The survey on the skin color and pigmentation index in Korean adult subjects

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SYNOPSIS

We selected 113 subjects (male:59, female:54) in 20 to 29 age and observed the skin color difference between female and male. Also we measured the minimal persistent pigment darkening dose (MPPD) in same subjects. The skin colors of upper inner arm and back were measured with chromameter (CR10, Minolta, Japan) which represents skin color as L*, a*, and b* in value. MPPD was measured with solar simulator multi-port 601(Solarlight Co. USA). All statistical analysis was performed on the computer software package SPSS 8.0.

The skin colors between male and female was significant difference in back and upper inner arm. There was significant difference of skin colors between back and upper inner arm in both male and female. There was no relationship existed between the values of MPPD and skin color (L*a*b*) of back in both male and female.

As a result of survey, we knew that there was apparent difference of skin color between back and upper inner arm due to gender. Also we hope these data will be helpful to study on the correlation of the pigmentation index and skin color.

KEYWORDS

lightness, redness, yellowness, MPPD, skin color, pigmentation index

INTRODUCTION

Human skin color shows variations throughout life, and many extrinsic and intrinsic factors influence melanogensesis. The characteristics of skin pigmentation have been studied largely in white Caucasions. Facultative pigmentation of sun-exposed skin has

been suggested to reflect cumulative lifetime ultraviolet (UV) radiation exposure in caucasions. However, pigmentary changes due to various regulatory factors may be different in dark-skinned peoples. The assessment of skin sensitivity UVR is important in treating a variety of skin diseases and preventing the deleterious effects of UV. Although there are many ways to predict the sensitivity to UVR, controversies exist over their objectivity, correlation, and applicability in various races. For the purpose of evaluating the relationship of skin color and UVA-induced Minimal Persistent Pigment darkening Dose (MPPD) responsiveness, this study was observed the variations in skin color due to gender difference and performed to assess the validity of constitutive skin color for an individual's UVA sensitivity in 113 healthy Korean subjects with aged 20 to 29.

MATERIAL AND METHODS

Subjects

A total of 113 subjects who were between 20 and 29 years old were surveyed. The subjects were divided into two groups due to gender : 59 subjects were male and 54 subjects were female. Skin measurements were performed at two sites of right upper inner arm and below the scapula of the left back. UVA exposure were performed at the site of back which had clear and not spots.

Skin Color Measurement

The Chromameter CR10(Minolta, Japan) was used to measure skin color (L*,a*,b*) on two sites. The L*, a*, and b* values mean the degree of lightness, redness, and yellowness respectively. Measurements, not exactly at the same location, were made in triplicate at each skin site and the average of these three measurements was calculated and used for group statistics.

Light sources

Multi-port solar simulator 601(Solarlight Co., Ltd., US) with xenon arc lamps was used as light sources for UVA irradiation. Light source was equipped with filter such as WG345

and UG5 to eliminate UVB, UVC, and visible light. The intensity of irradiated UVA energy was measured by 3-D UV meter(Solarlight Co., Ltd., US).

MPPD measurement

A subject was exposed to UVA on the back with six graded doses ranging from 8.75 J/㎠ to 26.69 J/㎠ in increments of 25%. The MPPD(Minimal Persistent Pigment darkening Dose) was defined as the lowest dose of UVA radiation that produced a minimum noticeable pigmentation of the skin immediately after 4 hours of UVA radiation.

Statistical Analysis

To evaluate the difference in skin color according to back and upper inner arm between the two groups, we used independent t-test of SPSS 8.0 software. To establish the relationship of skin colors according to MPPD, simple regression coefficient was determined by linear regression.

RESULTS

1. Comparison of skin color according to gender difference

There was significant differences of lightness, redness, and yellowness according to gender in back ($p<0.01$) (Table Ⅰ). Lightness of female was higher than that of male, but redness and yellowness of female were lower than those of male (Fig. 1, 2, and 3).

In upper inner arm, the lightness and redness between male and female showed significant difference ($p<0.01$) (Table Ⅱ) but the yellowness did not. Lightness of female was higher than that of male, but redness of female was lower than that of male. Yellowness of male showed high tendency compared with female, but there was no significant difference.

