original article

Knowledge and practices of, and attitudes towards, the use of hair dyes among females visiting a teaching hospital in Riyadh, Saudi Arabia

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BACKGROUND AND OBJECTIVES: Use of hair dye is extremely common worldwide. However, our literature search failed to find studies concerning the knowledge and attitudes of the public with regard to hair dyes. We sought to explore the knowledge and practices of, and attitudes towards, the use of hair dye among females.
DESIGN AND SETTING: A cross-sectional survey conducted on females who attended various outpatient clinics at King Khalid University Hospital in Riyadh, Saudi Arabia, a tertiary referral hospital open to the general public.
PATIENTS AND METHODS: A self-administered questionnaire about the use of hair dyes was distributed randomly among females attending the outpatient clinics at a university hospital in 2008.
RESULTS: The response rate was 87.2%, with completion of 567 of the 650 distributed questionnaires. The mean (SD) age of respondents was 32.0 (10.2) years. Among respondents, 82.6% (464/562) had at some point dyed their hair. Furthermore, 69.3% (334/482) had dyed their hair in the past 12 months. The mean (SD) age of the participants when they first dyed their hair was 22.2 (7.1) years (range, 7-50). Of the participants, 76.8% (354/461) used permanent dyes, and about the same percentage of participants believed such dyes were the safest hair dye type. However, 52.4% (278/531) of the participants believed that hair dyes are harmful, and 36% (191/531) believed that hair dyes could cause cancer. Younger females tend to dye their hair less frequently ($P<.001$), whereas those with less education tend to dye their hair more frequently ($P=.013$).
CONCLUSION: Use of hair dye is very common among females. Because the practice starts at a very young age, we conclude that hair dyes are overused and misused. The public should be informed about the risks associated with excessive hair dye use.

Hair coloring is common worldwide among males and females.[1,2] There are many products and techniques available for hair dyeing. The three main types of hair dyes (HDs) are temporary, semipermanent, and permanent.[1-3] Temporary dyes are acidic, textile, water-soluble dyes of high molecular weight that cannot penetrate the hair shaft and are only temporarily deposited until they are washed off.[1] Semipermanent dyes are usually synthetic.[4] They are composed of low–molecular weight coal tar dyes. As a result, they can diffuse freely in and out of the cortex and persist longer than temporary dyes.[1,4] The most commonly used HD type is the permanent type because it can be used to lighten or darken hair to any shade. Permanent HDs account for 70% of HD sales,[1] despite being the dye type that is most damaging to the hair.[1-4]

Dyes are composed of numerous substances, many of which are sensitizers.[5] Available dyes include natural and synthetic coloring agents. The most common natural component of HD is henna; and the most common synthetic component is *p*-phenylenediamine, which produces the most natural appearance and the longest lasting color.[1,2]

Despite the common use of HDs and abundant research describing the side effects of HDs, no previous studies have attempted to assess public knowledge of, and attitudes towards, hair dyeing. Our study aimed to explore the knowledge, attitudes, and practices among women with regard to HDs.

PATIENTS AND METHODS

The study was based on a cross-sectional survey conducted on females who attended various outpatient clinics at King Khalid University Hospital in Riyadh, Saudi Arabia, which is a tertiary referral hospital open to the general public. The data were collected from patients and their companions, while waiting at the outpatient clinics and pharmacy, during the period of June to August 2008. Data collection was performed by a trained research assistant.

The specially designed questionnaire used for data collection in this study was pilot-tested three times on 30 subjects each (90 subjects in all) to estimate the time required to complete the questionnaire and to determine the comprehension of questions by the participants so that it could be refined accordingly. Pilot questionnaires were excluded from the final analysis. The final self-administrated questionnaire included 36 questions, requiring approximately 8 minutes to answer completely. This study was approved by the ethical committee of King Khalid University Hospital. Personal information, including age, marital status, educational level, occupation, and household average monthly income, was collected. In addition, the questionnaire also requested detailed information regarding the use of HDs, the average number of HDs used per year, and the type of HD used. The different types of HDs were clearly defined to the participants as follows: temporary HDs wash off after shampooing the hair once or twice; semipermanent dyes wash off after shampooing the hair 4 to 6 times; and permanent dyes do not wash off, remaining until the hair grows out. Patients were asked to answer questions about their age at first HD use, and the amount of time they wait between 2 consecutive dyes. The questionnaire also requested details about performing an allergy test before using a new HD, the cost of HDs per year, and the patient's motive behind hair dyeing. Safety-related questions concerned the use of HDs during pregnancy and lactation, beliefs about safety in the use of HDs, and opinions regarding the safest type of dye. Several questions focused on the prevalence of HD use on children and the safety of this practice.

