

The cross-modal effect of type of fragrance on the sensory perception of hair leave-in conditioner and the effect of silicone copolymer on keratin fibres

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Gabriela Daniels, Ru En Teh, Marianne Martin, Slobodanka Tamburic
Cosmetic Science Research Group, London College of Fashion, University of the Arts London, London, UK

Introduction

Cross-modal associations between olfaction and other senses at neural and behaviour levels have been demonstrated in numerous studies [1,2]. The relationship between olfaction and tactile perception has a particular relevance to cosmetic products whose function often includes the improved sensorial experience of skin and hair. In addition, a 'halo' effect, defined as a failure to discriminate between potentially independent attributes (i.e. odour and touch) is likely to impact on the perception of product efficacy [3,4].

In this study, we have assessed the cross-modal and halo effects of two distinct fragrance categories, **fruity (F) and green (G)**, on the performance of a leave-in hair conditioner, using a sensory panel. The tactile performance of the conditioner was technically differentiated by the addition of amino-glycol-silicone block copolymer.

Materials and Methods

The formulation of leave-in conditioner base (CB) is presented in Table I. The **amino-glycol-silicone block copolymer (AGSC) Bis-Diisopropanolamino-PG-propyl Dimethicone/Bis-Isobutyl PEG-14 Copolymer** was added for enhanced slipperiness, smoothness and fragrance release.

Each fragrance was added to the respective conditioners at 2%. In addition, alcoholic solutions of the fragrances were prepared, containing 15%w/w fragrance and 85%w/w denatured alcohol (Table II).

Table I. Leave-in conditioner formulation

INCI Name	Cond	AGSP
	% w/w(g)	
Sodium Polyacrylate (and) Dimethicone (and) Cyclosiloxane (and) Trideceth-6 (and) PEG/PPG-18/18 Dimethicone	2	2
Dimethicone	7	7
Dimethicone (and) Dimethiconol	3	3
Deionized water	82.5	80.5
1,3-Butylene Glycol	5	5
Bis-Diisopropanolamino-PG-propyl Dimethicone/Bis-Isobutyl PEG-14 Copolymer (AGSP)	-	2
Phenoxyethanol (and) Ethylhexylglycerin	0.5	0.5

Table II. List of all hair treatments used for sensory evaluation

Type of Treatments	Description
Treatment 1	Cond Base
Treatment 2	AGSP Cond
Treatment 3	AGSP Cond + F (fruity fragrance)
Treatment 4	AGSP Cond + G (green fragrance)
Treatment 5	F (fruity fragrance) + 85% ethanol
Treatment 6	G (green fragrance) + 85% ethanol

- 1g conditioner treatment was dosed onto dry bleached Caucasian tresses of length=30cm and weight=3.5g (Banbury Postiche, UK).
- All sensory tests were conducted with **21 blind-folded volunteers** who had passed sensory acuity tests. Each fragrance was tested separately.
- Instrumental combing force was measured using Texture Analyser (Stable Microsystems, UK).



Fig.1 Participant completing the discrimination tests

Discrimination test:

- Each participant was presented with one of the four possible pairs of treatments: **2 matched pairs of Treatments 1 and 2 respectively; 2 unmatched pairs of Treatment 1 and Treatment 2** with their corresponding fragrance treatments
- The participants reported if the conditioning of the paired tresses was the same or different



Fig.2 Participant completing the attributes tests

Attributes test:

- Each participant was presented with one tress at the time, assessing **smoothness, softness and ease of combing**
- Within-participants repeated design, with two factors: fragrance (fruity/green) and presence of AGSP
- A ten-point scale with the following anchors: 0 = *drags, coarse and difficult to comb* and 10 = *smooth, soft and easy to comb*.

Results and Discussion

Discrimination test results

For each type of fragrance, the **tresses treated with a fragranced conditioner were perceived as being different from the ones treated with non-fragranced conditioner**. This outcome suggests that the presence of fragrance influences the perceptions of technically identical products, a halo effect of relevance to hair leave-on products.

Attribute test results

There was a statistically significant difference in the rating of smoothness between the hair treated with a fragranced conditioner and the hair treated with the conditioner base alone (Fig. 3a). For softness, only the fruity fragrance led to statistically significant result (Fig. 3b), suggesting cross-modal associations.

The inclusion of silicone-containing copolymer as a technical differentiator between the conditioner base and the fragranced treatments had an amplifying effect on the cross-modal associations of the fragranced products as it imparted low inter-fibre friction and slipperiness.

The differences between the products in terms of the combing ease were not statistically significant (not shown).

