A Study of Skin Color by Melanin Index according to Sex, Age, Site and Skin Phototype in Koreans

Tuk Woo Lim, M.D., Mu Hyoung Lee, M.D.

Department of Dermatology College of Medicine, Kyung Hee University, Seoul, Korea

Background: Skin color is determined by many factors including melanin and non-melanin pigments like hemoglobin and extraneous chemicals. Various factors such as race, sex, and age have been reported to have an influence on skin color.

Methods: Measurement of melanin index (M-index) was made by reflectance spectrophotometer at three different sites including forehead, abdomen and forearm in total 800 healthy subjects consisting of 100 males and 100 females of neonates (three days after birth) and children (male:8.08 ± 0.84, female:8.03 ± 0.80, total :8.06 ± 0.82 years of age), adolescence (male:13.89 ± 0.76, female:13.96 ± 0.79, total:13.93 ± 0.78 years of age), and adults (male:24.26 ± 0.82, female:24.40 ± 0.89, total:24.33 ± 0.86 years of age). We also investigated the change of M-index by each skin phototype of college students determined by Fitzpatrick classification.

Results: From the birth to the puberty, sex difference of melanin index was generally not noted, but adult females showed lower levels of melanin index in all sites measured. M-index increased from birth to adolescence, and decreased after adulthood. Forehead showed highest melanin index compared with other sites. Increase of M-index was noted as skin phototype goes from III to V.

Conclusions: Factors including sex, age, body sites and skin phototype have a significant influence on the changes of skin color in humans. (Ann Dermatol 14(2) 71-76, 2002).

Key Words: Skin color, Melanin index, Reflectance spectrophotometer

The human skin color depends not only on its constituent elements such as melanin, distribution of blood vessels, hemoglobin and thickness of stratum corneum, but equally on the light source with which it is illuminated and the detector with which it is perceived. Constitutive elements are the absorbing chromophores, scatters, and their constellation and distribution1. There are many factors that determine the color of human skin. They include quantity of melanin pigment and its chemical structure and nonmelanin pigments such as oxygenated and reduced hemoglobin which pass through the papillary capillaries, extraneous chemicals like carotene and other chemicals like lycopene and licorice2. Various factors including race, sex and age are reported to have an influence on change of human skin color. Human skin color is generally thought to be fairly constant throughout the life. For a long time, variation of human skin color has been of great concern for physical anthropologists. However, visual comparisons of skin color with standardized sets of colored paper were too subjective to obtain reliable results3. The first quantitative measurement of skin pigmentation in humans was made by Hardy spectrophotometer which could measure and analyze skin color objectively4. Recently, a hand-held microprocessor-controlled reflectance spectrophotometer with digital readout (Derma-Spectrophotometer® Cortex technology, Hadsund, Denmark) began to be used in

Received May 31, 2001.
Accepted for publication August 10, 2002.
Reprint request to: Mu Hyoung Lee, M.D., Department of Dermatology, College of Medicine, Kyung Hee University, 1 Hoeki-Dong, Dongdaemun-Ku, Seoul, 130-702 Korea Tel. (02)958-8512, Fax. (02)969-6538 E-mail: mhlee@khmc.or.kr.
many dermatological studies. This instrument provides a readout of the erythema and melanin indices as a function of the absorbance characteristic of human skin. Each index increases as the skin becomes more erythematous and more pigmented, respectively, so the M-index can be regarded as a parameter which is mainly influenced by the melanin content.

The purpose of this study is to investigate the patterns of variation of skin color according to sex, age, site and skin phototype in Koreans by using a hand-held microprocessor-controlled reflectance spectrophotometer (Derma-Spectrophotometer®, Cortex technology, Hadsund, Denmark).

SUBJECTS AND METHODS

Subjects
Total 800 healthy subjects consisting of 100 males and 100 females of neonates (three days after birth) and elementary school (male:8.08 ± 0.84, female:8.03 ± 0.80, total:8.06 ± 0.82 years of age), middle school (male:13.89 ± 0.76, female:13.96 ± 0.79, total:13.93 ± 0.78 years of age), and college students (male:24.26 ± 0.82, female:24.40 ± 0.89, total:24.33 ± 0.86 years of age) participated in this study in spring to avoid seasonal variations. All of neonates had a known gestational age (37-42 week) calculated from the date of mothers last menstrual period. We also investigated the change of melanin index (M-index) by each skin phototype of college students determined by Fitzpatrick classification.

They were all healthy without any dermatologic problems such as ance, melasma, or nevi and other systemic diseases. Women in their menstrual period were excluded.

Measurement
Measurements of cutaneous pigmentation using M-index by reflectance spectrophotometer (Derma-Spectrophotometer®, Cortex technology, Hadsund, Denmark) at three sites, forehead, abdomen and inner aspect of forearm were performed after calibration to every series of the measurement. For neonates, all measurements were taken between 6:00 AM and 7:00 AM, and for elementary, middle school, and college students, all measurements were taken between 5:00 PM and 6:00 PM.

RESULTS

1. Difference according to gender
In neonates, no significant sex difference of M-index was observed in all sites measured (Table. 1, Fig