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Hair greying associated with rosemary use: a cross-sectional study in Saudi Arabia

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Consent for publication: written informed consent was obtained for anonymized patient information to be published in this article.

Availability of data and materials: the datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Abstract

The sociological and psychological consequences of premature hair greying (PHG) are significant. PHG has been linked to various intrinsic and extrinsic factors, including genetic predispositions and environmental influences. The widespread use of hair growth-stimulating products may impact the hair greying process.

This cross-sectional study aimed to determine the prevalence of hair greying among rosemary users in the Saudi Arabian population. A self-administered questionnaire was distributed among the sample population in the form of an online survey. This questionnaire included sociodemographic data (*e.g.*, age, gender, and education), the use of several types of rosemary, and the outcomes.

A total of 994 participants completed the survey, the majority of whom were female (94.4%). Participants aged between 18 and 24 years represented 64% of the sample. Hair loss was reported by 75.4% of respondents. More than half (58.7%) reported using rosemary, particularly rosemary oil, as a treatment. Among those who used rosemary, 22.8% reported experiencing hair greying. Increasing age emerged as an independent risk factor for PHG. However, multivariate regression analysis showed that the use of rosemary oil was associated with a reduced likelihood of hair greying. Approximately 25% of rosemary users developed PHG and Individuals in the early to middle-age range with a bachelor's degree or higher had a 1.5 to 3.5 times greater risk of hair greying. Nevertheless, the use of rosemary oil appeared to mitigate this risk. Additional observational studies are needed to validate the high regional prevalence of hair greying, potentially associated with rosemary use.

Introduction

The appearance of people's hair plays a vital role in self-perception, especially in an ageing society in which maintaining a youthful look is highly valued.[1] The premature greying of hair has garnered attention from professionals in various fields, including skin biology, dermatology, trichology, and business, due to its significant psychological and economic societal impact. Research has indicated that a combination of oxidative and DNA damage, increased mTORC1 activity, melanocyte senescence, and an insufficient production of pigmentation-promoting factors in the hair matrix contributes to hair greying.[2] Several risk factors have also been identified, including smoking, vitamins, and mineral deficiencies (specifically, B12, folic acid, B7, calcium, and ferritin), a family history of greying, obesity, high blood pressure, a lack of exercise, medication use, genetic syndromes, dyslipidemia, thyroid disorders, hyperuricemia, and liver function alterations.[3]

With the increasing popularity of natural remedies, a growing number of plant-based medicinal products are entering the market. Among these, rosemary – an aromatic herb from the *Lamiaceae* family – is well recognized for its therapeutic properties. Traditionally, it has been used to relieve a variety of conditions, including headaches, neuralgia, hair loss, insomnia, depression, and rheumatic disorders. Its efficacy is attributed to several bioactive compounds, such as rosmarinic acid, caffeic acid, camphor, and 12-methoxycarnosic acid, which possess antioxidant, antimicrobial, and anti-inflammatory properties.[4] However, despite the potential benefits and minimal side effects, there is a significant lack of scientific research exploring the potential association between hair greying and rosemary use. Therefore, our study aimed to address this knowledge gap and elucidate the prevailing practices of rosemary use among the population of the Kingdom of Saudi Arabia.

Materials and Methods

This cross-sectional observational study employed a self-administered online validated questionnaire to investigate the prevalence of hair greying or premature hair greying among people of various age groups in Saudi Arabia who used rosemary products in 2024. Our questionnaire was an adapted version of the one used in a previous study on minoxidil and hair greying, which we used after receiving permission from the corresponding author (Alhayaza, G).[5] The study targeted both Saudi citizens and non-Saudi residents without age or gender restrictions and included only those who had consented to participate. Out of the 2,084 responses, 994 participants met the inclusion criteria. The study received ethical approval from the Prince Sultan Military Medical City Scientific Research Center (IRB number: E-2310), and participants provided informed consent through a questionnaire form.

