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Original article

Practice and Impact of Hair Dyeing; A Local Study

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Abstract

Background: Hair dying has become a common practice among men and women. However, hair dye can be associated with several adverse effects varying from mild to severe reactions. Therefore, the study's main objective was to assess public practice, perception, and experienced complications of hair color treatments in Al-Ahsa region in Saudi Arabia. ***Methodology:*** A cross-sectional study was conducted on 355 male and female subjects among a single city population in Saudi Arabia; An online questionnaire was distributed to male and female subjects to evaluate the practice and impact of hair color usage. The questionnaire constituted three sections: biographical data, dye usage attitude, and awareness and knowledge about dye and its effects. Data were analyzed using descriptive analysis using Statistical Package for the Social Sciences (SPSS) v22. Results with a P value less than 0.05 were considered statistically significant. ***Results:*** Among 355 participants, 212 (59.7%) reported using hair dyes. The age of hair dye users averaged 36.1 ± 12.9 years old. The majority of dye users were females, 165 (77.8%). Most of them (29.2%) started using hair dyes at 20-25 years old. The frequency of dye usage, 91 (42.9%) dye their hair once a year. Additionally, 109 (51.4%) of subjects dye their hair by themselves at home. Hair colors have been used for various reasons, and the most common is to disguise grey hair and look younger, 97 (45.8%). 166 (78.3%) participants believe that non-chemical or herbal hair dyes are safer than chemical ones. Moreover, hair dye-caused side effects in 42 (19.8%) participants, with itching being the most common side effect (47.6 %). ***Conclusion:*** Our study found that hair dyeing is widely used for different purposes, and inappropriate beliefs and practices were detected among participants. Health education on hair-dying products must be improved to enhance the public's awareness of ingredients and side effects. Furthermore, an informative tool designed by experts will help individuals use hair coloring products safely and appropriately.

Keywords: ***Hair dye, Hair coloring, Allergic reaction, PPD.***

Introduction

Since lookism is prevalent in all societies, people have become more concerned with their looks and appearances [1]. Consumers of cosmetic products consider using these products safe since there are several steps to be taken by manufacturers before they are allowed to sell their cosmetics in markets [2]. Hair expresses attractiveness, health, and beauty. Hair dyeing has become popular among men and women looking for such values or fashion trends [3]. Hair dyeing can be associated with adverse effects, including contact dermatitis, urticaria, and systemic allergic reactions, including bronchospasm [4]. Hair dyeing, nowadays, is considered a way of style and self-expression, in addition to its historical use to mask aging [5-6]. This article aims to assess the practice, attitude, and perception of hair color treatments in a local population in Saudi Arabia.

Method

A qualitative cross-sectional anonymous questionnaire-based study was performed among the adult population of Al-Ahsa region, Saudi Arabia. The questionnaire used in this study was obtained from a previous study in the literature with similar research objectives [1]. The data was collected in a period between June - august 2021. Informed consent was obtained electronically at the beginning of the survey from all enrolled participants. Those younger than 18 years of age and not living in Al-Ahsa were excluded.

The extracted data was revised, coded, and fed to statistical software IBM SPSS version 22 (SPSS, Inc. Chicago, IL). All statistical analyses were done using two-tailed tests, and a P-value less than 0.05 was considered statistically significant. Descriptive analysis based on frequency and percent distribution was done for all variables, including the prevalence of using hair dyes among study participants and the most used dyes. Moreover, hair dye users' bio-demographic data, use pattern, side effects after hair dye use, and medical consultation were also tabulated. Crosstabulation was used to assess hair dye-associated side effects distribution by users' demographic data and use patterns. Significance of relation was tested using the Pearson chi-square test and exact probability test in case of small frequency distributions.

Ethical approval was obtained from the Institutional Research Board (IRB) and the Research Ethics Committee of King Faisal University in Al-Ahsa, Saudi Arabia.

Results

The exact 212 (59.7%) reported using hair dyes, while 143 (40.3%) denied using any hair dyes in their life.

