

THE PATTERN OF HAIR DYE USAGE AND SIDE EFFECTS ENCOUNTERED IN INDIAN POPULATION

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DOI: [10.5281/zenodo.12069751](https://doi.org/10.5281/zenodo.12069751)

Abstract

Background: Canities are a very common cosmetic concern in the present world. It is one of the earliest signs of ageing. Most people try to counter gray hair by concealing it with hair dye. There is a diverse selection of hair dye products accessible in the Indian market. Most of the hair dyeing products available in the Indian market are either temporary or semi-permanent dyes. Among the ingredients in hair dye, para-phenylenediamine, m-aminophenol, p-methyl-aminophenol, and propylene glycol are the key ingredients known to cause adverse effects. **Aim & Objective:** The objective of this study is to assess the pattern of hair dyeing among the Indian population, the side effects commonly seen, and the awareness of the general population to seek medical help. **Materials & Methods:** It is a questionnaire-based cross-sectional descriptive survey. A total of 100 participants, both male and female, above 18 years of age with grey hair, were included in the study. Participants below 18 years of age, and those who were unwilling to participate in the study were excluded. The statistical analysis was conducted employing SPSS version 20, with a significance threshold set at 0.05. The survey items that did not have any significant consequences were eliminated from subsequent statistical analysis and interpretations. **Results:** The study population included 52% females and 48% males and the mean age of the investigation population was 41.54 years. The most common age of onset of grey hair in the study population was between 31 to 40 years of age. 81% of people had resorted to hair dyeing to cover their grey hair. Around 35.8% of people reported that they started coloring their hair between 31 to 40 years of age. Of these people, the most common symptom observed was itching in 73.4% followed by eye irritation in 38.7% of people. Other symptoms noted include scaling, vesicles or oozing, erythema, and pigmentation. 87.7% of the people who had experienced side effects reported that they continued dyeing their hair occasionally or using different products. **Conclusion:** Even though a majority of the patients had experienced side effects, many of them lacked the awareness to seek medical help and continued to use different products or methods to change their hair color.

Keywords: Canities, Hair dyes, Adverse effects.

INTRODUCTION

Grey hair is a natural process by which hair starts losing its color due to partial or total loss of melanocytes in the hair follicle. It is one of the earliest signs of ageing. In medical terms, this is referred to as Canities or Achromotrichia. Apart from the natural process of ageing, there are various other factors like the use of chemicals in various hair care products, environmental factors, diet, etc... that have contributed to greying and premature greying in many people. The mean age at which hair greying occurs in

the Indian population is 30 years [1]. The age of onset of greying has shown association with paternal and maternal genetics in many studies [2, 3].

The melanin unit of a hair follicle consists of a single melanocyte connected to five keratinocytes in the hair bulb and one melanocyte attached to one keratinocyte in the basal layer of the hair bulb matrix [4]. Melanocytes originate from the neural crest and differentiate into either DOPA oxidase-positive cells that express tyrosinase, or DOPA oxidase-negative cells, depending on the specific location inside the hair follicle where they land [5]. Melanocytes that reach the bulb of anagen hair generate tyrosinase and undergo pigmentation. Hair follicles that are located within the outer root sheath (ORS) do not contain melanin. The amelanogenic or non-melanized melanocytes act like stem cells, replenishing the melanogenic melanocytes when their numbers decrease [6].

In many cultures, healthy pigmented hair is viewed as an aesthetically pleasing aspect, which is considered a sign of youth. This makes for a significant psychological impact on many individuals, making them ultimately opt for treatment or camouflaging techniques, hair dyeing being the most common method used. Hair dyeing is the practice of applying natural and/or artificial chemical compounds to the hair targeting a change in its colour. Artificial hair color is often classified into three main categories: permanent, semi-permanent, and temporary (USFDA, 2014).

Temporary hair colors consist of bigger molecules that cannot enter the cortex, while semi-permanent hair dyes contain smaller molecules that can easily enter the cortex but are easily washed away in successive washes [7]. When using permanent hair dye, the tiny dye precursors enter the inner layer of the hair and conduct a chemical reaction to create larger colored molecules. These molecules tend to remain inside the inner layer of the hair and are unlikely to spread to other parts [8]. Most of the hair dyeing products available in the Indian market are either temporary or semi-permanent dyes. Hair dye products may result in several adverse effects, including allergic contact dermatitis [9, 10], presenting with symptoms like pruritus, redness, dryness, burning sensation, and soreness. This study aimed to assess the pattern of hair dyeing among the Indian population, the side effects commonly seen, and the awareness of the general population to seek medical help.