Descriptive statistics were used to present categorical variables in terms of numbers and percentages. The chi-square test examined the relationship between hair greying after rosemary use and participants' sociodemographic and clinical characteristics. Significant results from the chi-square test were further analysed using multivariate regression to identify independent predictors of hair greying, providing corresponding odds ratios (ORs) and 95% confidence intervals (CIs). A p-value of less than 0.05 was considered statistically significant. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 26 (IBM Corporation, Armonk, NY, USA).

Results

A total of 994 participants were recruited. Table 1 presents the sociodemographic characteristics of the participants. The predominant age group ranged from 18 to 24 years old (64%), with females constituting the majority at 94.4%. More than half (55.7%) were Saudis, and 58.6% had bachelor's degrees. The prevalence of participants suffering from hair loss was 75.4%, with female pattern hair loss being the most common (18.6%). Figure 1 shows that the most used type of rosemary was rosemary oil (58.7%), followed by rosemary herb infusion (26.9%) and rosemary spray (12.6%).

As shown in Table 2, the percentage of participants who noticed hair greying after rosemary use was 22.8%. Of these, 44.1% noticed hair greying after one to three months of use. A total of 17.5% of participants indicated changing their hair colour to a colour other than grey, with light brown being the most common (67.8%). A total of 19.8% of participants used medication or other products to treat hair loss, with vitamins being the most common (31%). Interestingly, 7.1% used minoxidil spray or foam along with rosemary. Finally, 42.2% had a family history of grey hair.

Table 3 presents the results obtained from applying the chi-square test to investigate the relationship between hair greying and rosemary use among patients with various sociodemographic and clinical characteristics. The results indicated that hair greying was significantly more common among the older age group ($p<0.001$), those with higher education ($p<0.001$), and those who used rosemary herb infusion or minoxidil spray or foam in combination with rosemary ($p=0.046$). However, the prevalence of hair greying was significantly lower among those who used rosemary oil ($p<0.001$).

The multivariate regression analysis (Table 4) revealed that age was significantly associated with hair greying following rosemary use. Participants aged 18-24 years had a 3.5-fold higher odds of hair greying compared to those under 18 years (adjusted odds ratio [AOR]=3.496; 95% CI=1.887-6.477; $p<0.001$). Similarly, participants over 24 years had 3.15 times higher odds of hair greying (AOR=3.152; 95% CI=2.136-4.651; $p<0.001$). Moreover, participants with a higher level of education had odds of hair greying that were at least 1.18 times higher (AOR=1.181; 95% CI=1.021-2.403; $p=0.040$) than those with a lower level of education. In contrast, participants who used rosemary oil decreased their chances of hair greying by at least 38% (AOR=0.618; 95% CI=0.406-0.941; $p=0.025$). No significant differences were found between hair greying due to the use of rosemary herb infusion and minoxidil spray or foam, or between rosemary use and hair greying after adjusting for the regression model ($p>0.05$).

Discussion

This study investigated whether there is an existing link between hair greying and rosemary use. Its findings could substantially contribute to the existing body of literature, considering that traditional medicine – including rosemary oil – is widely valued and offers notable advantages for hair care with

minimal side effects.[6] The prevalence of hair greying after rosemary use was 22.8%. This prevalence is consistent with findings reported in the literature.[5,7-9] However, a study in India contradicted these findings, with a higher prevalence of PHG accounting for the 41.4%. Due to this higher prevalence, over half (54.1%) of the students exhibited a poor quality of life (QoL), with males and residents in rural areas demonstrating the worst-case scenario in terms of QoL due to PHG.[10]