2. Comparison of skin color according to measuring sites

There was significant differences of lightness, redness, and yellowness according to measuring sites in male ($p<0.01$) (Table Ⅰ and Ⅱ). In male, lightness of upper inner arm

was higher than that of back, but redness and yellowness of upper inner arm were lower than those of back (Fig. 1, 2, and 3). In female, there was no difference of lightness between back and upper inner arm, but redness and yellowness of back were higher than those of upper inner arm respectively ($p<0.05$ and $p<0.01$).

3. Relationship between skin color and MPPD according to gender difference

In male, the MPPD of back the number of persons shown the MPPD were follows: 13.65 J/㎠: 6, 17.08 J/㎠: 22, 21.35 J/㎠: 20, 26.69 J/㎠: 11. In female, the MPPD of back the number of persons shown the MPPD were follows: 13.65 J/㎠: 4, 17.08 J/㎠: 24, 21.35 J/㎠: 17, 26.69 J/㎠: 9 (TableⅢ). The skin color of back according to MPPD showed as TableⅣ. The skin color (L*a*b*) of back was not correlated to MPPD (Fig. 5).

DISCUSSION

We found some interesting results from this study: 1) We confirmed again that the skin color between male and female was significant difference in back and upper inner arm except for the yellowness of upper inner arm. 2) There was significant difference of skin color between back and upper inner arm in both male and female except for the lightness of female. 3) We could find no relationship existed between the values of MPPD and skin color(L*a*b*) of back in both male and female.

Skin color is classified as either constitutive or facultative skin color. The constitutive skin color is the genetically determined color of healthy skin unaffected by solar irradiation in the areas such as buttock and upper inner arm. When studying skin color to determine the predictive value of UV sensitivity, the constitutive skin color is used as the representative skin color. In white Caucasians, Andreassi et al. reported that the constitutive skin color (L*) dropped significantly with increasing MED. In pigmented individuals, Kawada reported that the values of constitutive skin color and MED were well correlated to Japanese skin type. In Koreans, Lee reported that the values of constitutive skin color (L*) only in the young-aged group was inversely correlated with the value of MED but did not correlate with that of MPPD in both young-aged group and old-aged group.

Since previous reports have been not given consideration to gender and redness / yellowness, we divided the subjects into male and female with aged 20 to 29. In this study, we found no relationship existed between the value of MPPD and of L*a*b* in both male and female.

CONCLUSION

For the purpose of evaluating the relationship of skin color and UVA-induced Minimal Persistent Pigment darkening Dose (MPPD) responsiveness, this study was observed the variations in skin color due to gender difference and performed to assess the validity of constitutive skin color for an individual's UVA sensitivity in 113 healthy Korean subjects with aged 20 to 29. From the study, the following conclusions were obtained.

1) The skin colors between male and female was significant difference in back and upper inner arm except for the yellowness of upper inner arm.
2) There was significant difference of skin colors between back and upper inner arm in both male and female except for the lightness of female.
3) In male, compared with female, lightness of back and upper inner arm was low but redness and yellowness of back and upper inner arm were high.
4) In male, lightness of upper inner arm was higher than that of back but there was no difference in female.
5) Redness and yellowness of back were higher than those of upper inner arm in both female and male.
6) There was no relationship existed between the values of MPPD and skin color (L*a*b*) of back in both male and female.

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Table Ⅰ. The skin color of back

Gender	L	a	b
Male	61.5±3.6	19.6±1.7	19.6±1.9
Female	65.8±2.9	9.4±1.6	18.4±2.1

Mean±S.D. (male: n=59, female: n=54) L : lightness, a : redness, b : yellowness

Table Ⅱ. The skin color of upper inner arm

Gender	L	a	b
Male	63.9±2.3	10.2±1.1	16.1±1.7
Female	65.4±2.0	8.8±1.1	15.7±1.9

Mean±S.D. (male: n=59, female: n=54) L : lightness, a : redness, b : yellowness

Table Ⅲ. Distribution of MPPD in male and female

MPPD	13.65 J/㎠	17.08 J/㎠	21.35 J/㎠	26.69 J/㎠
Male	6(10.2%)	22(37.3%)	20(33.9%)	11(18.6%)
Female	4(7.4%)	24(44.4%)	17(31.5%)	9(16.7%)