MATERIALS & METHODS

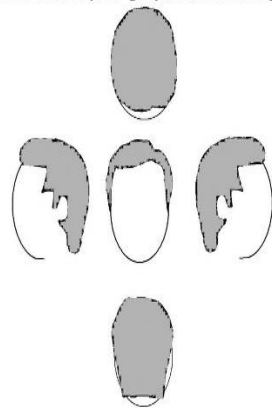
The present research is a descriptive cross-sectional investigation that used a questionnaire to collect data. It was conducted in a tertiary care centre in a semi-urban area among patients and other patients. The study included participants above 18 years of age, both male and female, with grey hair, irrespective of the use of hair coloring products. Individuals under the age of 18 and those unwilling to participate in the study are excluded. This already validated questionnaire was adopted and modified by Kim JE et al [11]. It consisted of four parts, each of which recorded the basic details of the patient, clinical presentation of grey hair, the use of hair dye products and the incidence of side effects respectively (Figure 1). A detailed history was taken and a very careful record of all the symptoms experienced by the subjects made. Statistical analysis was made using SPSS version 20 and the level of significance was set at 0.05. The survey items that had no significant implications were excluded from further statistical analysis and interpretations.

1. Demographics and the basic information of the surveyed subjects

- 1) What is your gender? (female, male) 2) How old are you?
- 3) Have you ever had or do you have a systemic disease (yes, no)?
- 4) If "yes" to No.3, write down the name of disease.
- 5) Have you ever had or do you currently have a skin disease (yes, no)?
- 6) If "yes" to No.5, write down the name of disease.

2. Clinical findings of gray hair and the related information

- 1) When did you detect your gray hair for the first time
- 2) Have you ever been stressed out because of your gray hair (yes, no)?
- 3) What is your hair graying pattern (partial, overall)?
- 4) If it is partial, mark the location of your gray hair on the figure.



3. Use or non-use of hair coloring products and the status of use

- 1) Have you ever colored your hair because of gray hair (yes, no)? If you do not color your hair, please quit the survey.
- 2) If yes, what was the reason (to look younger, by strong recommendation of the people around me, to keep good impression, other)?
- 3) How old were you when you colored your graying hair for the first time?
- 4) How often do you color your graying hair?
- 5) Write down the brand name of the hair dyeing products you use most frequently. If you don't know the brand, choose it on the annexed paper.

4. Hair dyeing related side effects and the status of recognizing side effects

- 1) Have you ever experienced side effects after coloring your gray hair (yes, no)?
- 2) If yes, what kind of symptoms did you have Choose all answers (itching, erythema, scales, vesicles and/or oozing, eye irritation, eyelid and/or facial swelling, other)?
- 3) Have you ever had medical treatment at the hospital for side effects of hair dyeing (yes, no)?
- 4) If "no" to No. 3, why?
- 5) Do you still color your hair even after experiencing side effects (yes, sometimes, never, use a different method, other)?
- 6) If you still color your hair even after experiencing side effects, why (side effects are minor, Side effects are serious but I don't want gray hair, It's ok to do it occasionally, I like this way best, other)?
- 7) Have you ever changed your tint because of side effects (yes, no)?
- 8) If "yes" to No. 7, write down the brand before and after changing your tint.
- 9) Have you had side effects even after changing the hair dyeing products (yes, no)?
- 10) If "yes" to No. 9, what kind of symptoms did you have (pruritus, erythema, scales, vesicle and/or oozing, eye irritation, eyelid and/or facial swelling, other)?
- 11) Are you going keep coloring your hair in the future (yes, no)?

Figure 1: A questionnaire about the awareness, knowledge and behavior of hair dye use

RESULTS

Demographics and associated disorders: The study population included 52% females and 48% males and the mean age of the investigation population was 41.54 years. Around 55% of the study population reported the presence of co-morbidities, the most common being diabetes mellitus followed by hypertension. 16% of the study subjects had a history of dermatological complaints (table 1).

