	4.63E-13	4.35E-13	4.60E-13	4.55E-13	4.40E-13
		Becute	5.10E-13	4.79E-13	5.07E-13	5.00E-13	4.84E-13
Revlon	4.79E-13	4.49E-13	4.76E-13	4.70E-13	4.55E-13		
36-50	Lipstick	MAC cosmetics	4.96E-13	4.66E-13	4.93E-13	4.87E-13	4.72 -13
		Yeves sain lausehia	4.37E-13	4.10E-13	4.34E-13	4.29E-13	4.15 E -13
		Dior	4.59E-13	4.310E-13	4.56E-13	4.50E-13	4.36 E -13
		Clinique	4.74E-13	4.45E-13	4.71E-13	4.69E-13	4.51 E -13
		Maybelline	5.01E-13	4.70E-13	4.98E-13	4.92E-13	4.76 E -13
		Orifalme	4.14E-13	3.89E-13	4.12E-13	4.07E-13	4.15 E -13
		Etude	4.76E-13	4.47E-13	4.74E-13	4.68E-13	4.53 E -13
		Guerlain	3.61E-13	3.39E-13	3.59E-13	3.52 E -13	3.43 E -13
		Medora	9.02E-12	9.15E-12	9.15E-12	9.09E-12	9.12 E-12
		L'Oreal	9.42E-12	9.55E-12	9.55E-12	9.48E-12	9.51 E-12
		Rivaj	7.45E-12	7.56E-12	7.56E-12	7.51E-12	7.53E-12
		Nars	8.50E-12	8.62E-12	8.62E-12	8.56E-12	8.59 E-12
		Lakme	9.16E-12	9.28E-12	9.28E-12	9.22E-12	9.25 E-12
		Becute	9.81E-12	9.88E-12	9.88E-12	9.88E-12	9.91 E-12
Revlon	9.55E-12	9.61E-12	9.61 E-12	9.61 E-12	9.55 E-12		
16-35	Nail polish	MAC cosmetics	9.94E-13	1.00E-11	1.00E-11	1.00E-11	1.00 E-11
		Yeves sain lausehia	9.16E-12	9.21E-12	9.21E-12	9.22E-12	9.25 E-12
		Dior	9.42E-12	9.48E-12	9.48E-12	9.48E-12	9.51 E-12
		Clinique	1.01-11	1.01E-11	1.01E-11	1.01E-11	1.02 E-11
		Maybelline	1.07-11	1.09E-11	1.09E-11	1.08E-11	1.08 E-11
		Orifalme	8.50E-12	8.50E-12	8.50E-12	8.56E-12	8.59E-12
		Etude	1.03-11	1.03E-11	1.03E-11	1.04E-11	1.04 E-11
		Guerlain	8.11E-12	8.11E-12	8.11E-12	8.17E-12	8.19E-12
		Medora	5.26E-12	4.94E-12	5.22E-12	5.16E-12	4.99E-12
		L'Oreal	5.49E-12	5.15E-12	5.45E-12	5.39E-12	5.22E-12
		Rivaj	4.34E-12	4.08E-12	4.32E-12	4.26E-12	4.13E-12
		Nars	6.38E-12	4.65E-12	4.92E-12	4.86E-12	4.71E-12
		Lakme	5.33E-12	5.01E-12	5.30E-12	5.24E-12	5.07E-12
		Becute	5.71E-12	5.37E-12	5.68E-12	5.61E-12	5.43E-12
Revlon	5.56E-12	5.22E-12	5.53E-12	5.46E-12	5.28E-12		
36-50	Nail polish	MAC cosmetics	5.49E-12	5.44E-12	5.75E-12	5.69E-12	5.50E-12
		Yeves sain lausehia	5.33E-12	5.01E-12	5.30E-12	5.24E-12	5.26E-12
		Dior	5.49E-12	5.15E-12	5.45E-12	5.39 E-12	5.21E-12

Clinique	5.87E-12	5.51E-12	5.83E-12	5.46E-12	5.57E-12
Maybelline	6.25E-12	5.87E-12	6.21E-12	6.13E-12	5.94E-12
Orifalme	4.95E-12	4.62E-12	4.92E-12	4.86E-12	4.71E-12
Etude	6.02E-12	5.65E-12	5.98E-12	5.91E-12	5.72E-12
Guerlain	4.72E-12	4.44E-12	4.69E-12	4.75E-12	4.49E-12

Implication of the calculated chronic daily intake

The toxicity of heavy metal to people is determined by how much they consume on a daily basis. The chronic daily intake (CDI) of Cd was calculated according to the mean concentration of Cd in different types of cosmetic products. The CDI and maximum tolerable daily intake (MTDI) of the Cd are shown in Table-10. Daily intakes of Cd is less than the MTDI.

