

# Skin color diversity and skin quality of Chinese women

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## Introduction:

- According to Chinese consumers, definition of beautiful skin is multidimensional :
  - Color: an even tone, without pigmented spots, and transparent.
  - Skin quality: items of color and its repartition, radiance, skin relief (texture and wrinkles), hydration or ptosis and associated mechanical properties.
- Worldwide facial skin color : a large continuous space, with overlaps between ethnic groups (asian skin color has its own characteristics, with diversity [1], [2]).
- Identification of specificities of skin color and/or skin quality of several ethnic groups, countries or cities but what about:
  - Differences within ethnic groups (woman's uniqueness skin)?
  - Cross analysis of skin color / skin quality on a large number of Asian subjects?

### AIMS OF THIS STUDY:

- By a scientific review, to map Asian skin color,
  - To measure and identify skin color and skin quality typologies among the diversity of Asian skin color within a Chinese women population.
- Interest for makeup industry knowledge:
  - Beyond ethnic groups, diversity of skin tones, perceptions, expectations, and makeup strategies, taking into account bare skin color, allow to explain why and how women enhance, correct or transform their skin [2].
  - To better fulfill needs of Asian women for skin ideal product enhancer.

## Materials & Methods:

### PHASE 1: SCIENTIFIC LITERATURE REVIEW

- Focus on Asian skin color for a meta-analysis of the skin color ranges. Studies, either from academic or cosmetic field research, were included if they:
  - Measure Asian skin color through spectral measurement,
  - Provide descriptive statistics (raw data or at least the min, max and/or mean),
  - Have been written in English.
- For each study, following items were recorded:
  - Year of publication, country of the study, number of Asian subjects among the total number of subjects, country of origin of Asian subjects, gender,
  - Measurement tool, measuring area and L\*, a\*, b\*, C\*, h data (min, max and/or mean).
- Data are expressed in the CIE 1976 standard colorimetric space L\*C\*h (describe each color through three coordinates that reflect perception by human eye):
  - h for hue angle (from red to yellow for skin color,  $h^* = \arctan(b^*/a^*)$ ),
  - C\* for chroma (from muted, even close to gray color to vivid and intense color,  $C^* = (a^{*2} + b^{*2})^{1/2}$ ),
  - L\* for lightness (from dark to white, using a gray scale).



### PHASE 2: SKIN COLOR PRE-INCLUSION AND STUDY ON SKIN COLOR AND QUALITY OF CHINESE WOMEN

#### SUBJECTS

- Pre-inclusion phase: 176 Chinese women, users of cosmetics from the selective market, from 19 to 59 y.o (mean = 34; std = 7.4). Measurement of their facial skin color with the objective to select about 100 women.
- Study on skin color and quality: 102 Chinese women (from 20 to 68 y.o (mean = 42.2; std = 13.5)) among the 176 women of the pre-inclusion phase, selected because their skin color homogeneously covers the full range of Asian skin color diversity identified in the literature.

#### EXPERIMENTAL ACQUISITION DEVICES

Non-invasive devices to measure facial skin color, translucency, pores, hydration, elasticity.

- Skin color and skin color heterogeneity: Spectrophotometer (RM200QC, X-Rite Inc) on the forehead and on the cheek.
- Hydration: Corneometer® (CM825, Courage & Khazaka Electronic GmbH) on the cheek (5 times, the mean was considered)
- Elasticity: Cutometer® (MPA580, Courage & Khazaka Electronic GmbH) on the cheek (3 times, the mean was considered)
- Translucency: Translucencymeter® (TSL850, Dia Stron Limited) on the cheek
- Pores: through image analysis, VISIA-CR®. Canfield Scientific Inc.)

Measurements made in a room with standardized temperature (21°C +/- 3°C) on clean and bare skin.

#### STATISTICS

- Clusters of women made separately for skin color: considering the color of the bare skin on the cheek and the gap between the bare skin color on the cheek and the bare skin color on the forehead (L\*, a\*, b\*, C\* and h data), and skin quality (6 variables for elasticity, 3 variables for translucency and 6 variables for pores) according to CAH + two-step clustering method, to identify skin typologies.
- Data analysis performed using JMP (JMP®, Version 13.2.1, SAS Institute Inc., Cary, NC, 1989-2016) and R statistical environment (v.3.5.1).

## Results & Discussion:

### PHASE 1: SCIENTIFIC LITERATURE REVIEW

- 10 reviewed publications, ranging from 2006 to 2020, to gather skin color data measurement, corresponding to more than 8000 Asian subjects.
- Low availability of raw data and diversity of skin color measurement tools that have a great impact when computing colorimetric data.
- Asian skin color tends to be lighter (min L\* = 44.3; max L\* = 80.5; mean L\* = 62.9) and a little bit quite yellower (min h = 37.7; max h = 80.4; mean h = 52.2) even if some Asian women have a rather red skin.
- Important differences remain between countries, cities (i.e Chinese skin seems to be less yellow but more red and darker than Japanese skin).

### PHASE 2: SKIN COLOR PRE-INCLUSION AND STUDY ON SKIN COLOR AND QUALITY OF CHINESE WOMEN

- Pre-inclusion phase with 176 Chinese women: good skin color diversity for lightness (min L\* = 52.2, max L\* = 71.4, mean L\* = 63.6, delta L\* = 19.2, std = 3.1) and hue (min h = 41.5, max h = 82.9, mean h = 63.3, delta h = 41.4, standard deviation = 6.5), quite equivalent to the one identified in the literature, especially for hue, but in a lesser extent for lightness.
- Study on skin color and quality with 102 Chinese women:
  - Identification of 3 groups of women, based on their skin color on the cheek and the skin color difference between the forehead and the cheek:



- 24 women: the yellowest skin and homogeneous skin color. The oldest (mean age = 52.5 y.o).
  - 37 women: lighter and desaturated skin, heterogeneous for the C\*. The youngest (mean age = 34.0 y.o).
  - 41 women: darker and redder skin, homogeneous for the L\* but heterogeneous for the h\* (mean age = 43.6 y.o).
- Identification of 3 groups of women, based on their skin quality characteristics:

#### SKIN COLOR TYPOLOGIES

Number of women per group	Yellow and homogeneous	Light and desaturated, heterogeneous (saturation)	Dark and red, homogeneous (lightness) and heterogeneous (hue)
Transparent and poreless skin, lack of hydration	7	12	8
Hydrated and elastic skin	3	15	7
Less transparent skin with pores	14	10	26

No specific association between skin color and skin quality. Nevertheless, some trends can be observed.

Table 1: Number of women in the 9 typologies of skin color and skin qualities (3 color typologies in columns and 3 quality typologies in lines)

- Go deeper with:
  - A meta-analysis specifically on differences between Asian countries because of the great diversity of Asian skin color, especially in India, Korea, or in China with Mongolian skins.
  - Quantify skin thickness because it could have an impact on the age-related skin color and quality items (ie. [3] for an example).
  - Include lifestyle habits questionnaire to explain and modulated the differences between women.
  - To investigate makeup complexion strategy to observe the modulation of skin color and skin quality with makeup product, like foundation.

## Conclusions:

- Cross-analysis definition of typologies on skin colors and skin qualities allowed to highlight woman's uniqueness with regard to the diversity of skin tones and qualities among Chinese women.
- Skin color with its skin quality items: a key tool for understanding the diversity of concerns and needs of Chinese women, both for skin care and makeup usage.
- This work helped the formulation and development of a new makeup foundation range, especially developed for Asian skin in all their color and quality diversity.

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