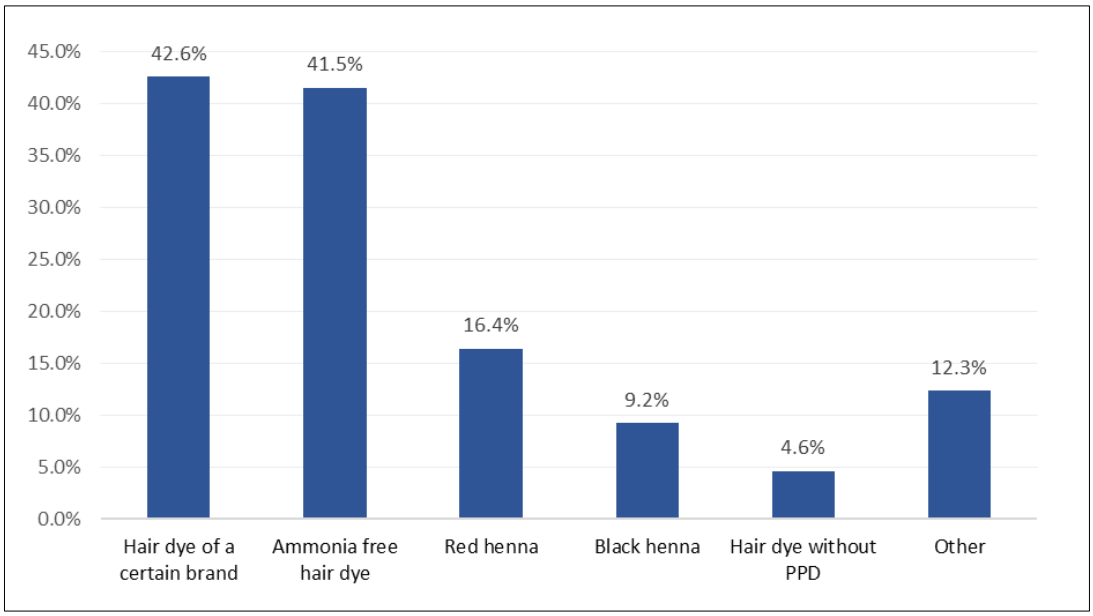

Figure 1: The most commonly used hair dyes among participants.

The most-reported used hair dyes were regular hair dyes of a particular brand (42.6%), followed by ammonia-free hair dye (41.5%), red henna (16.4%), black henna (9.2%), and hair dye without PPD (4.6%) (**Figure 1**).

Table 1: Socio-demographic data of hair dye users.

Socio-demographic data	**No**	**%**
Age in years		
< 20	13	6.1%
21-30	54	25.5%
31-40	56	26.4%
41-50	56	26.4%
51+	33	15.6%
Gender		
Male	47	22.2%
Female	165	77.8%
Educational level		
Below university	69	32.5%
University / above	143	67.5%
Marital status		
Single	43	20.3%
Married	160	75.5%
Divorced / widow	9	4.2%
Work		
Not working	56	26.4%
Student	46	21.7%
Employed	89	42.0%
Retired	21	9.9%

The age of hair dye users ranged from 18 to more than 60 years, with a mean age of 36.1 ± 12.9 years old. The exact 165 (77.8%) of the hair dye users were females, and 143 (67.5%) had a university level of education or above. Considering marital status, 160 (75.5%) were married, and 43 (20.3%) were single. As for work, 89 (42%) were employed, and 46 (21.7%) were students. An exact 17 (8.1%) complained of G6PD deficiency. (**Table 1**)

Table 2: Pattern of hair dye use among dye users.

The pattern of hair dyes use		**No**	**%**
How old were you when you first started dyeing your hair?	< 20	54	25.5%
	20-25	62	29.2%
	26-30	35	16.5%
	31-35	21	9.9%
	36-40	17	8.0%
	41-45	12	5.7%
	46-50	5	2.4%
	> 50	6	2.8%
Duration of using hair dyes	< 6 months	78	36.8%
	6-12 months	40	18.9%