Non-carcinogenic risk

The health hazards associated with the use of contaminated cosmetics by populations are measured using HQ, which is the ratio of a pollutant's determined dose to a reference dose level. If HQ value > 1, then The exposed population is likely to suffer negative consequence. HQ value of Cd for types of cosmetic products shown in Table 11. It is observed that HQ of Cd was < 1 achieved for all cosmetic products samples, showing that the residents in Hyderabad, Sindh, Pakistan will not experience any significant health risk via dermal adsorption of these cosmetic products.

The cadmium concentration in cosmetic products create health problem in many ways. A study which was performed on rats, tumors on upper layer of skin and lesions in the scrotum were examined following dermal application of cadmium [37]. There are two mechanisms, which create adverse effect on the layer of the skin. First one is the binding of free Cd ions with sulfhydryl radicals of cysteine in epidermal keratins or complexing, while other is induction of Cd into the metallothionein. Studies were reported that 0.5 % absorption of cadmium could be occurred by the skin, which were very low level and it would be of arise just those conditions, where the skin would be experience for by concentrated solutions for numerous hours [38].

Exposure of cadmium on the health of users

In the environment, cadmium is one of the most toxic metal & present in water, air and dietary food. Cadmium ions are concentrated in liver and their absorption takes place by most of the tissues of the body. Accumulation of Cd throughout a life time is one of the most dangerous threat. Anemia, Renal dysfunction, osteotoxicities hepatic dysfunction and

cancer in multiple organs of body, kidney dysfunction are the chronic human exposure to Cd [39].

International Agency research on cancer (IARC) has classified cadmium as in the first category of human carcinogens, because of its carcinogenic properties. Lung, prostate cancer, pancreas and kidney cancer have been associated with Cadmium, which is true human Carcinogen [40]. The accumulation and absorption of these elements through cosmetic products is accumulated by the dermal route. Some metals such as cadmium, nickel, cobalt, chromium are added or deposited in the stratum corneum, where these metals cause a dermatitis namely, allergic contact dermatitis [41, 42].

Increased concentration of metals such as aluminum, lead, cadmium & mercury are entered into the blood after passing or absorption through skin layer. These elements are deposited in different organs from the blood and create toxicity [43].

The higher concentration of toxic metals in the internal organs (kidney, heart, stomach), human blood and urine of excessive cosmetic user confirm the absorption of toxic elements through skin that or the unnecessary contact to these metals by a person who uses these cosmetics on regular basis that illustrate their absorption through the skin [44, 45].

The absorption of toxic elements via skin is less efficient as compare to gastrointestinal tract or inhalation. Some toxic elements (As, Cd, Pb, Ni) enter into the human body by the routes of skin as a result of the use of cosmetics. The long time usage of cosmetic products, the chemicals present in the cosmetic products may deposit in the third and bottam layer of skin (Subcutaneous fat). Despite the fact that ingestion of these toxicants through the epidermal layer of our skin is less efficient than by the breathing and gastrointestinal tract. A small amount of them might go inside the human body by this means as consequence of the significant apply of these beauty products.

Table-11: Non-carcinogenic risk (HQ dermal) of Cd in different types of cosmetics samples.