The SPSS program, version 16 (SPSS Inc., Chicago, IL), was used. Numerical variables were reported as mean (SD); and categorical variables, as frequencies (n) and percentages (%). The chi-square test for trend was used to test the association between frequency of HD use and demographic variables. A value of $P<.05$ was considered statistically significant. Ordinal logistic regression was used to relate HD use to various sociodemographic variables.

Table 1. Socio-demographic characteristics of the participants in the survey (n=567 females).

Variables	Count[a]	Percentage
Age group (y)		
<20	61/528	11.6
20-29	217/528	41.1
30-39	138/528	26.1
>40	112/528	21.2
Marital status		
Single	139/540	25.7
Married	370/540	68.5
Divorced	17/540	3.1
Widowed	11/540	2.0
Separated	3/540	0.6
Education		
Illiterate	28/535	5.2
High school or lower	250/535	46.7
University or higher	257/535	48.0
Occupation		
Student	97/535	18.5
Unemployed	285/535	54.3
Employed	143/535	27.2
Household average monthly income[b]		
<2000 SR	50/527	9.5
Between 2000 and 5000 SR	132/527	25.0
Between 5000 and 10 000 SR	177/527	33.6
>10 000 SR	128/527	24.3
>20 000 SR	40/527	7.6

[a]Some of the responses are missing.

[b]3.74 Saudi riyals (SR)=1 US dollar.

RESULTS

The questionnaire was distributed among 650 females. In total, 567 females aged 14 to 67 years (mean [SD]: 32.01 [10.17]) returned the questionnaire (87.2% response rate). Sociodemographic data of the participating females are shown in **Table 1**.

Knowledge

When asked if they agreed that HDs are safe, 52.4% (278/531) disagreed or strongly disagreed. When asked if they agreed that HDs could cause cancer, 36% (191/531) agreed or strongly agreed. Among respondents, 38.9% (206/530) agreed that HDs could harm their general health, while only 10.4% (55/530) disagreed and 50.8% (269/530) did not know.

When asked which type of HD is the safest, 70.9% (371/523) chose natural dyes, 10.9% (57/523) chose synthetic dyes, and 18.2% (95/523) believed that there is no difference between these types with respect to safety. When asked to identify the safest type of synthetic dye, 76.9% (362/471) chose permanent dyes, 17.0% (80/471) chose the temporary type, and 6.2% (29/471) chose semipermanent dyes.

Attitude

When asked if they were satisfied with their original hair color, 77.4% (401/518) of the participants agreed, while 22.6% (117/518) did not. When asked if they were satisfied with their hair color after the most recent dye, 64.1% (275/429) of the participants said yes, while 35.9% (154/429) said no.

Of the participants, 46.1% (195/423) felt that, after

Table 2. Association between frequency of hair dye use and socio-demographic characteristics.

Socio-demographic characteristics	Frequency of hair dye use (per year)			
	Once	2 to 5 times	>5 times	*P* value*
Age (y)				
<20	28 (57.1)	18 (36.7)	3 (6.1)	
21-30	111 (68.1)	45 (27.6)	7 (4.3)	>.001
31-40	65 (56.0)	35 (30.2)	16 (13.8)	
>40	21 (28.4)	23 (31.1)	30 (40.5)	
Marital status				
Single	65 (65.0)	32 (32.0)	3 (3.0)	
Married	153 (54.1)	86 (30.4)	44 (15.5)	>.001
Divorced/widowed/ separated	12 (44.4)	7 (25.9)	8 (29.6)	
Education				
Illiterate	5 (35.7)	3 (21.4)	6 (42.9)	
High school or lower	101 (54.0)	59 (31.6)	27 (14.4)	>.001
University or higher	121 (59.6)	61 (30.0)	21 (10.3)	
Occupation				
Student	52 (69.3)	21 (28.0)	2 (2.7)	
Unemployed	119 (56.4)	61 (28.9)	31 (14.7)	.001
Employed	55 (48.2)	39 (34.2)	20 (17.5)	
Household average monthly income (SR)				
<5000	86(62.3)	35 (25.4)	17 (12.3)	
5000-10 000	77 (58.3)	41 (31.1)	14 (10.6)	.07
>10 000	63 (49.6)	44 (34.6)	20 (15.7)	

