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## Trends in Use of Hair Dye: A Cross-Sectional Study

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### Abstract

#### Objective:

The objective of the following study was to assess the knowledge, practice, perception and adverse reactions among hair dye users.

#### Settings and Design:

A cross-sectional study was conducted on patients, their attenders and staff of SDUMC.

#### Materials and Methods:

A questionnaire (28) pertaining to use of hair dyes and reactions to them was administered randomly.

#### Statistical Analysis:

The demographic data are expressed as mean  $\pm$  standard deviation, quantitative data expressed as percentages.

#### Results:

A total of 263 volunteers responded of which 52.5% and 47.5% were females and males respectively with mean age of  $32.40 \pm 6.01$  years. The participants started using hair dye at an age of  $27 (\pm 3.63)$  years. Synthetic dyes were used by 91%. Frequency of use in a year was 2-5 times in 51%. Instruction of the package insert was followed by 63.5%. Skin test was never performed in 34% prior to their use. Nearly 96% expressed hair dyeing was unsafe during pregnancy, lactation and in children. Adverse reactions were reported by 42%, with headache (63%) and itching (38%) being the most common.

#### Conclusion:

Hair dyeing was started at very early age. Majority used semi-permanent dyes even though they perceived natural dyes were safe. They continued dyeing despite adverse reactions, which indicates cosmetic importance.

**Keywords:** Aromatic hair dyes, attitude, paraphenylenediamine, perception, practices

### INTRODUCTION

Hair dye use is very common among both the genders, today millions use it. Coloring of hair is performed not only by professionals but also a popular cosmetic procedure at home. Hair is made up of root and shaft. Shaft has three layers: Cuticle consisting of tightly packed colorless cells, cortex contains natural color pigments that determine color and medulla a hollow core.

Coloring agents remove natural color or add new color or accomplish both. For permanent color, the product

should penetrate the cuticle to deposit or remove color in the cortex. Earlier natural hair dyes were used but now, due to advancement in cosmetic industry, different types have been developed. Three types available are temporary dyes containing large molecules too big to penetrate and only coat the shaft. The semi-permanent with small molecules containing aromatic amines, cause swelling of shaft, raise the cuticle and allow it to enter the cortex thus coloring it. The oxidative dyes are permanent with smallest molecules.[1] The aromatic amines swell the cuticle and allows hydrogen peroxide and the dye to penetrate the cortex which removes color and lightens the hair which lasts until the hair grows out.[2]

The alkalizing agent (aromatic amines), paraphenylenediamine (PPD) [C<sub>6</sub>H<sub>4</sub> (NH<sub>2</sub>)<sub>2</sub>] or toluene-2,5-diamine, are the most important constituents of these formulations.[2,3] It is absorbed from the skin resulting in allergic dermatitis. Systemic effects include angioedema, rhabdomyolysis, renal and cardiac toxicity. It is mutagenic and carcinogenic but not a known teratogen.[4,5] The aim of this study was to assess the knowledge, practice, perception and adverse reactions among the hair dye users.

## MATERIALS AND METHODS

The protocol was approved by the Institutional Ethics Committee. This was a cross-sectional study conducted by the Department of Pharmacology. Study included the patients and their attenders visiting RL Jalappa Hospital and Research Center, staff and students of Sri Devaraj Urs Medical College. It was conducted for a period of 3 months from July to September 2012.

Volunteers of both gender, aged above 18 years who were willing to give consent were administered a questionnaire randomly, those who were unable to understand, the questions were explained to them in local language. It included 28 questions regarding the use of hair dyes and required approximately 15 minutes to answer completely. Questionnaire included detailed information regarding their educational status, occupation and income, the age at which they first started using hair dyes, type of hair dyes, frequency of its use, their motives behind coloring their hair, use during pregnancy and in their children and also if they had suffered from any reactions after its use.

## RESULTS

A total of 263 volunteers responded to the questionnaire. [Table 1](#) shows the demographic details of the volunteers. 16% of the volunteers were illiterate and the same percentages were unemployed, 72.6% employed and 11.4% students. Majority of them (45%) had monthly income between Rs. 15,000 and Rs. 30,000, 27% has < Rs. 15,000. [Table 2](#) represents the knowledge regarding the use of hair dyes.

### Attitude regarding use of hair dyes

Among the participants, 72% felt the need for repeated dyeing because of uneven hair color. Almost 81% of the volunteers were satisfied with the color after dyeing. 96% expressed that hair dyeing was unsafe during pregnancy, lactation and in children.