The number of person(percentage) MPPD : Minimal Persistent Pigment darkening Dose

Table Ⅳ. The skin color of back according to MPPD in male and female

MPPD		13.65 J/㎠	17.08 J/㎠	21.35 J/㎠	26.69 J/㎠
Male	L	61.4±3.3	61.5±3.9	61.9±3.2	61.1±4.4
	a	11.7±1.7	11.7±1.6	11.9±1.6	11.9±2.3
	b	18.5±1.5	19.9±2.0	19.4±1.8	19.8±1.9
Female	L	65.8±2.1	65.7±3.0	65.2±3.1	67.0±2.9
	a	8.6±0.7	9.5±1.5	9.8±2.0	8.9±1.3
	b	18.3±1.4	18.1±1.6	19.4±2.0	17.3±2.8

Mean±S.D. (male: n=59, female: n=54) L : lightness, a : redness, b : yellowness

MPPD : Minimal Persistent Pigment darkening Dose

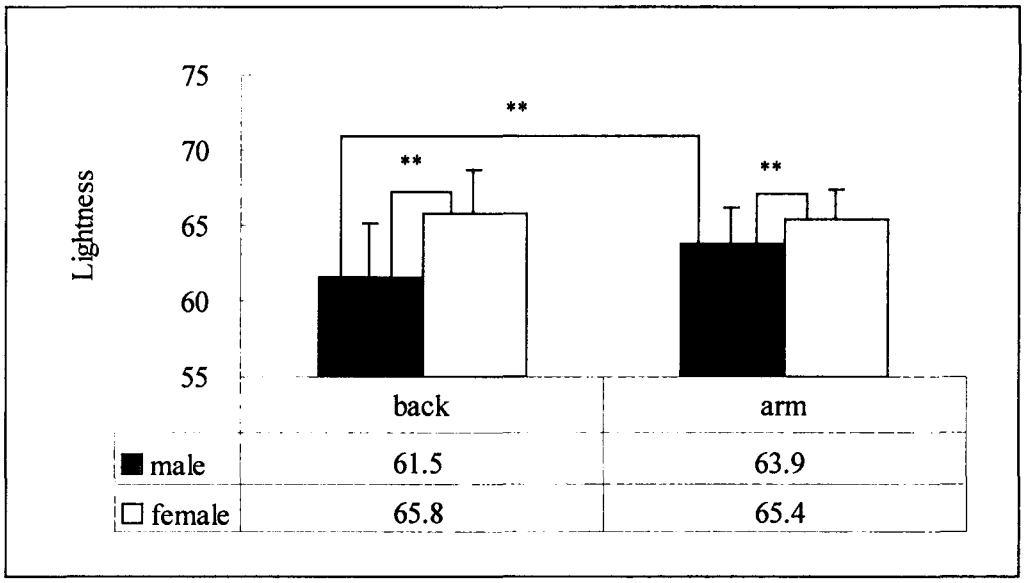

Figure 1. The lightness of the skin of back and upper inner arm according to gender difference.

