**Title:** A study to assess the Knowledge, Attitude and Practices of young Indian Women towards the presence of Lead and other Heavy Metals in Cosmetics.

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**Abstract:**

Cosmetics used by women for personal care and altering appearance are known to contain heavy metals as additives or contaminants. They are absorbed and accumulate in the body with prolong use and pose several health hazards. This study was conducted to assess the knowledge, attitude and practices of toxic elements in cosmetics among women who are the larger consumers. The observations revealed that there was lack of knowledge among young educated women about the heavy metal contaminants and its health hazards. This presses a compelling need to investigate further in larger groups involving all strata of women and men. There is a need to conduct campaigns at production and regulatory levels to manufacture and market cosmetics and personal care products which have safe levels of contaminants.

**Introduction:**

It is an age old practice to use cosmetics for personal hygiene and beautification. Depending on the local traditions and practices they are prepared and used either on special occasions or as a routine. Nowadays, a variety of products prepared from natural and synthetic ingredients are available in the market.

Cosmetic is defined under section 3(aaa) of the Drugs and Cosmetics Act, 1940 as, any article intended to be rubbed, poured, sprinkled or sprayed on, or introduced into, or otherwise applied to, the human body or any part thereof for cleansing, beautifying, promoting attractiveness or altering the appearance, and includes any article intended for use as a component of cosmetic. It is widely used by all age groups, more so by women. Those cosmetics which are used for face and hair colouring agents are a mixture of a number of chemicals which contain colouring additives. Hair colouring and grooming agents have cadmium (Cd), lead (Pb), and nickel (Ni) in varying proportions (1). The colouring agents in the lipsticks are made up of compounds containing Cd, Pb (2,3), Chromium (Cr) (4), arsenic (As), Mercury (Hg), Cobalt (Co) and Copper (Cu) (5). Surma, Kajal or Kohl used for eye makeup contain salts of Pb, Cu, Mg and Fe (6–8). Sindur used as a custom by the Hindu women in India has a very high content of Pb (9,10). Constant use over the years poses health risk to the consumers who are primarily women.

Lead and other heavy metals can enter body through skin, gut and by inhalation. They are excreted through urine and faeces. They remain in circulation for prolonged periods, about 30- 45 days half-life. It is deposited into skeletal system and other soft tissues if not taken into RBCs. Lead deposited in bone has a half-life of between 20 and 30 years (11).

Neurotoxicity caused by heavy metals, such as lead, mercury, and arsenic, is either acute or chronic. Acute exposure often results in immediate feeling of nausea, headache, impairment of decision making as well as emotional instability. In a chronic condition it often presents with protracted issues such as tiredness, reduced motor skills and an overall degradation of cognitive and behavioural activity (12).

With the information available about the heavy metal content in cosmetics and the health risk due to repeated use, we were urged to conduct a survey about the knowledge, attitude and practices of toxic elements in cosmetics among women who are the larger consumers.

**Methodology:**

Verbal informed consent or informed consent in google form was obtained from the participants and confidentiality of the data were maintained in the department. Once consented for, the structured questionnaire-based interview was administered by a single trained interviewer for all the participants. The inclusion criteria were for women of 16-35 years of age, having any occupation or not. Those who could fill up the questionnaire on their own were asked to do so, others needed assistance from our personnel who helped with the interview. The observations from the individual questionnaire were compiled and tabulated. The sample size was calculated considering 95% confidence interval, 5% significance and 5% precision, was for 208 participants. Out of 250 young women approached, 214 responded. The results were analysed by both quantitative and qualitative measures and correlated with their level of education.

**Results:**

There were 214 young women between the ages 17-33 years who consented to participate in this study, the mean age was 20.4 ± 1.9 years. The mean age at which our study group started using cosmetics was 11.9 years, some of them had started as early as 4 years. On an average they have been using cosmetics since 5 years (Figure 2). The women were literate; 92% were in university and the rest had education till high school. There were more urban dwellers (66.4%) than rural (Figure 1). The major skin ailment among them were acne (16.4%) and skin allergies (5.4%). The most common cosmetics used were soap, face wash and shampoo (Figures 3-5), some of which were on daily basis. They used cosmetics on lip, eyes and nails occasionally (Figure 6). The single most common factor in choosing a cosmetic was its brand, followed by ingredients, and recommendation from friends and professionals (Figure 7). During the interview/ questionnaire based study, most of the study population were made aware that there is a possibility of heavy metal contamination in cosmetics and though they were not sure (responded as ‘may be’) of the toxic levels and metabolism of heavy metals, they wanted to know more (about 55% of the respondents) about it (Figure 8). They were not definite about the precautions to be observed while applying and removing make up. The curiosity generated was palpable as 62% and 69% were definite (responded ‘yes’) about knowing Lead levels in their blood and in cosmetics respectively. There was no correlation (not shown) of education with the knowledge and perception about toxic contaminants in cosmetics.