Age Groups	Cosmetic products	Referent	Dermatitis patients						
			Seborrheic dermatitis	Rosacea	Allergic contact dermatitis	Irritant contact dermatitis			
16-35	Eye Shadow	Morphei	1.51E-15	1.53E-12	1.53E-12	1.52E-12	1.53E-12		
		Sweat Touch	2.15E-15	2.18E-12	2.18E-12	2.16E-12	2.17E-12		
		Maybelline eye shadow high pearls	2.41E-15	2.44E-12	2.42E-12	2.42E-12	2.43E-12		
		E.L.F eye shadow	4.21 E-12	4.27E-12	4.27E-12	4.24E-12	4.25E-12		
		Urban Decay	5.22E-12	5.29E-12	5.29E-12	5.25E-12	5.27E-12		
		L'Oreal eye shadow	6.14E-12	6.18E-12	6.18E-12	6.18E-12	6.21 E-12		
		Cover Girl Eye shadow	5.13E-12	5.17E-12	5.17E-12	5.17E-12	5.19E-12		
		Lancome eye shadow	5.87E-12	5.91 E-12	5.91 E-12	5.91 E-12	5.91 E-12		
		Dior eye shadow	5.18E-12	5.21E-12	5.21E-12	5.21E-12	5.23E-12		
		Mac	6.53E-12	6.58E-12	6.58E-12	6.58E-12	6.60E-12		
		Etude	3.59E-12	3.61 E-12	3.61 E-12	3.61 E-12	3.63E-12		
		Revlon	2.72E-12	2.76E-12	2.76E-12	2.74E-12	2.75E-12		
		Maybelline	3.78E-12	3.78E-12	3.78E-12	3.80E-12	3.82E-12		
		Oriflme	4.70E-12	4.70E-12	4.70E-12	4.73E-12	4.75E-12		
		Clinque	3.82E-12	3.82E-12	3.82E-12	3.85E-12	3.86E-12		
		36-50	Eye Shadow	Morphei	8.82E-13	8.88E-13	8.86E-13	8.66 E-13	8.38E-13
				Sweat Touch	1.25E-12	1.17E-12	1.25E-12	1.23E-12	1.19E-12
Maybelline eye shadow high pearls	1.40E-12			1.32E-12	1.39E-12	1.38E-12	1.33E-12		
E.L.F eye shadow	3.16E-13			2.31E-13	2.44 E-12	2.41 E-12	2.33E-12		
Urban Decay	3.04E-12			2.85E-12	3.02E-12	2.99E-12	2.89 E-12		
L'Oreal eye shadow	3.58E-12			3.36E-12	3.56E-12	3.51E-12	3.41E-12		
Cover Girl Eye shadow	2.99E-12			2.81E-12	2.97E-12	2.94E-12	2.84E-12		
Lancome eye shadow	3.48E-12			3.21E-12	3.40E-12	3.36E-12	3.25E-12		
Dior eye shadow	3.01E-12			2.83E-12	3.00E-12	2.96E-12	3.02E-12		
Mac	3.80E-12			3.57E-12	3.78E-12	3.74E-12	3.61E-12		
Etude	2.09E-12			1.96E-12	2.08E-12	2.08E-12	2.00E-12		
Revlon	1.59E-12			1.49E-12	1.58E-12	1.56E-12	1.51E-12		
Maybelline	2.20E-12			2.17E-12	2.19E-12	2.16E-12	2.18E-12		
Oriflme	2.74E-12			2.57E-12	2.72E-12	2.69E-12	2.60E-12		
Clinque	2.23E-12			2.09E-12	2.21E-12	2.16E-12	2.11E-12		
16-35	Face powder Brands			L'Oreal pairs	1.11E-6	1.13E-6	1.13E-6	1.12E-6	1.12E-6
				New York Coour	1.17E-6	1.19E-6	1.19E-6	1.18E-6	1.18E-6
		D Ganish	1.30E-6	1.32E-6	1.32E-6	1.31E-6	1.32E-6		
		Glamours	1.43E-6	1.45E-6	1.45E-6	1.44E-6	1.45E-6		
		Etude	9.62E-8	9.75E-8	9.75E-8	9.69E-8	9.72E-8		
		ELF	9.05E-8	9.12E-8	9.12E-8	9.12E-8	9.15E-8		
		sweat touch twin cake face powder	1.09E-1	1.10E-1	1.10E-1	1.10E-1	1.10E-1		
		Clinque	9.81E-8	9.88E-8	9.88E-8	9.88E-8	9.91 E-8		
		Maybelline matifying powder	8.86E-8	8.92E-8	8.92E-8	8.93E-8	8.96E-8		
		Rimmel London	7.54E-8	7.60E-8	7.60E-8	7.60E-8	7.62E-2		
		Diana of London	1.04E-1	1.04 E-1	1.04E-1	1.04E-1	1.05E-1		
		CoverGirl face powder	9.62E-8	9.75E-8	9.75E-8	9.69 E-8	9.72E-8		
		Makeup Revolution London	1.11E-1	1.11E-1	1.11E-1	1.11E-1	1.11E-1		
		36-50	Face powder Brands	L'Oreal pairs	6.48E-8	6.09E-8	6.14E-4	6.37E--8	6.16E--8
				New York Coour	6.81E--8	6.4E--8	6.77E--8	6.69E--8	6.47E--8
				D Ganish	7.58E--8	7.12E-8	7.53E-8	7.44E-8	7.2E-8
				Glamours	8.35E-8	7.84E-8	8.30E-8	8.20E-8	7.93E-8
Etude	5.60E-8			5.26E-8	5.57E-8	5.50E-8	5.32E-8		
ELF	5.27E-8			4.95E-8	5.24E-8	5.50E-8	5.32E-8		
sweat touch twin cake face powder	6.37E-8			5.98E-8	6.33E-8	6.26E-8	6.05E-8		
Clinque	5.71E-8			5.36E-8	5.68E-8	5.07E-8	6.73E-8		
Maybelline matifying powder	5.16E-8			4.85E-8	5.13E-8	5.07E-8	6.73E-8		
Rimmel London	4.39E-8			4.13E-8	4.37E-8	4.31E-8	4.18E-8		
Diana of London	6.04E-8			5.67E-8	6.01E-8	7.82E-8	5.74E-8		
CoverGirl face powder	5.60E-8			5.26E-8	5.57E-8	5.50E-8	5.32E-8		
Makeup Revolution London	6.48E-8			6.09E-8	6.44E-8	6.36E-8	6.16E-8		
16-35	Eye Linear			M.A.C cake	2.19 E-12	2.22 E-12	2.22E-12	2.21 E-12	2.21 E-12
				Botanic cake	2.02 E-12	2.05 E-12	2.05E-12	2.03E-12	2.04E-12
				Maybelline Gel	1.61 E-12	1.64 E-12	1.64 E-12	1.63 E-12	1.63 E-12
				E.L.Ff cream	1.51 E-12	1.53E-12	1.53 E-12	1.52 E-12	1.53 E-12
		kryolan	1.87 E-12	1.90 E-12	1.89 E-12	1.89 E-12	1.89 E-12		
		Medora pencil	2.05 E-12	2.06E-12	2.06E-12	2.06E-12	20.7 E-12		
		Body shop carbon eye definer	2.41 E-12	2.42 E-12	2.42 E-12	2.42 E-12	2.43 E-12		