*Chi-square test for trend was used.

Table 3. Socio-demographic characteristics associated with frequency of hair dye use using ordinal logistic regression with complementary log-log link.

Socio-demographic variables	Odds ratio (OR)	95% Confidence interval for OR	*P* value
Age (years)	1.05	1.0-1.1	<.001
Marital status			
Single	0.87	0.5-1.6	.653
Married	0.66	0.4-1.1	.139
Divorced/widowed/ separated (Reference)	1.0	-	-
Education			
Illiterate	1.64	0.8-3.6	.218
High school or lower	1.36	1.0-1.8	.029
University or higher (Reference)	1.0	-	-
Occupation			
Student	0.90	0.6-1.4	.616
Unemployed	0.81	0.6-1.1	.192
Employed (Reference)	1.0	-	-
Household average monthly income (SR)			
<5000 SR	0.74	0.6-1.0	.054
5000-10 000	0.79	1.0-1.1	.113
>10 000 (Reference)	1.0	-	-

they first dyed their hair, they had to continue dyeing it to avoid showing the difference in color between the roots and the rest of the hair, while 53.9% (228/423) did not feel compelled in this way.

Of the participants, 88.9% (466/524) believed that dyeing the hair of children is harmful.

Practice

Of the participants, 82.6% (464/562) indicated that they dyed their hair at some point in their lives, and 69.3% (334/482) revealed that they had dyed their hair in the past 12 months. When questioned on the frequency of HD use, 56.4% (239/424) of participants indicated that they dye their hair only once in a year, 30.2% (128/424) indicated that they do so 2 to 5 times in a year, and 13.4% (57/424) do so more than 5 times in a year. When asked about the age at which they first started dyeing their hair, participants responded with ages ranging from 7 to 50 years (mean [SD]: 22.23 [7.05] years; median: 20 years). The participants were also asked about the interval between 2 consecutive HD applications; their answers ranged from 1 to 60 months (mean [SD]: 7.73 [7.16] months).

Among participants, 7.8% (36/461) used temporary dyes, 15.4% (71/461) used semipermanent dyes, and 76.8% (354/461) used permanent dyes. While 22.6% (97/429) of respondents stated that they only highlight a few strands of hair, 77.4% (332/429) dyed the entire hair on their head. While 95.3% of the participants (422/443) colored their hair with a dye of a natural hair color, 4.7% (21/443) used exotic colors, ie, blue or green. Although 53.8% (242/450) of the participants got their hair dyed at beauty salons, 46% (207/450) dyed their hair at home. The mean (SD) annual cost of HDs was 437.66 (570.41) SR, or about US$116 (152). When the participants were asked if they performed an allergy test before using a new HD, 64% (297/464) indicated that they never did so, while only 6% (28/464) reported that they always did so. When the participants were asked if they followed the instructions for use of HDs, only 40.1% (178/444) indicated that they did so all of the time. Within a week

of dyeing their hair, 10% of the participants (44/441) had their hair permed. Of the participants, 21.1% (69/326) dyed their hair during pregnancy, and 37.3% (119/319) did so during lactation. The motives behind using HDs varied drastically; 91.9% (329/358) indicated that they dyed their hair regularly just to renew their look (**Figure 1**).

Among the respondents, 88.9% (466/524) believed that dyeing children's hair is harmful. Although 97.6% (497/509) did not allow their children to dye their hair, 3 of the 12 respondents who dyed their children's hair did so more than once per year. All 12 (100%) of these respondents reported that their children had allergic reactions to the HD.

