

Appendix

Criteria for Research Indicator Selection

1. Relationship between Sample Size and Number of Indicators

Principle: Ensure that the sample size is at least 5 to 10 times the number of research indicators needed to meet the minimum requirements for statistical analysis.

2. Relevance and Importance of Indicators

(I) Necessity principle: All indicators must be directly related to the research purpose, meaning they should provide direct or indirect information on the characteristics of oily sensitive skin. (II) Sufficiency principle: The selected indicators should be comprehensive enough to fully cover the key characteristics of oily sensitive skin, including but not limited to moisture level, colour level, texture level, and perception level.

3. Preliminary screening

Data Integrity: Consider only indicators with complete data, ensuring that no significant information is missing.

4. Correlation Analysis

Pearson correlation analysis was performed on the screened indicators, and the correlations among the indicators were visualized using a heatmap to intuitively assess the interrelationships between the indicators.

5. Classification and Labelling of Indicators

Classification: Indicators are divided into three categories: "essential," "optional," and "excluded." "Essential" indicators are crucial for classifying oily sensitive skin. "Optional" indicators may be helpful for classification but are not needed. The "excluded" indicators were those that did not meet the research purpose or data integrity requirements.

Table 1 Classification criteria

Category	Requirements
Essential	Must have been used in at least three

	academic journal articles for research on oily or sensitive skin
	The measurement results of the indicator are highly reproducible
	The selection of the indicator should be consistent with the consensus of experts in the field, reflected in expert consensus or industry standards
Optional	The measurement method of the indicator is under development, and preliminary standardization methods are available
	Indicators from outdated research literature
Excluded	The measurement results of the indicator are not reproducible

6. Practical Significance of Indicators

(I) Literature Support: Prioritize indicators that have clear records in the literature showing an impact on oily sensitive skin; (II) Functionality: Select functional indicators that can reflect physiological and pathological changes in the skin.

7. Final Determination of Indicators

(I) Comprehensive assessment: Based on the above criteria, the applicability of each indicator was comprehensively assessed. (II) Expert consultation: The opinions of experts in dermatological science and cosmetic research and development (with at least five years of industry experience) were consulted to ensure the scientific and rational selection of indicators.