36-50	Eye Linear	Rivaj pencil linear	2.59 E-12	2.61 E-12	2.61 E-12	2.61 E-12	2.62 E-12
		sweat touch pencil	2.26 E-12	2.28 E-12	2.28 E-12	2.28 E-12	2.29 E-12
		Christin cake	4.54 E-12	4.57 E-12	4.57 E-12	4.57 E-12	4.59 E-12
		Glamours cake	5.19 E-12	5.23 E-12	5.23 E-12	5.23 E-12	5.24 E-12
		M.A.C cake	1.18 E-12	1.10 E-12	1.15 E-12	1.15 E-12	1.12 E-12
		Botanic cake	9.40 E-13	8.83 E-13	8.92 E-13	9.24 E-13	8.94 E-13
		Maybelline Gel	1.14 E-12	8.28 E-13	8.45 E-13	8.66 E-13	8.38 E-13
		E.L.Ff cream	1.09 E-12	1.03 E-12	1.05 E-12	1.07 E-12	1.04 E-12
		kryolan	1.19 E-12	1.12 E-12	1.15 E-12	1.17 E-12	1.13 E-12
		Medora pencil	1.40 E-12	1.32 E-12	1.35 E-12	1.38 E-12	1.33 E-12
		Body shop carbon eye definer	1.51 E-12	1.42 E-12	1.45 E-12	1.48 E-12	1.44 E-12
		Rivaj pencil linear	1.32 E-12	1.24 E-12	1.29 E-12	1.29 E-12	1.72 E-12
		sweat touch pencil	2.65 E-12	2.48 E-12	2.53 E-12	2.60 E-12	2.51 E-12
		Christin cake	2.41 E-12	2.69 E-12	2.57 E-12	2.73 E-12	2.82 E-12
16-35	Lipstick	Glamours cake	3.02 E-12	2.84 E-12	2.93 E-12	3.91 E-12	2.87 E-12
		Medora	7.11 E-10	7.21 E-10	7.21 E-10	7.16 E-10	7.19 E-10
		LOreal	8.18 E-10	8.29 E-10	8.29 E-10	8.24 E-10	8.26 E-10
		Rivaj	6.36 E-10	6.45 E-10	6.45 E-10	6.41 E-10	6.43 E-10
		Nars	6.77 E-10	6.87 E-10	6.87 E-10	6.82 E-10	6.84 E-10
		Lakme	7.95 E-10	8.04 E-10	8.06 E-10	8.01 E-10	8.03 E-10
		Becute	8.75 E-10	8.81 E-10	8.81 E-10	8.81 E-10	8.84 E-10
		Revlon	8.22 E-10	8.27 E-10	8.27 E-10	8.27 E-10	8.30 E-10
		MAC cosmetics	8.52 E-10	8.58 E-10	8.58 E-10	8.58 E-10	8.61 E-10
		Yeves sain lausehia	7.49 E-10	7.54 E-10	7.54 E-10	7.55 E-10	7.57 E-10
		Dior	7.87 E-10	7.93 E-10	7.93 E-10	7.93 E-10	7.96 E-10
		Clinique	8.14 E-10	8.20 E-10	8.20 E-10	8.20 E-10	8.23 E-10
		Maybelline	8.60 E-10	8.72 E-10	8.72 E-10	8.66 E-10	8.69 E-10
		Orifalme	7.11 E-10	7.11 E-10	7.11 E-10	7.16 E-130	7.19 E-10
36-50	Lipstick	Etude	8.18 E-10	8.18 E-10	8.18 E-10	8.24 E-10	8.26 E-10
		Guerlain	6.20 E-10	6.20 E-10	6.20 E-10	6.24 E-10	6.27 E-10
		Medora	4.14 E-10	3.89 E-10	4.12 E-10	4.07 E-10	3.94 E-10
		LOreal	4.76 E-10	4.47 E-10	4.74 E-10	4.68 E-10	4.53 E-10
		Rivaj	3.71 E-10	3.48 E-10	3.68 E-10	3.64 E-10	3.52 E-10
		Nars	5.08 E-10	3.70 E-10	3.92 E-10	3.87 E-10	3.75 E-10
		Lakme	4.63 E-10	4.35 E-10	4.60 E-10	4.55 E-10	4.40 E-10
		Becute	5.10 E-10	4.79 E-10	5.07 E-10	5.00 E-10	4.84 E-10