Associations between socio-demographic variables and hair dyeing practices

Participants with higher incomes tended to start dyeing their hair at a younger age (P=.017). Younger participants performed an allergy test before using a new HD less often than older participants (P=.037). Younger participants also considered dyes to be safer than did older participants (P=.001). A greater percentage of older participants believed that HDs cause cancer compared with younger ones (P=.007). Less educated individuals were also more likely to consider dyes safe compared with highly educated participants (P=.019).

Table 2 shows the association between frequency of HD use and demographic characteristics. Participants of an older age (>40 years) tended to use HDs more frequently than younger people (P<.001). Employed persons used HD more frequently than did unemployed persons (P<.001). Illiterate persons (P=.01) and individuals separated from their spouse (P<.001) were also found to use HDs more frequently. Although the frequency of HD use was greater among higher-income participants, this difference was not statistically significant (P=.07).

Table 3 shows the association between demographic characteristics and the frequency of HD use, using ordinal logistic regression. The following 3 variables were significantly correlated to the frequency of hair dye use, after adjusting for all other variables simultaneously in the analysis: age (P<.001), education (P=.03), and average household monthly income (P=.05). In the adjusted model, marital status and occupation were not significantly associated with the frequency of HD use.

DISCUSSION

The safety of hair-coloring agents is a matter of active debate. Although some studies have linked these agents to cancer, others have claimed that they have no systemic effects, except for the potential to elicit allergic reactions.[6-9] Although previous studies have investigated the side effects of, and skin reactions to, HDs, they have not explored the HD users' perceptions of these issues. Therefore, we explored the prevalence of HD use as it relates to the public's knowledge, attitudes, and practices.

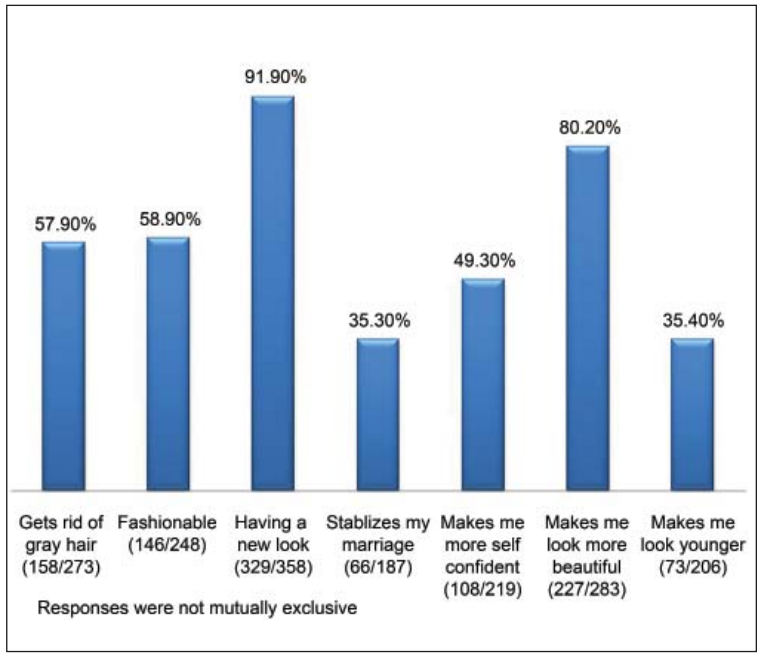

Figure 1. Motives behind use of hair dyes among a cohort of 567 females.

The results of this survey indicate that the use of HDs is very common among females in Saudi Arabia. In this survey, 82.6% of the participating females had dyed their hair at some point in their lives; this percentage is not considered particularly high because more than 50% of women in the industrial world use HDs.[10] The prevalence of HD use among females reported in a previous study performed in Denmark was 74.9%.[11] The median age at first hair dyeing was 22 years in our study, while it was 16 years in the Danish study. In our sample, 11.6% of the participants started dyeing their hair at 15 years of age or younger. The practice of hair dyeing began at an extremely young age, as young as 7 years. However, in the Danish study, the practice began at an age as young as 1 year.