### Practice regarding use of hair dye

The mean age at which the participants started using hair dyes was around  $27 \pm 3.63$  years among both genders. Around 48% used hair dye frequently (more than 5 times a year). 65% used hair dye to mask grey hair compared to 13% who felt it was fashionable. [Figure 1](#) shows types of dyes used. 64% of the participants preferred to color their hair black while 16% brown and 20% other exotic colors. However 33% preferred to dye their hair at a saloon/parlor compared with 32% at home. Majority (63.5%) of the participants followed the instruction given on the package box. 90% of the volunteers never performed a skin test prior to the use compared to 10% who did skin test at times. 54 out of 94 volunteers had done hair dyeing during pregnancy.

### Adverse reactions to hair dyes

A total of 110 volunteers had suffered from adverse reactions. Of these, 67% of the volunteers had suffered from reactions within 1 h of using hair dye compared to 33% after 24 h. [Figure 2](#) represents adverse reactions.

## DISCUSSION

Coloring of hair signifies a major step in self-expression which has recently been influenced by innovative science. Owing to increased demand the market is poised for a new scientific breakthrough to produce quick and efficient hair coloring products. The results in our study indicate that >50% females dye their hair. The mean age at which both genders started hair dyeing was 27 years, while it was 16 years in a study conducted on Danish adult population and 40-49 years in Korean population.[6,7] The youngest volunteer using hair dye in our study was 20 years. However, in a study done in Riyadh, the practice began at an age as young as 15 years.[8]

The majority of participants, particularly the illiterates and those who used hair dyes at home, were able to mention the brand names of the product they used. However they did not perform an allergy test before using it. Around 36% of them did not follow the instructions before the use of dyes. Though majority of them believed that hair dyeing was not safe they continued their use even during pregnancy. Most of them felt that temporary dyes were the safest but they were not able to substantiate it, the probable reason could be temporary dyes being large molecules do not penetrate the shaft and only coats it.

Greying of the scalp hair is an inevitable physiologic process in human aging. It is caused by the loss of the pigmented-forming melanocytes from the hair follicles, which reflects loss of the melanocyte stem cell population in the aging hair follicles.[9] Majority (86%) of them used hair dye 3-5 times a year to conceal their grey hairs. Even though small percentage were not satisfied with the outcome, they continued the use of hair dyes. A very small percentage of students used exotic color to look fashionable.

Hair dyeing products can cause various adverse effects, including allergic contact dermatitis.[10] In addition, an association with cancer and other systemic disease has also been suggested.[11,12,13,14] Among the composition of hair dye, PPD is known as the primary substance that causes allergic contact dermatitis. In this study, we had observed adverse reactions in 42%. They were itching on the scalp, hair loss and hair breakage, redness on the scalp, conjunctivitis, pigmentation and ulceration other than scalp and headache. Despite such experiences 89% (98/110) continued hair dyeing. This is another alarming issue because the overuse or misuse of hair dyes is damaging to the hair. Only 10% of the volunteers performed a skin test overall. They also continued the use of hair dyes during pregnancy (54/94). Several studies suggest that toxic chemicals in hair products may be absorbed through the scalp in sufficient amounts to increase the risks of adverse health effects in women and their infants.[15] Studies have suggested an association between maternal hair dye use and elevated risk of cancer like neuroblastoma in offsprings.[16]

The results suggest that most of the people who used hair dyes have insufficient knowledge of hair dye products. Hair dye reactions are usually diagnosed by the patients themselves and studies have shown that 0.1-1% of the patients are sensitized to PPD.[17] Many cases of dermatitis due to hair dye may be overlooked, but severe dermatitis may sometimes last for a longer period of time and may be serious. This study shows that the level of awareness was fairly low. It is important that the hair dye users have proper knowledge about the contents of the product, the method of their use by following the instructions given on the package insert and be aware about their various side-effects. They should be encouraged to use natural products, which have fewer side-effects.

## CONCLUSION

In our study, hair dyeing was started at an early age. Irrespective of their economic and education status volunteers dyed their hair which emphasizes the importance given to appearance. Majority used semi-permanent dyes even though they perceived natural dyes were safe. They continued dyeing despite adverse reactions which indicates cosmetic importance.

## Footnotes

**Source of Support:** Nil

**Conflict of Interest:** Nil.

## REFERENCES

1. Handa S, Mahajan R, De D. Contact dermatitis to hair dye: An update. *Indian J Dermatol Venereol Leprol*. 2012;78:583–90. [PubMed: 22960813]