		Revlon	4.79 E-10	4.49 E-10	4.76 E-10	4.70 E-10	4.55 E-10
		MAC cosmetics	4.96 E-10	4.66 E-10	4.93 E-10	4.87 E-10	4.72 E-10
		Yeves sain lausehia	4.37 E-10	4.10 E-10	4.34 E-10	4.29 E-10	4.15 E-10
		Dior	4.59 E-10	4.310 E-10	4.56 E-10	4.50 E-10	4.36 E-10
		Clinique	4.74 E-10	4.45 E-10	4.71 E-10	4.69 E-10	4.51 E-10
		Maybelline	5.01 E-10	4.70 E-10	4.98 E-10	4.92 E-10	4.76 E-10
16-35	Nail polish	Orifalme	4.14 E-10	3.89 E-10	4.12 E-10	4.07 E-10	4.15 E-10
		Etude	4.76 E-10	4.47 E-10	4.74 E-10	4.68 E-10	4.53 E-10
		Guerlain	3.61 E-10	3.39 E-10	3.59 E-10	3.52 E-10	3.43 E-10
		Medora	9.02 E-9	9.15 E-9	9.15 E-9	9.09 E-9	9.12 E-9
		LOreal	9.42 E-9	9.55 E-9	9.55 E-9	9.48 E-9	9.51 E-9
		Rivaj	7.45 E-9	7.56 E-9	7.56 E-9	7.51 E-9	7.53 E-9
		Nars	8.50 E-9	8.62 E-9	8.62 E-9	8.56 E-9	8.59 E-9
		Lakme	9.16 E-9	9.28 E-9	9.28 E-9	9.22 E-9	9.25 E-9
		Becute	9.81 E-9	9.88 E-9	9.88 E-9	9.88 E-9	9.91 E-9
		Revlon	9.55 E-9	9.61 E-9	9.61 E-9	9.61 E-9	9.55 E-9
		MAC cosmetics	9.94 E-10	1.00 E-8	1.00 E-8	1.00 E-8	1.00 E-8
		Yeves sain lausehia	9.16 E-9	9.21 E-9	9.21 E-9	9.22 E-9	9.25 E-9
		Dior	9.42 E-9	9.48 E-9	9.48 E-9	9.48 E-9	9.51 E-9
		Clinique	1.01 E-8	1.01 E-8	1.01 E-8	1.01 E-8	1.02 E-8
36-50	Nail polish	Maybelline	1.07 E-8	1.09 E-8	1.09 E-8	1.08 E-8	1.08 E-8
		Orifalme	8.50 E-9	8.50 E-9	8.50 E-9	8.56 E-9	8.59 E-9
		Etude	1.03 E-8	1.03 E-118	1.03 E-8	1.04 E-8	1.04 E-8
		Guerlain	8.11 E-9	8.11 E-9	8.11 E-9	8.17 E-9	8.19 E-9
		Medora	5.26 E-9	4.94 E-9	5.22 E-9	5.16 E-9	4.99 E-9
		LOreal	5.49 E-9	5.15 E-9	5.45 E-9	5.39 E-9	5.22 E-9
		Rivaj	4.34 E-9	4.08 E-9	4.32 E-9	4.26 E-9	4.13 E-9
		Nars	6.38 E-9	4.65 E-9	4.92 E-9	4.86 E-9	4.71 E-9
		Lakme	5.33 E-9	5.01 E-9	5.30 E-9	5.24 E-9	5.07 E-9
		Becute	5.71 E-9	5.37 E-9	5.68 E-9	5.61 E-9	5.43 E-9
		Revlon	5.56 E-9	5.22 E-9	5.53 E-9	5.46 E-9	5.28 E-9
		MAC cosmetics	5.49 E-9	5.44 E-9	5.75 E-9	5.69 E-9	5.50 E-9
		Yeves sain lausehia	5.33 E-9	5.01 E-9	5.30 E-9	5.24 E-9	5.26 E-9
		Dior	5.49 E-9	5.15 E-9	5.45 E-9	5.39 E-9	5.21 E-9
Clinique	5.87 E-9	5.51 E-9	5.83 E-9	5.46 E-9	5.57 E-9		
36-50	Nail polish	Maybelline	6.25 E-9	5.87 E-9	6.21 E-9	6.13 E-9	5.94 E-9
		Orifalme	4.95 E-9	4.62 E-9	4.92 E-9	4.86 E-9	4.71 E-9
		Etude	6.02 E-9	5.65 E-9	5.98 E-9	5.91 E-9	5.72 E-9
		Guerlain	4.72 E-9	4.44 E-9	4.69 E-9	4.75 E-9	4.49 E-9