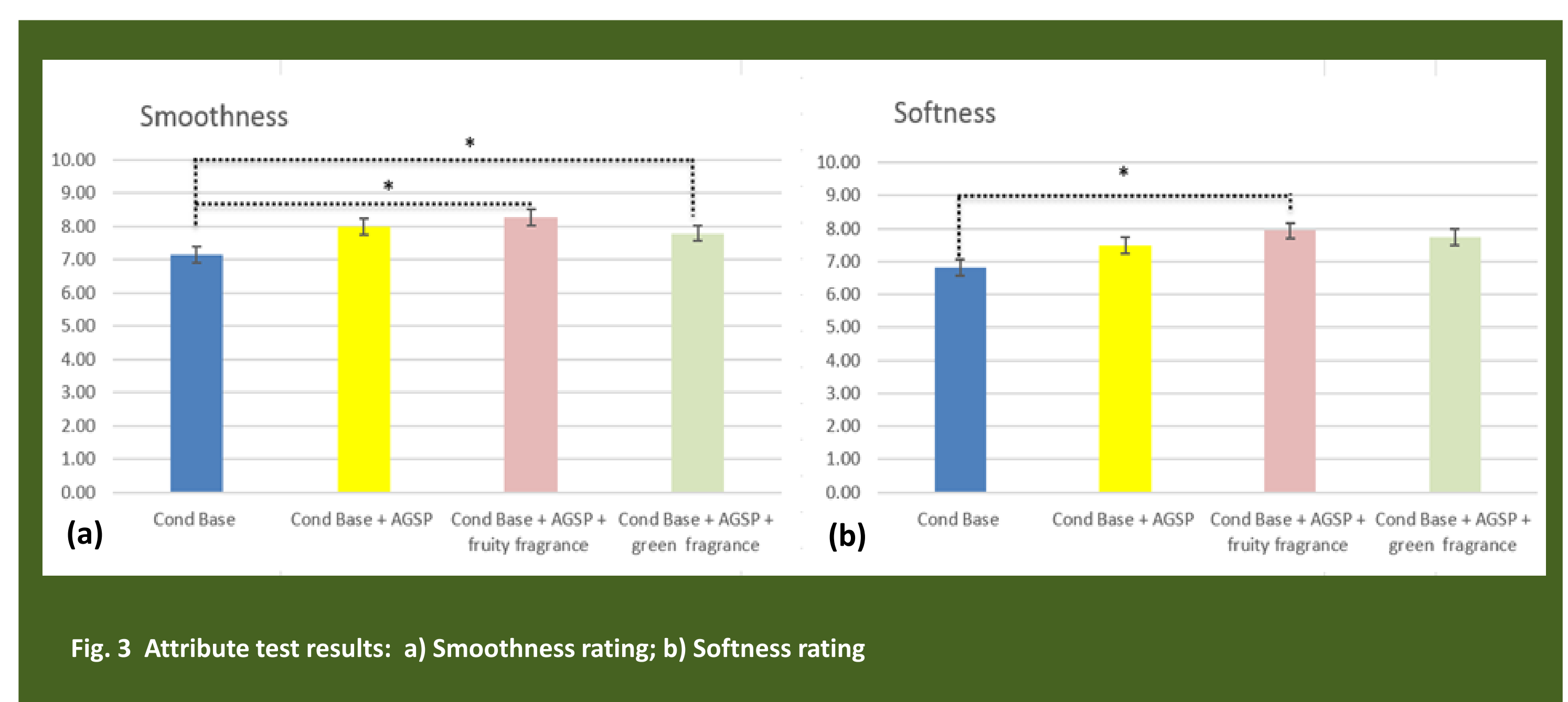


Fig. 3 Attribute test results: a) Smoothness rating; b) Softness rating

Mean combing force (N) of bleached hair vs respective treatment

There was no significant difference in the mean combing force of a bleached hair tress before and after the respective leave-in conditioner treatments. Dry combing is less sensitive to product differences as reported elsewhere [5]. Both alcoholic solutions (treatments 5 and 6) significantly increased the mean combing force, suggesting cuticle swelling effect due to the presence of ethanol (Table III).

Table III. Mean combing force (N) of bleached hair vs respective treatments using multiple paired samples t-tests.

	Cond Base	AGSP Cond	AGSP Cond + fruity fragrance	AGSP Cond + green fragrance	fruity fragrance + 85% ethanol	green fragrance+ 85% ethanol
Combing force (N)	0.08 ±0.02	0.11 ±0.04	0.14±0.08	0.014±0.04	0.015±0.06	0.15±0.06
Combing force (N) after conditioning	0.09 ±0.01	0.08±0.002	0.08±0.002	0.09±0.005	0.23±0.01	0.23±0.01
p value (two-tailed)	0.53	0.59	0.16	0.047**	0.02*	0.04*

Conclusion

- The combined results for smoothness and softness infer a **strong cross-modal association effect for the odours and the tactile attribute of smoothness**.
- The inclusion of an **active ingredient for hair tactile enhancement** (in this case amino glycol silicone copolymer) **may not lead to enhanced differentiation of the product, unless the fragrance congruent with the desired sensory association is present**.
- The **halo effect of fragrance** was also demonstrated, which supported the cross-modal data.
- Combing ease of dry hair should be investigated further for halo fragrance effect. It is more likely that such effect manifests itself in cases of coarser hair and hair with higher curvature which require combing forces of higher magnitude.
- Hair scents containing high concentrations of alcohol and no cuticle smoothing active increase combing force.

References:

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