**Discussion:**

Cosmetics and daily personal care products are in use for centuries and they have evolved in many ways. They are universally used by both genders. There has been reports of heavy metals as contaminants from several countries and in varied quantities (1–3,5–7,10–13). The objective of our study was to assess the knowledge about contaminants in cosmetics, the common practices and to create awareness among young women. Our study population was young, educated, brand conscious and confident as a small group (1.9- 3.3%) had concerns about their appearance. Majority of them used personal care products like soaps and face washes on daily basis and occasionally used products on lips, eyes and nails. Majority (about 50%) of women in our study doubted the possibility of contaminants in the products they used. It was difficult to assess whether they had the knowledge or through our questionnaire we were able to induce suspicion. Later in the questionnaire, when there were questions about whether they would want to know more about toxicity with heavy metal contaminants and whether they would want to know the levels of contaminants in their blood and cosmetic products, there was an assertive ‘yes’ by majority of them. Only 9 to 14 of them out of 214 women did not want to check the above. There is a need for creating awareness among both the manufacturing companies, the consumers and the policy makers about the health implications these heavy metals can cause. It was reported that even the herbs and plants gathered from different localities had toxic levels of lead more than commercially available products (14). It was attributed to the levels in soil where the plants were grown. In India, the major sources of Pb was from herbal products and cosmetics (15). With prolonged exposure to minute quantities of heavy metals, they tend to accumulate in the body and cause an imbalance in the normal free radical generation and signal transduction. Both epidemiological and laboratory data suggest that heavy metal induced oxidative stress damage are linked with an increased risk of cancer, renal failure, developmental, behavioral and neurological disorders and certain high prevalent non-communicable diseases like diabetes mellitus, infertility, and cardiovascular disease (16). As the age at which they start the use of cosmetics in our study group was very young (11.9 years), there is a likelihood of sequestration of large quantities of harmful heavy metals in the body which will not only affect that person using but also the next generation (11,17). Lack of awareness can pose an outsized risk to public health and affect other aspects like quality of life, efficiency and productivity of the population at large.

**Conclusion:**

Our observations from this study compels us to believe that there was lack of knowledge among young educated women about the heavy metal contaminants and its health hazards. There is a compelling need to investigate further in larger groups involving all strata of women and men. It is also basic to conduct campaigns at production and regulatory levels to manufacture and market cosmetics and personal care products which have safe levels of contaminants.

**References:**

1. Sipahi H, Charehsaz M, Sonmez I, Soykut B, Erdem O, Aydin A. Assessment of cadmium, lead, and nickel levels in hair care products marketed in Turkey. J Cosmet Sci. 2014 Aug;65(4):239–44.

2. Nourmoradi H, Foroghi M, Farhadkhani M, Vahid Dastjerdi M. Assessment of lead and cadmium levels in frequently used cosmetic products in Iran. J Environ Public Health. 2013;2013:962727.

3. Hepp NM. Determination of total lead in 400 lipsticks on the U.S. market using a validated microwave-assisted digestion, inductively coupled plasma-mass spectrometric method. J Cosmet Sci. 2012 Jun;63(3):159–76.

4. Malvandi H, Sancholi F. Assessments of some metals contamination in lipsticks and their associated health risks to lipstick consumers in Iran. Environ Monit Assess. 2018 Oct 27;190(11):680.

5. Hepp NM, Mindak WR, Gasper JW, Thompson CB, Barrows JN. Survey of cosmetics for arsenic, cadmium, chromium, cobalt, lead, mercury, and nickel content. J Cosmet Sci. 2014 Jun;65(3):125–45.

6. Massadeh AM, El-Khateeb MY, Ibrahim SM. Evaluation of Cd, Cr, Cu, Ni, and Pb in selected cosmetic products from Jordanian, Sudanese, and Syrian markets. Public Health. 2017 Aug;149:130–7.

7. McMichael JR, Stoff BK. Surma eye cosmetic in Afghanistan: a potential source of lead toxicity in children. Eur J Pediatr. 2018 Feb;177(2):265–8.

8. Hardy A, Walton R, Vaishnav R. Composition of eye cosmetics (kohls) used in Cairo. Int J Environ Health Res. 2004 Feb;14(1):83–91.

9. Patel AB, Belsare H, Banerjee A. Feeding practices and blood lead levels in infants in Nagpur, India. Int J Occup Environ Health. 2011 Mar;17(1):24–30.

10. Shah MP, Shendell DG, Strickland PO, Bogden JD, Kemp FW, Halperin W. Lead Content of Sindoor, a Hindu Religious Powder and Cosmetic: New Jersey and India, 2014-2015. Am J Public Health. 2017 Oct;107(10):1630–2.

11. Fatmi Z, Sahito A, Ikegami A, Mizuno A, Cui X, Mise N, et al. Lead Exposure Assessment among Pregnant Women, Newborns, and Children: Case Study from Karachi, Pakistan. Int J Environ Res Public Health. 2017 Apr 13;14(4):E413.

12. Piccinini P, Piecha M, Torrent SF. European survey on the content of lead in lip products. J Pharm Biomed Anal. 2013 Mar 25;76:225–33.

13. Ozbek N, Akman S. Determination of lead, cadmium and nickel in hennas and other hair dyes sold in Turkey. Regul Toxicol Pharmacol RTP. 2016 Aug;79:49–53.

14. Fischer A, Brodziak-Dopierała B, Loska K, Stojko J. The Assessment of Toxic Metals in Plants Used in Cosmetics and Cosmetology. Int J Environ Res Public Health. 2017 Oct 24;14(10):E1280.

15. Obeng-Gyasi E. Sources of lead exposure in various countries. Rev Environ Health. 2019 Mar 26;34(1):25–34.

16. Paithankar JG, Saini S, Dwivedi S, Sharma A, Chowdhuri DK. Heavy metal associated health hazards: An interplay of oxidative stress and signal transduction. Chemosphere. 2021 Jan;262:128350.

17. Marie C, Cabut S, Vendittelli F, Sauvant-Rochat MP. Changes in Cosmetics Use during Pregnancy and Risk Perception by Women. Int J Environ Res Public Health. 2016 Mar 30;13(4):383.