In this study, rosemary oil was found to be the most prominent ingredient in hair care (58.7%). Other types of rosemary, including rosemary herb infusion (26.9%), rosemary spray (12.6%), oral rosemary (1.3%), and rosemary powder (0.2%), were less popular than rosemary oil. Among the products used in our study, users of rosemary oil had a higher prevalence of hair greying (48.5%) compared to those who used rosemary infusion (33.9%) or spray. These variations can be attributed to differences in bioavailability, concentration, and application methods. Furthermore, our data indicated a prevalence of hair greying after rosemary herb infusion. In contrast, the use of rosemary oil had a protective effect on hair colour. Data from a regression model indicated that rosemary oil could decrease the risk of hair greying by at least 38% (AOR=0.618). Other studies have found that rosemary oil had a preventive effect on hair greying, and thus were consistent with our study. For instance, a literature review by Ufomadu (2024) found that rosemary oil was a natural, effective ingredient used for treating androgenetic alopecia. Other treatments deemed effective included pumpkin seed oil, saw palmetto, caffeine extract, and melatonin extract.[4] When comparing the efficacy of rosemary oil *versus* 2% topical minoxidil for treating hair loss, one study indicated that the rosemary oil group showed better results than the 2% topical minoxidil group at three and six months.[11] Satisfaction with rosemary oil treatment was marginally higher than satisfaction with topical minoxidil. Therefore, our study provides evidence that rosemary oil does not induce hair greying but rather inhibits the process. Minoxidil was linked to hair discolouration (26%), particularly among those with a family history of hair greying and longer use.[5] Our study's results also showed a high prevalence of hair greying associated with minoxidil spray (10.1%; p=0.046).

Acer *et al.* (2020) established that age and educational status were independently associated with hair greying.[12] This finding corroborates Parihar *et al.*'s (2023) findings, which established that older age and rural residence were identified as significant indicators of PHG. Additionally, lifestyle factors associated with PHG included irregular meal patterns, the frequency of meals, and fruit consumption.[11] Our study found that higher education (AOR=1.57) and increasing age (age 18-24 years [AOR=3.49]; age >24 years [AOR=3.15]) heightened the risk of hair greying. Assumedly, the participants' intention to seek hair care increased with age. Our study also suggests that individuals with higher education levels may be more aware of the effectiveness of traditional medicine. However, they also tend to be more conscious about hair care compared to those with lower education

levels. As a result, people with higher education used rosemary more frequently than those with less education, regardless of its effectiveness. Nonetheless, considering the diverse causes of hair greying, other factors cannot be entirely ruled out.

A family history of hair greying is one of the most important factors identified across publications. For example, a systematic review and meta-analysis by Mahendiratta *et al.* (2020)[3] determined that family history, obesity, lack of exercise, and hypertension were the main factors documented in the literature. This finding is supported by a study by Anggraini *et al.* (2019), who identified family history of PHG, hypertension, obesity, and diabetes as influential factors for PHG.[13] Our study established that nearly half of the population had a familial history of hair greying, but this history was not found to influence hair greying (p=0.416).

Data from this study indicated that hair greying varied significantly by gender. However, this result could be due to the unequal distribution between males (n=56) and females (n=938). Thus, this could significantly affect a pairwise comparison, leading to statistically insignificant test results (p=0.361). This finding did not align with Kansal *et al.*'s (2021) finding,[7] according to which male gender and a positive paternal history of PHG were significant predictors of PHG. This was confirmed by Acer *et al.*'s (2020) study, which established that male participants exhibited more severe hair greying than female participants, and that late-onset and temporal-onset hair greying may also be linked to poor prognostic factors for hair greying.[12]

Notably, approximately 20% of the present study's population used medications or other products besides rosemary for hair care, with vitamins and oils being the most common. Others were inclined to use minoxidil spray or foam with rosemary (7.1%). Although minoxidil was a significant factor in univariate analysis, it did not remain significant after regression adjustments (p=0.251). Medication use yielded similar findings (p=0.416).

Limitations

The generalisation of this study was subject to limitations. First, the data between males and females were not equally distributed. Thus, we could not generalise the results of the gender comparison. Additionally, most of the enrolled participants were in early adulthood, which could have influenced the results, as age was not evenly distributed. Moreover, we noticed that the short duration of rosemary use may be insufficient to detect significant changes in hair greying. We recommend that future studies include longer follow-up periods to better assess rosemary's effect on hair greying. Finally, as a cross-sectional survey utilizing a self-administered questionnaire, it was susceptible to bias, did not establish causality, and lacked a dermatological assessment of the underlying etiology of hair loss.