	1-5 years	29	13.7%
	6-10 years	26	12.3%
	11-20 years	23	10.8%
	> 20 years	16	7.5%
Frequency of using hair dyes/year	> 6 times / year	55	25.9%
	5-6 times/year	17	8.0%
	2-4 times/year	49	23.1%
	Once / year	91	42.9%
The time period between frequent use of hair dyes	< 2 weeks	11	5.2%
	2-4 weeks	27	12.7%
	1-2 months	36	17.0%
	2-6 months	34	16.0%
	6-12 months	26	12.3%
	1 year	18	8.5%
	2 years	12	5.7%
	Irregular	48	22.6%
Where do you use hair color treatment?	At home by myself	109	51.4%
	At home by another one	49	23.1%
	In the saloon	54	25.5%
Causes of using hair color treatment	To look younger/hide greying	97	45.8%
	Fashion/Change Colour	89	42.0%
	Others	26	12.3%

54 (25.5%) of participants started using hair dyes below the age of 20 years, 62 (29.2%) started to use at the age of 20-25 years old, while 35 (16.5%) started hair dye use at the age of 26-30 years old. Regarding the duration of using hair dyes, 78 (36.8%) used the dyes for less than six months, 40 (18.9%) used dyes for 6-12 months, and 29 (13.7%) used dyes for 1-5 years, while 16 (7.5%) used dyes for more than 20 years. Regarding the frequency of hair dye use, 55 (25.9%) use hair dyes more than six times per year, while 91 (42.9%) use dyes once per year. Considering the period between frequent use of hair dyes, 48 (22.6%) use it irregularly, 11 (5.2%) use it every two weeks, and 36 (17%) use hair dyes every 1-2 months. Regarding the setting of hair dye application, 109 (51.4%) apply hair dyes at home by themselves and 54 (25.5%) at a salon. As for causes of hair dyes, 97 (45.8%) reported looking younger/hiding grey hair, and 89 (42%) reported fashion and changing color as a cause. (**Table 2**).

Table 3: Perception and awareness regarding hair dyes.

Perception & awareness	**No**	**%**
Using hair color treatment is safe.		
Yes	58	27.4%
No	92	43.4%
Don't know	62	29.2%
Hair color treatment causes cancer		
Yes	41	19.3%
No	44	20.8%
Don't know	127	59.9%
Hair color treatment can be used during pregnancy and lactation		
Yes	36	17.0%
No	119	56.1%
Don't know	57	26.9%
Which hair color treatment is safer		
herbal	166	78.3%
Manufactured/Chemical	5	2.4%
Don't know	41	19.3%

58 (27.4%) of hair dye users think hair color treatments are safe, while 41 (19.3%) think it causes cancer. An exact 119 (56.1%) said that hair color treatment could not be used during pregnancy and lactation. Furthermore, 166 (78.3%) of users think that non-chemical/herbal hair dyes are safer, while only 5 (2.4%) think chemical dyes are safer. (**Table 3**)

Table 4: Side effects of using hair dyes among users.

Side effects	**No**	**%**
Have you had an allergy test before using hair dye?		
Yes	40	18.9%
No	172	81.1%
Do you read the instruction manual before using hair dye?		
Yes	161	75.9%
No	51	24.1%
Have you ever experienced any side effects when using hair dye?		
Yes	42	19.8%
No	170	80.2%

If yes, what are the complications		
Itching	20	47.6%
Skin redness	7	16.7%
Swelling	2	4.8%
Hair loss	9	21.4%
Others	4	9.5%
If yes, consulted a physician		
Yes	10	23.8%
No	32	76.2%
If not, why?		
Symptoms were not severe	15	48.4%
It is normal to have side effects	11	35.5%
Self-treatment	4	12.9%
Others	1	3.2%
Are you still using hair dye even after experiencing side effects?		
Still using the same brand	13	31.0%
Shifted to another brand	11	26.2%
Shifted to herbal dyes	8	19.0%
Stopped using hair dyes	10	23.8%

42 (19.8%) of the study participants experienced side effects due to hair dye use. The most commonly reported side effects were itching (47.6%), followed by hair loss (21.4%), skin redness (16.7%), and others (9.5%). A total of 10 (23.8%) consulted a physician. Those who did not consult a physician reported that symptoms were not severe (48.4%); of them, 35.5% think that it is normal to have side effects, and 12.9% tried to treat themselves at home. As a result of experiencing side effects, 13 (31%) continued using the same brand, 11 (26.2%) shifted to another brand, 8 (19%) shifted to herbal/organic dyes, but 10 (23.8%) stopped using hair dyes. A total of 161 users (75.9%) read the instruction manual before using hair dye, and 40 (18.9%) have tried to verify the absence of allergic contact dermatitis by applying the dye on a smaller area before the regular application on the hair of the whole scalp before using hair dye. (**Table 4**)

Table 5: Distribution of hair dye associated side effects by users' demographic data and use pattern.