2. Lewis D, Mama J, Hawkes J. A review of aspects of oxidative hair dye chemistry with special reference to n-nitrosamine formation. *Material*. 2013;6:517–34.
3. Bhargava P, Matthew P. Hair dye poisoning. *J Assoc Physicians India*. 2007;55:871–2. [PubMed: 18405138]
4. Abdelraheem M, Hamdouk M, Zijlstra EE. Paraphenylenediamine (Hair Dye) poisoning in children. *Arab J Nephrol Transplant*. 2010;3:39–43.
5. Nohynek GJ, Antignac E, Re T, Toutain H. Safety assessment of personal care products/cosmetics and their ingredients. *Toxicol Appl Pharmacol*. 2010;243:239–59. [PubMed: 20005888]
6. Søstved H, Hesse U, Menné T, Andersen KE, Johansen JD. Contact dermatitis to hair dyes in a Danish adult population: An interview-based study. *Br J Dermatol*. 2005;153:132–5. [PubMed: 16029338]
7. Kim JE, Jung HD, Kang H. A survey of the awareness, knowledge and behavior of hair dye use in a Korean population with gray hair. *Ann Dermatol*. 2012;24:274–9. [PMCID: PMC3412235] [PubMed: 22879710]
8. AlGhamdi KM, Moussa NA. Knowledge and practices of, and attitudes towards, the use of hair dyes among females visiting a teaching hospital in Riyadh, Saudi Arabia. *Ann Saudi Med*. 2011;31:613–9. [PMCID: PMC3221134] [PubMed: 22048508]
9. Kim DW, Shin DJ, Lee SJ, Chung SL, Kim JC. Statistical and clinical study of gray hair. *Korean J Dermatol*. 1999;37:1567–75.
10. Chey WY, Kim KL, Yoo TY, Lee AY. Allergic contact dermatitis from hair dye and development of lichen simplex chronicus. *Contact Dermatitis*. 2004;51:5–8. [PubMed: 15291824]
11. Thun MJ, Altekruse SF, Namboodiri MM, Calle EE, Myers DG, Heath CW., Jr Hair dye use and risk of fatal cancers in U.S. women. *J Natl Cancer Inst*. 1994;86:210–5. [PubMed: 8283493]
12. Mendelsohn JB, Li QZ, Ji BT, Shu XO, Yang G, Li HL, et al. Personal use of hair dye and cancer risk in a prospective cohort of Chinese women. *Cancer Sci*. 2009;100:1088–91. [PMCID: PMC2768318] [PubMed: 19385970]
13. Andrew AS, Schned AR, Heaney JA, Karagas MR. Bladder cancer risk and personal hair dye use. *Int J Cancer*. 2004;109:581–6. [PubMed: 14991581]
14. Grodstein F, Hennekens CH, Colditz GA, Hunter DJ, Stampfer MJ. A prospective study of permanent hair dye use and hematopoietic cancer. *J Natl Cancer Inst*. 1994;86:1466–70. [PubMed: 8089866]
15. Blackmore-Prince C, Harlow SD, Gargiullo P, Lee MA, Savitz DA. Chemical hair treatments and adverse pregnancy outcome among black women in central North Carolina. *Am J Epidemiol*. 1999;149:712–6. [PubMed: 10206620]
16. McCall EE, Olshan AF, Daniels JL. Maternal hair dye use and risk of neuroblastoma in offspring. *Cancer Causes Control*. 2005;16:743–8. [PubMed: 16049813]
17. Schäfer T, Böhler E, Ruhdorfer S, Weigl L, Wessner D, Filipiak B, et al. Epidemiology of contact allergy in adults. *Allergy*. 2001;56:1192–6. [PubMed: 11736749]

## Figures and Tables

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**Table 1**

| Variables               | Frequency (%) |
|-------------------------|---------------|
| Gender                  |               |
| Females                 | 52.5          |
| Males                   | 47.5          |
| Mean age years (SD)     | 32.4±6.01     |
| Marital status          |               |
| Single                  | 91 (34.6)     |
| Married                 | 172 (65.4)    |
| Educational status      |               |
| Illiterate              | 42 (16)       |
| High school             | 82 (31.2)     |
| University (PUC/degree) | 139 (52.9)    |
| Occupation              |               |
| Unemployed              | 42 (16)       |
| Employed                | 191 (72.6)    |
| Student                 | 30 (11.4)     |
| Monthly income (Rs.)    |               |
| <15,000                 | 62 (26.6)     |
| 15,000-30,000           | 105 (45)      |
| 30,000-45,000           | 50 (21.4)     |
| >45,000                 | 16 (6.8)      |

