To reveal the correlation of sensory attributes in different types of cosmetics

Poster ID 543

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Introduction:

During the development of skin care products, sensory evaluation has been commonly used in recent years. Bunches of sensory attributes are set to help researchers not only to link consumer real needs, but also to deeply understand products behaviors . However, setting more attributes makes it more difficult for sensory panelists to define and more confusing for consumers to fill out the designed questionnaire. Thus, a considerable proportion of failed products come from the mismatch between sensory properties and consumer needs . To address these limitations, we propose to use the principal component analysis method and heat maps to explore the correlation of several sensory attributes. For example, from product conception to post-launch monitoring, this kind of analysis could help researchers to deeply understand products behaviors from consumer feedback both on products sensory and effects [3-4]. Additionally, the analysis could also provide reference for researchers to design the right questionnaire when choosing sensory attributes.

Materials & Methods:

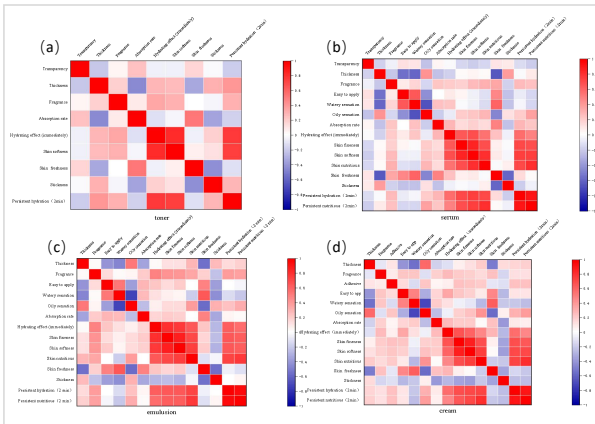| Materials		20 toner products，16 serum products, 17 emulsion products，28 cream products；8~10professionally trained panelists with high sensitivity and veracity；4 kinds of questionnaires；
Methods	assessment	the inside of forearms were divided into 3 quadrants, with each panelist applying one of the formulations in one of the quadrants randomly according to the random table, and taking six samples at each time.After the application,apanelists answer questionnaires which they had been used
	Statistical analysis	the relationship of attributes among four kinds of skin care cosmetics were studied by the principal component analysis (PCA) and heat maps of sensory attributes

Results & Discussion:

(1)According to the correlation heat maps of attributes (Figure1), among with four kinds of skin care cosmetics, there were negative correlations between transparency and thickness, thickness and absorption rate, thickness and skin freshness. On the contrary, hydrating effect (immediately) and skin softness, hydrating effect (immediately) and thickness showed positive correlations.

(2)In the interpretation of total variance from toner, serum, emulsion, cream (Table1), the results of principal component analysis presented that among the four skin care cosmetics, there are three, four, two, and three components greater than 1, and the variances of these

Figure1. Correlation heat maps of attributes about four kinds of skin care cosmetics（a-Toner，b-Serum，c-Emulsion，d-Cream）

Table 1. The interpretation of total variance from products

Component	% of Variance			
	Toner	Serum	Emulsion	Cream
The first principal component	35.10%	32.40%	35.92%	33.19%
The second principal component	22.30%	25.10%	27.69%	24.19%
The third principal component	11.32%	8.07%	/	6.85%
The fourth principal component	/	6.81%	/	/
Cumulative %	68.79%	72.50%	63.60%	64.22%

Table 2. The results of principal component analysis for the four kinds of skin care cosmetic

	Toner	Serum	Emulsion	Cream
The first principal component	Thickness, Hydrating effect (immediately), Skin softness, Persistent hydration (2min)	Hydrating effect (immediately), Skin fineness, Skin softness, Skin stiffness, Persistent nutritious(2min),	Hydrating effect (immediately), Skin fineness, Skin softness, Persistent hydration (2min), Persistent nutritious(2min), Skin nutrition	Hydrating effect (immediately), Skin fineness, Skin softness, Persistent hydration, Persistent nutritious, Skin nutrition
The second principal component	Absorption rate, Skin freshness	Thickness, Easy to apply, Watery sensation, Oily sensation, Skin freshness	Easy to apply, Watery sensation, Oily sensation, Skin firmness, Stickness, Thickness, Absorption rate	Thickness, Easy to apply, Watery sensation, Oily sensation, Skin freshness
The thirdly principal component	Transparency	Stickness	/	Absorption rate
The last principal component	/	Transparency, Absorption rate	/	/

components in the corresponding principal components were 68.787%, 72.497%, 63.604%, and 64.219%, respectively.

(3)The detail results of principal component was presented in table 2.

Conclusions:

In this study, it could be concluded that the same type of cosmetic products had obvious three key factors, correlating several sensory attributes. Furthermore, similar correlation could be found by principal component analysis in different types of skin care products such as toner, serum, emulsion and cream.Additionally, in the process of product development, cosmetic developers should fully understand the needs of consumers, grasp the relationship between these sensory attributes, and design sensory questionnaires reasonably, so as to design more satisfactory products and improve the possibility of product success. In parallel with the above study, it is vital for us to study which sensory attributes of the products are key to the consumer's purchase in different types of cosmetic products. Therefore, to find out which sensory attributes play an important role in popular products ,it is possible to design the sensory attributes questionnaires which include degree of preference in the future.

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