Conclusion

It is estimated that the Cd concentration in the different types of cosmetic products were found to be higher than the respective maximum allowable concentration. It is concluded that the documented reports are the cases of different types of female dermatitis, which were caused by the toxicity of transition heavy elements in beauty cosmetics products. These cosmetic products have toxic elemental level above than the reported value. A long time usage of these cosmetic products confirms the risk of adverse effects on human health. Therefore, suitable measures, including in particular the setting of limits of amount while they are missing until nowadays in addition to ordinary manage of raw materials, order of cosmetics manufacturing & the last item are compulsory. This is mostly important finding because cosmetic items are employed daily throughout the world. The users are not only women and men, but also children and older aged people. In older age persons, the skin is very sensitive for the absorption of toxic elements thought the cosmetic products, are more susceptible to their toxic action.

It was also monitored that the socioeconomic factors play an important role in the risk of dermatitis, for example, ir-regular screening, the poor or fast food nutrition, late diagnosis and unequal access to health care. The role of Cd in the mechanism of different types of dermatitis development is still unclear, and further comprehensive examinations are necessary.

The cosmetic products are carefully measured as possible source of toxic elemental exposure and in the results of Cd poisonings when the history of the case do not provide the evidence of toxic elemental exposure from occupational and environmental conditions, the cosmetics should be believed as possible causative factors. Therefore, it is compulsory to reduce the levels of Cd in cosmetics products to improve the safety of these commonly used cosmetic products.

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