PUC – Pre-university course; SD – Standard deviation

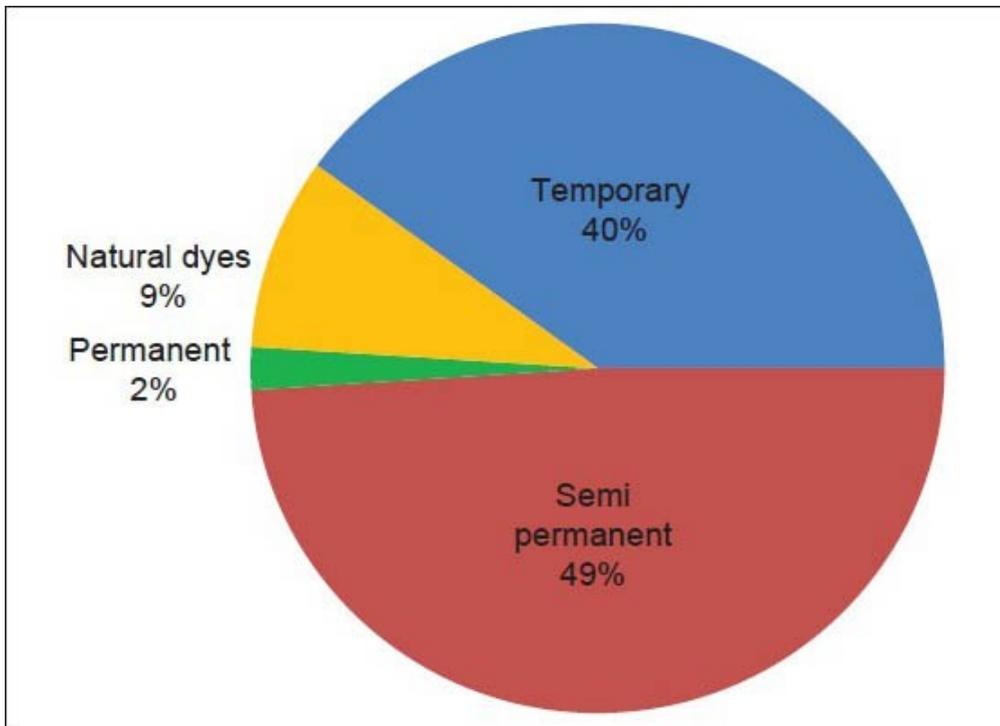
Demographic data

**Table 2**

| Variables                               | Frequency % |
|---|-------------|
| Hair dyeing was unsafe                  | 76          |
| Believed that dyeing would cause cancer | 57          |
| Natural dyes were safe                  | 46          |
| Synthetic dyes were safe                | 37          |
| Temporary were safe                     | 42.5        |
| Semi-permanent were safe                | 41          |
| Permanent were safe                     | 13.5        |

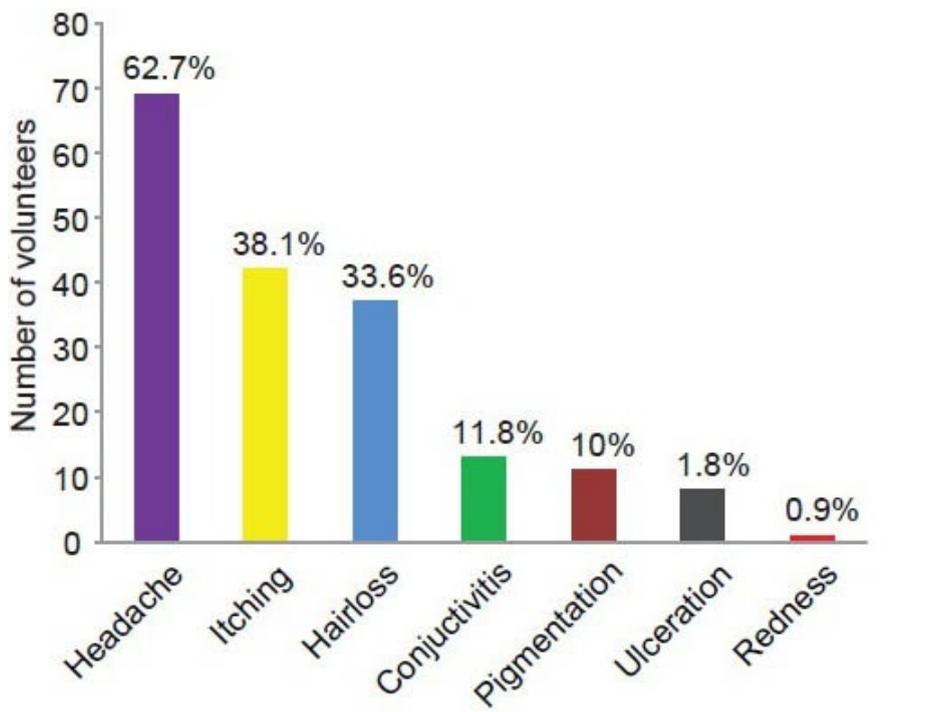
Knowledge of use of hair dye

**Figure 1**



Types of hair dyes

Figure 2



Adverse reactions to hair dyes

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