Table 1 : Frequency distribution of demographic data of the study Population

Demographic Data		Frequency (N=100)	Percent
Age distribution	21 – 30 years	26	26.0
	31 – 40 years	24	24.0
	41 – 50 years	30	30.0
	51 – 60 years	11	11.0
	60 years	9	9.0
Age		41.54 (Mean)	11.94 (SD)
Gender	Male	48	48.0
	Female	52	52.0
Any other co-morbidities	No	45	45.0
	Diabetes Mellitus	22	22.0
	Asthma	07	7.0
	Epilepsy	03	3.0
	Hypertension	16	16.0
	Myasthenia gravis	01	1.0
	Renal/Hepatic insufficiency	01	1.0
	Thyroid dysfunction	04	4.0
	Tuberculosis	01	1.0
H/O any dermatological disease	No	84	84.0
	Psoriasis	05	5.0
	Acne	03	3.0
	Allergic condition	02	2.0
	Dandruff	03	3.0
	Xerosis	03	3.0

Canities-related demographics: The most common age of onset of grey hair in the study population was between 31 to 40 years of age, which accounts for about 35% and around 26% people reported onset between 41 to 50 years of age.

83% reported partial greying while 17%, all of whom were above 50 years reported complete greying of hair. Among the patients with partial patterns of greying, around 29% of people had greying in more than one region of the scalp.

As evident, the partial pattern of hair greying was much more common than complete hair greying. As far as the focal distribution of grey hair is concerned, the frontal and vertex regions of the scalp showed the highest distribution with 18% and 17% respectively.

The least common patterns included greying predominantly in the left temporal region, accounting for 9% and 5% each in the right temporal and occipital regions (table 2).

Table 2: Frequency distribution of Graying of hair and dye usage in the study Population

S.no	Hair questionnaires	Frequency (N=100)	Percent	
1)	When did you detect your grey hair for the first time?	< 10 years	05	5.0
		11 – 20 years	08	8.0
		21 – 30 years	22	22.0
		31 – 40 years	35	35.0
		41 – 50 years	26	26.0
		>50 years	04	4.0
2)	Have you ever been stressed out because of your grey hair?	Yes	66	66.0
		No	34	34.0
3)	What is your hair greying pattern?	Complete	17	17.0
		Partial	83	83.0
4)	If it is Partial, Location? (N=83)	Vertex	17	17.0
		Frontal	18	18.0
		Right temporal	05	5.0
		Left temporal	09	9.0
		Occipital	05	5.0
		Mixed	29	29.0
5)	Have you ever coloured your hair because of grey hair?	Yes	81	81.0
		No	19	19.0

The pattern of hair dyeing: Of the study population, 81% of people had resorted to hair dyeing to cover their grey hair. Around 35.8% of people reported that they started coloring their hair between 31 to 40 years of age. And 61.7% have used leaves, fruits, and food products to color their hair (table 3).

Table 3: Frequency distribution of subjects based on Hair dye usage

S.no	Hair questionnaires	Frequency (N=81)	Percent	
1)	If you had colored your hair, what was the reason?	By strong recommendation of people around	08	9.8
		Self confidence	12	14.8
		To create a good impression	43	53.1
		To look younger	18	22.2
2)	How old were you when you coloured your hair for the first time?	11 – 20 years	02	2.4
		21 – 30 years	27	33.3
		31 – 40 years	29	35.8
		41 – 50 years	19	23.4
		51 – 60 years	04	4.9
3)	Have you ever used products like leaves, fruits or food products to color your hair?	Yes	50	61.7
		No	31	38.3

Side effects and their recurrence: A significant 60.5% of people reported side effects following hair dye usage. Of these people, the most common symptom observed was itching in 73.4% followed by eye irritation in 38.7% of people. Other symptoms noted include scaling, vesicles or oozing, erythema, and pigmentation (table 4).

Table 4: Distribution of subjects based on type of side effects:

Adverse effects	Number of subjects (%)	
	Adverse effects after hair dyeing (N=49)	Adverse effects after using different hair color product (N=26)
Itching	36 (73.4)	17 (65.3)
Erythema	4 (8.1)	1 (3.8)
Eye Irritation/ Eyelid or Facial Swelling	19 (38.7)	5 (19.2)
Scaling	11 (22.4)	10 (38.4)
Vesicles or oozing	5 (10.2)	4 (15.3)
Pigmentation	3 (6.1)	2 (7.6)

Only 44.9% of people had sought medical advice for their complaints. 87.7% of the people who had experienced side effects reported that they continued dyeing their hair occasionally or using different products (table 5).