Factors	**Have you ever experienced any side effects when using hair dye?**				**p-value**
	Yes		**No**		
	No	**%**	**No**	**%**	
Age in years					.006*
< 20	0	0.0%	13	100.0%	
21-30	4	7.4%	50	92.6%	
31-40	12	21.4%	44	78.6%	
41-50	18	32.1%	38	67.9%	
51+	8	24.2%	25	75.8%	
Gender					.897
Male	9	19.1%	38	80.9%	
Female	33	20.0%	132	80.0%	
Duration of using hair dyes					.136
< 6 months	17	21.8%	61	78.2%	
6-12 months	4	10.0%	36	90.0%	
1-5 years	4	13.8%	25	86.2%	
6-10 years	4	15.4%	22	84.6%	
11-20 years	7	30.4%	16	69.6%	
> 20 years	6	37.5%	10	62.5%	
Frequency of using hair dyes/year					.005*
> 6 times / year	19	34.5%	36	65.5%	
5-6 times/year	5	29.4%	12	70.6%	
2-4 times/year	6	12.2%	43	87.8%	
Once / year	12	13.2%	79	86.8%	
Time period between frequent use of hair dyes					.020*$
< 2 weeks	0	0.0%	11	100.0%	
2-4 weeks	11	40.7%	16	59.3%	
1-2 months	9	25.0%	27	75.0%	
2-6 months	9	26.5%	25	73.5%	
6-12 months	5	19.2%	21	80.8%	
1 year	1	5.6%	17	94.4%	
2 years	1	8.3%	11	91.7%	
Irregular	6	12.5%	42	87.5%	

Have you had an allergy test (or have you tried to verify the absence of allergy) before using hair dye?					.684
Yes	7	17.5%	33	82.5%	
No	35	20.3%	137	79.7%	
Do you read the instruction manual before using hair dye?					.718
Yes	31	19.3%	130	80.7%	
No	11	21.6%	40	78.4%	

*P: Pearson X2 test; $: Exact probability test; * P < 0.05 (significant)*

Side effects as 32.1% among users aged 41-50 years compared to none of those aged less than 20 years with recorded statistical significance (P=.006). Moreover, 34.5% of those who use hair dyes more than six times per year experienced side effects compared to 13.2% of others who use dyes annually (P=.005). Additionally, 40.7% of users who apply hair dyes every 2-4 weeks had side effects compared to 8.3% who apply them in two-year intervals (P=.020). (**Table 5**)

Discussion

Hair reflects beauty, health, and attractiveness [7-9]. According to a Danish population-based study, around 75% of women and 18% of men used hair coloring products at some point in their lives [4]. Herbal hair dyes were used, but recently, various types have been created as the cosmetic industry progresses [10]. The different types include the temporary dyes containing large molecules too big to penetrate but only cover the shaft however, the semi-permanent with small molecules containing aromatic amines. In additional type, the oxidative dyes are permanent with the smallest molecules [11]. Permanent hair dyes are the most popular, accounting for 70% of all hair dyes used [11-13]. In a cross-sectional study about hair dye conducted in Saudi Arabia, 82.6% of participants had dyed their hair at some point in their lives [14]. Furthermore, 69.3% had dyed their hair in the last 12 months, with 76.8% using permanent dyes [14]. The defined routine of coloring or dyeing hair at home has been reduced, and there has been an increase in visiting salons for coloring hair [7]. The difference is that the participants feel that professional hair coloring gives a better result [5]. Additionally, hair salons are more convivial and interactive socially [6].