Conclusions

A significant incidence of hair greying was observed among individuals using rosemary, and it was correlated with increasing age. Nevertheless, the application of rosemary oil could serve as a protective factor against hair greying; however, products derived from the rosemary herb may not confer the same benefit. Given the growing recognition of herbal medicine in hair care, further studies should be conducted to determine its effectiveness. This study's findings provide evidence that hair greying is a common phenomenon; therefore, the factors contributing to hair greying should be further investigated.

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Table 1. Sociodemographic characteristics of participants (n=994).

Study variables	**n (%)**
Age group	
• <18 years	213 (21.4%)
• 18-24 years	636 (64.0%)
• 25-34 years	119 (12.0%)
• 35-44 years	14 (01.4%)
• 45-64 years	12 (01.2%)
Gender	
• Male	56 (05.6%)
• Female	938 (94.4%)
Nationality	
• Saudi	554 (55.7%)
• Non-Saudi	440 (44.3%)
Educational level	
• Uneducated	14 (01.4%)
• Secondary school	363 (36.5%)
• Bachelor's degree	582 (58.6%)
• Postgraduate	35 (03.5%)
Are you suffering from hair loss?	
• Yes	749 (75.4%)
• No	245 (24.6%)
If the previous answer is yes, what type of hair loss are you suffering from? (n=749)	
• Male pattern hair loss	22 (02.9%)
• Female pattern hair loss	139 (18.6%)

• Telogen effluvium	19 (02.5%)
• Alopecia areata	03 (0.40%)
• Traction alopecia	02 (0.30%)
• I don’t know	564 (75.3%)

Figure 1. Modes of rosemary administration.

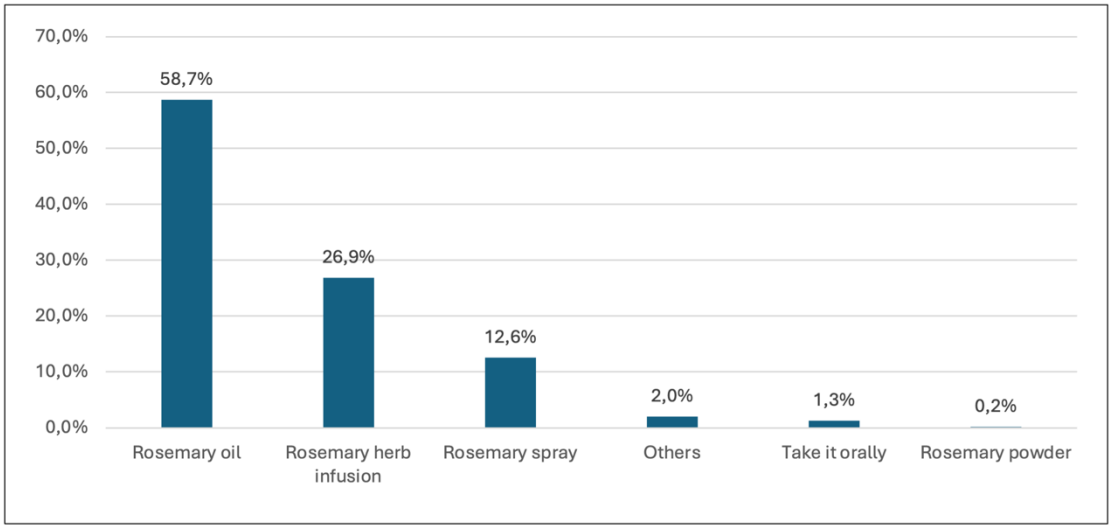

Table 2. Participants' characteristics associated with rosemary use (n=994).