Surprisingly, more than 52% of the respondents believed that dyes are harmful. Believing that HDs are harmful did not stop the participants from using these products extensively. The safest type of HDs are temporary dyes because they cannot penetrate the hair shaft.[1] The majority of participants did not know this

fact and believed that permanent dyes are the safest type.

The majority (77.4%) of participants were satisfied with their original hair color; the most common hair colors in Saudi Arabia are black and dark brown. Fewer (22.6%) participants were unsatisfied with their original hair color in comparison with those who were unsatisfied with their hair color after dyeing (35.9%). These findings demonstrate that people continue to use HDs even though they are not certain about their safety and are not always satisfied with the outcome.

The mean (SD) cost of annual HD use was 437.66 (570.41) SR, or approximately US$116 (152), which is acceptable because the average monthly income per capita in Saudi Arabia, according to the 2008 edition of The World Factbook of the Central Intelligence Agency of the United States, is US$1708.[12]

The majority of participants, particularly the young participants, did not perform an allergy test before using a new dye. This practice is a cause for concern because 6.4% of HD users suffer allergy symptoms following hair dyeing.[11] A large portion of the participants did not follow the instructions for use of HDs, which is another alarming issue because the overuse or misuse of HDs is damaging to the hair.[1]

A small portion of the participants dyed their hair during pregnancy and lactation. There are very few studies concerning HD use during human pregnancy.[13] In animal studies, doses 100 times higher than the dose that would normally be used in human application did not produce significant changes in fetal development.[14] Low levels of HD can be absorbed through the skin after application. This minimal amount is not enough to cause a developmental problem to the fetus, and the compounds are excreted in the urine.[15] However, the use of HDs during pregnancy is not recommended and might be associated with future health problems in children.[16]

The majority of participants were opposed to dyeing children's hair and did not allow their children to do so. All of the children whose hair was dyed experienced allergic reactions to the dye, which was expected, as previous studies have demonstrated that children are susceptible to *p*-phenylenediamine allergy.[17,18] Hair dyeing and body tattooing should be completely banned for children. The public needs to be aware that the exposure of children to HDs, especially to toxic fumes from HDs, is being researched, and experts believe that HD use may increase risks of cancer and infertility problems in their future.[19,20]

Older participants used HDs more than younger ones. This result was expected because older individuals frequently use HDs to conceal gray hair. Our findings demonstrate that HD use is not extremely high among teenagers in Saudi society. Furthermore, the use of exotic hair colors is also not prevalent. We also did not find a high prevalence of the practice of perming hair within a week of hair dyeing, which is known to be damaging to hair.[1] Younger participants, believing that they are safe, were more comfortable with hair dyes than older participants. This result was also expected because older individuals seem to be more cautious and more aware of health concerns.

As expected, individuals with higher income used HDs more often than those with lower income because they can afford the luxury of coloring their hair more often and at an earlier age. Individuals that are more educated used HDs less than those with less education. Individuals who had completed higher levels of education tended to avoid "unnatural" products, while less educated individuals used HDs with less fear of side effects.

Using ordinal logistic regression with a complementary log-log method, the model's assumption of parallel lines was not violated (χ^2=3.53; P=.94). In addition, the Pearson χ^2 goodness-of-fit test (χ^2=488.1; P=.53) indicated that the observed data were consistent with estimated values in the fitted model.

Our study is the first to demonstrate the knowledge, attitudes, and practices of females with regard to HDs in the Middle East, and it is the first, worldwide, to discuss the public's knowledge of, and attitude towards, HDs. The large sample size (567) also contributes to the strength of the study. Limitations of our work include the use of a convenience sample, which might not be representative of the whole community. We believe that the prevalence of HD use among children and young adolescents is much greater in groups with higher incomes.

The conflicts in results of various reported studies regarding the safety of HDs, especially during pregnancy and lactation, must be resolved by additional studies. HDs are commonly considered safe, but recent studies have proposed possible health risks associated with the overuse of such products. The public must be informed about the possible side effects of HD use, especially if HDs are used excessively or used on children. The public should also be educated about the relative safety of different types of HDs; the majority of participants in our study did not know that permanent HDs are the most harmful.

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