Our study showed that more than half (59.7%) of participants had previously used hair dyes. The most used hair dyes were over-the-counter hair dyeing brands, ammonia-free dyes, red henna, black henna, and PPD-free hair dyes. Similarly, in Europe and the United States, it has been found that more than one-third of women above the age of 18 and nearly 10% of men over the age of 40 use some type of hair dye to change and renew their hair color when graying has appeared [15-18]. A total of 58 (27.4%) of the users believe that hair color treatment is safe, while 92 (43.4%) users think that hair color treatment is not safe. AlGhamdi et al. have found that more than 52% of the respondents believed that dyes are harmful. Nevertheless, participants continue using these products extensively [6].

Considering hair dye's side effects, about 1 out of 5 users experienced side effects. The most reported side effects were itching among half of the users, hair loss among one-fifth, and skin redness (16.7%). One-third of them still use the same type of hair dye. Similar to our finding, Alghamdi et al. reported that more than 85% (127 of 149) of those who had side effects did not seek medical attention for their side effects [19]. Moreover, this did not prevent them from using the same dye because they consider these symptoms part of the normal hair-dying process. Only one-fourth of participants shifted to another brand, while less than one-quarter stopped dying their hair. Side effects were more reported among older-age users, with a high frequency of hair dying. Hair dye use-associated side effects are mostly limited to the skin and/or the hair shaft, including contact dermatitis, hair breakage, and texture change. However, few cases may experience systemic adverse events, varying from simple headaches to facial edema and a possible risk of severe and life-threatening allergic reactions [20-22]. Skin reactions are the main reported side effects after hair dyeing, and p-phenylenediamine (PPD) and its derivatives are the main causative chemical in allergic contact dermatitis [21-23]. Recently, many manufacturers have started to produce permanent and semi-permanent hair coloring products in which PPD has been replaced by para-toluene diamine sulfate (PTDS) [24]. PTDS is an excellent alternative for PPD-allergic patients as 57% of patients allergic to PPD will tolerate PTDS-based hair coloring products [24]. Additionally, henna is a well-known substance used usually as a temporary tint for hair and skin [25]. PPD is frequently added to henna in order to prolong its effect or intensify the color [25]. In a study done in the United Arab Emirates, it was found that PPD was added to almost all black henna dyes found in salons in percentages ranging between 0.4% and 29.5%, which is higher than the recommended concentration [26].

Moreover, Henna usage can lead to hemolytic anemia in glucose-6-phosphatase dehydrogenase (G6PD) deficient patients [27-28].

Regarding users' perception of hair dyes, more than one-fourth think hair color treatments are safe, while only one-fifth think it causes cancer. Kim JE et al. [29] found that 73.0% of Korean hair dye users ignore the hair dye's exact brand name. Moreover, about 23.8% stated that they experienced side effects. Despite having adverse reactions from hair dyeing products, they did not understand the seriousness of the side effects or the need for treatment. On the other hand, Arafah L et al. [30] found that 11.5% of participants knew about hair dye complications while most (86.9%) did not have enough knowledge.

Conclusion and recommendations

In conclusion, those undergoing hair coloring treatments need to be familiar with the ingredients of the products put on their hair and their proper usage to avoid possible preventable reactions. Health education on hair dye products must be established to improve public awareness about the ingredients, side effects, skin allergies, and home testing methods. Moreover, increasing the consumer's awareness about such side effects may decrease and/or facilitate a safer approach to hair coloring treatments.

Ethics approval and consent to participate

Ethical approval was obtained from the Institutional Research Board (IRB) and the Research Ethics Committee of King Faisal University in Al-Ahsa, Saudi Arabia.

List of abbreviations

Statistical Package for the Social – Sciences (SPSS)
Institutional Research Board (IRB)
para-toluene diamine sulfate (PTDS)
p-phenylenediamine (PPD)
glucose-6-phosphatase dehydrogenase (G6PD)

Data Availability

All main results are described in the text. However, a detailed data are kept with the main author, and it will be provided upon request.

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None

Authors' contributions

MAD: Supervision, manuscript writing, revision, final approval; BAF: Data collection, data analysis, manuscript writing, final approval; AAJ, TAS, AAD, RAF, SAB: Data collection, manuscript writing, final approval;

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