Variables	**n (%)**
Have you noticed hair greying after using rosemary?	
• Yes	227 (22.8%)
• No	767 (77.2%)
If the previous answer is yes, then how long after using rosemary? (n=227)	
• 1–3 months	100 (44.1%)
• 4–6 months	50 (22.0%)
• 7–9 months	19 (08.4%)
• 10–12 months	05 (02.2%)
• More than 12 months	08 (03.5%)
• I do not remember	45 (19.8%)
Have you noticed any other changes in hair colour?	
• Yes	174 (17.5%)

• No	820 (82.5%)
If the previous answer is yes, what are the changes to hair colour? (n=174)	
• Light brown colour	118 (67.8%)
• Orange colour	10 (05.7%)
• Yellow colour	06 (03.4%)
• Darkening of white hair	23 (13.2%)
• Another colour	17 (09.8%)
Do you use medications or other products to treat hair loss?	
• Yes	197 (19.8%)
• No	797 (80.2%)
If the previous answer is yes, please note the medication. (n=197)	
• Oils	46 (23.4%)
• Vitamins	61 (31.0%)
• Shampoo	19 (09.6%)
• Spray	06 (03.0%)
• Henna	10 (05.1%)
• Herbs	15 (07.6%)
• Others	40 (20.3%)
Do you use minoxidil spray or foam with rosemary?	
• Yes	71 (07.1%)
• No	923 (92.9%)
Is there a family history of grey hair?	
• Yes	419 (42.2%)
• No	575 (57.8%)

Table 3. Relationship between hair greying after rosemary use among the sociodemographic and clinical characteristics of participants (n=994).

Factor	**Hair greying after rosemary use**		**p-value[§]**
	Yes **n (%)** **(n=227)**	**No** **n (%)** **(n=767)**	
Age group			**<0.001****
• <18 years	31 (13.7%)	182 (23.7%)	
• 18-24 years	130 (57.3%)	506 (66.0%)	
• >24 years	66 (29.1%)	79 (10.3%)	
Gender			
• Male	10 (04.4%)	46 (06.0%)	0.361
• Female	217 (95.6%)	721 (94.0%)	
Nationality			
• Saudi	139 (61.2%)	415 (54.1%)	0.058
• Non-Saudi	88 (38.8%)	352 (45.9%)	
Educational level			
• Secondary or below	61 (26.9%)	316 (41.2%)	**<0.001****
• Bachelor or higher	166 (73.1%)	451 (58.8%)	
Are you suffering from hair loss?			
• Yes	178 (78.4%)	571 (74.4%)	0.223
• No	49 (21.6%)	196 (25.6%)	
Pattern of rosemary use*			
• Rosemary herb infusion	77 (33.9%)	190 (24.8%)	**0.006****
• Rosemary oil	110 (48.5%)	473 (61.7%)	**<0.001****
• Rosemary spray	34 (15.0%)	91 (11.9%)	0.214
Have you noticed any other changes in hair colour?			

• Yes	48 (21.1%)	149 (19.4%)	0.568
• No	179 (78.9%)	618 (80.6%)	
Do you use medications or other products to treat hair loss?			
• Yes	101 (44.5%)	318 (41.5%)	0.416
• No	126 (55.5%)	449 (58.5%)	
Do you use minoxidil spray or foam with rosemary?			
• Yes	23 (10.1%)	48 (06.3%)	**0.046****
• No	204 (89.9%)	719 (93.7%)	
Is there a family history of grey hair?			
• Yes	101 (44.5%)	318 (41.5%)	0.416
• No	126 (55.5%)	449 (58.5%)	

*Variable with multiple response answers; §p-value calculated using chi-square test; **Significant at p<0.05.

Table 4. Multivariate regression analysis to determine the significant independent predictors of hair greying after rosemary use (n=994).

Factors	**AOR**	**95% CI**	**p-value**
Age group			
• <18 years	Ref		
• 18–24 years	3.496	1.887-6.477	**<0.001****
• >24 years	3.152	2.136-4.651	**<0.001****
Educational level			
• Secondary or below	Ref		
• Bachelor or higher	1.566	1.021-2.403	**0.040****
Use of rosemary herb infusion			
• Yes	1.181	0.751-1.857	0.472

• No	Ref		
Use of rosemary oil			
• Yes	0.618	0.406-0.941	**0.025****
• No	Ref		
Do you use minoxidil spray or foam with rosemary?			
• Yes	1.386	0.794–2.418	0.251
• No	Ref		

AOR, adjusted odds ratio; CI, confidence interval; Ref, reference group; **Significant at $p<0.05$.