Table 5: Frequency distribution of behavioural pattern post hair dye usage and awareness to seek medical help

S.no	Hair questionnaires	Frequency (N=49)	Percent	
1)	Have you ever had medical treatment at the hospital for side effects of hair dyeing?	Yes	22	44.9
		No	27	55.1
2)	Do you still colour your hair even after experiencing side effects?	Never	6	12.2
		Sometimes	20	40.8
		Regularly	23	46.9
3)	Have you ever changed your tint because of side effects?	Yes	37	75.5
		No	12	24.5
4)	Are you going to keep colouring your hair in future?	Yes	41	83.6
		No	8	16.3

Many patients who experienced side effects reportedly changed to a different hair color tint or product. Of patients who changed the hair dye product, about 70.2% experienced side effects (table 6). The most common side effect among this particular population was again pruritus, seen in 65.3% followed by scaling in 38.4% each.

Table 6: Distribution of subjects based on adverse effects post hair dye usage

Occurrence of adverse effect	Initial use of hair dye (N=81)		Post changing hair dye products (N=37)	
	Frequency	Percent	Frequency	Present
Yes	49	60.5	26	70.2
No	32	39.5	11	29.7

DISCUSSION

With the increase in life expectancy of humans combined with a renewed focus on aesthetics, many people resort to hair coloring. The wide range of hair color options available and their easy availability are also a major factor. The use of hair dye can lead to several adverse effects, including contact dermatitis, hair loss, hyperpigmentation, and leukoderma. In severe cases, exposure to PPD in hair dye can lead to systemic toxicities, including kidney failure requiring dialysis, rhabdomyolysis, severe electrolyte imbalances, myocardial infarction, and anaphylaxis, potentially leading to death, have been reported [12,13]. The long-term use of dark hair dye has been linked to a heightened risk of cancer in several studies [14, 15].

Our study consisting of 100 subjects was a major eye-opener in understanding the way the general population viewed and used hair dye. While the average age of our investigation population was 41.54 years, the mean age of greying in Indians is reported to be 30 years by few studies [1], the average age of onset of grey hair in our investigation was found to be 33.1 years.

No significant correlation of side effects to hair dye due to any medical or dermatological condition could be inferred from this study. Around 66% reported that they were stressed because of their grey hair. This was more common in younger age groups and in the female population. A majority of 81% of people resorted to dyeing their hair at some point and the main reason was to create a good impression.

Among the ingredients in hair dye, para-phenylenediamine, m-aminophenol, p-methyl-aminophenol, and propylene glycol are the key ingredients known to cause allergic contact dermatitis [16]. In many previous studies, the prevalence of side effects from hair dye has been assessed using patch testing with para-phenylenediamine.

However, a positive patch test result does not equate to the prevalence of hair dye allergy [17]. During the study, it was also found that around 61.7% of people who used hair dye, had tried natural products like leaves or fruits at least on some occasion. The most common product used was Henna leaves followed by tea leaves. On further questioning, many of them opted for natural products as they believed they caused lesser side effects and others viewed it as a cheaper alternative.

The most common symptom was pruritus yet it was the most overlooked symptom and needed careful questioning to elicit the history. Some people believed that pruritus directly correlated to the onset of action of the hair dye.

Even though, the survey was conducted in a semi-urban setting, more than half the population who experienced side effects (around 55.1%), failed to seek medical intervention for their adverse reactions. In spite of the side effects, many people continued to colour their hair as most patients recounted to have experienced only minor side effects.

This suggests that despite the high incidence of side effects from hair dye usage, there is still a low level of awareness regarding the importance of seeking medical attention for these issues. Recently, a new derivative of para-phenylenediamine, 2-methoxymethyl-para-phenylenediamine, has been developed and investigated to ensure safer hair dye use [18].

CONCLUSION

This study clearly indicates that while there is a high incidence of side effects post hair dye usage, the awareness to seek medical attention for the same is quite low. Also, people are persistent in their desire to achieve a younger look. Education about safer alternatives and the need to test for sensitivity against any component of hair dye prior to their use can also help.

LIMITATIONS

Limitations of the study include small sample size of 100 participants, potentially limiting the generalizability of the findings, and reliance on self-reported data, which may be subject to recall bias

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