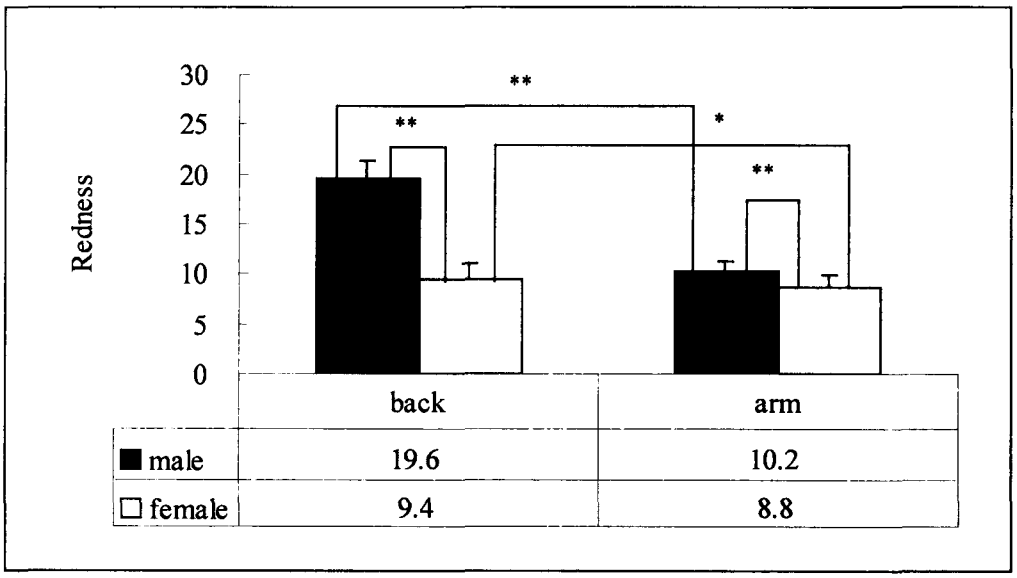

Figure 2. The redness of the skin of back and upper inner arm according to gender difference.

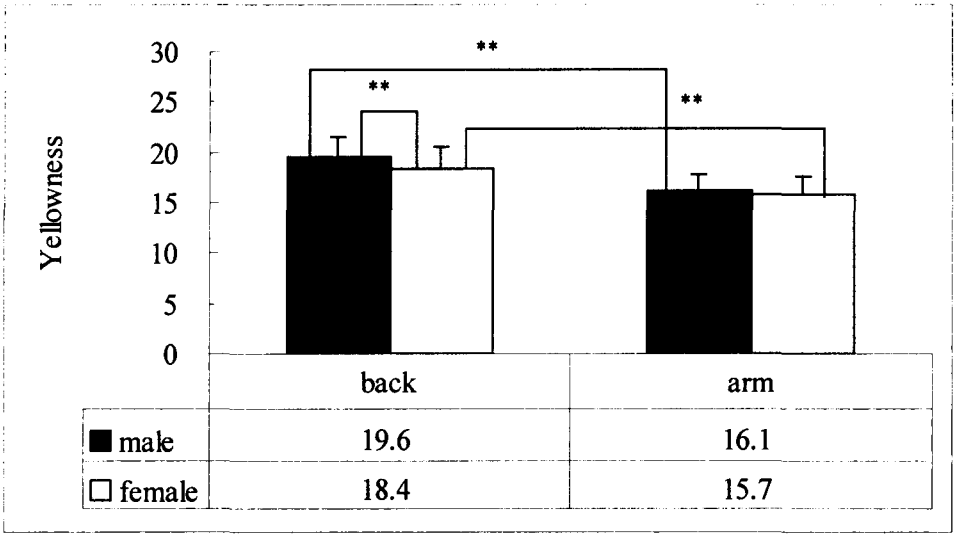

Figure 3. The yellowness of the skin of back and upper inner arm according to gender difference.

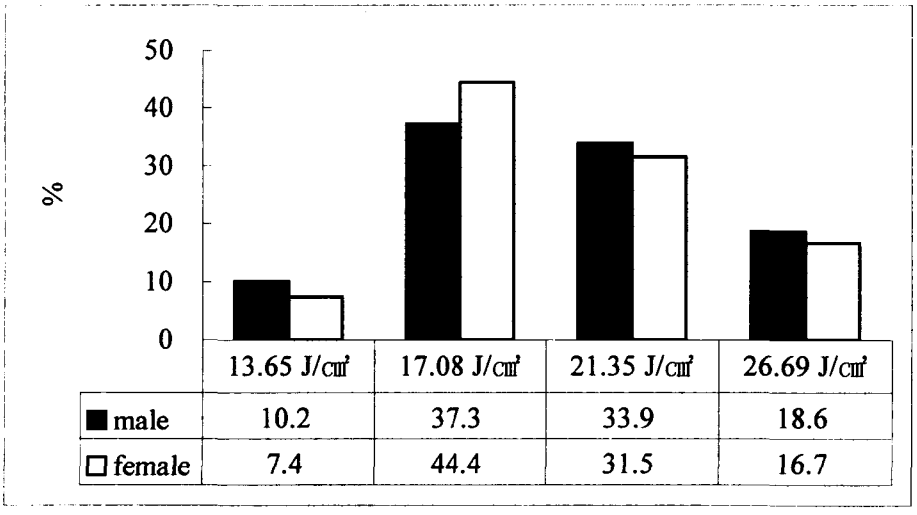

Figure 4. Distribution of MPPD in male and female.

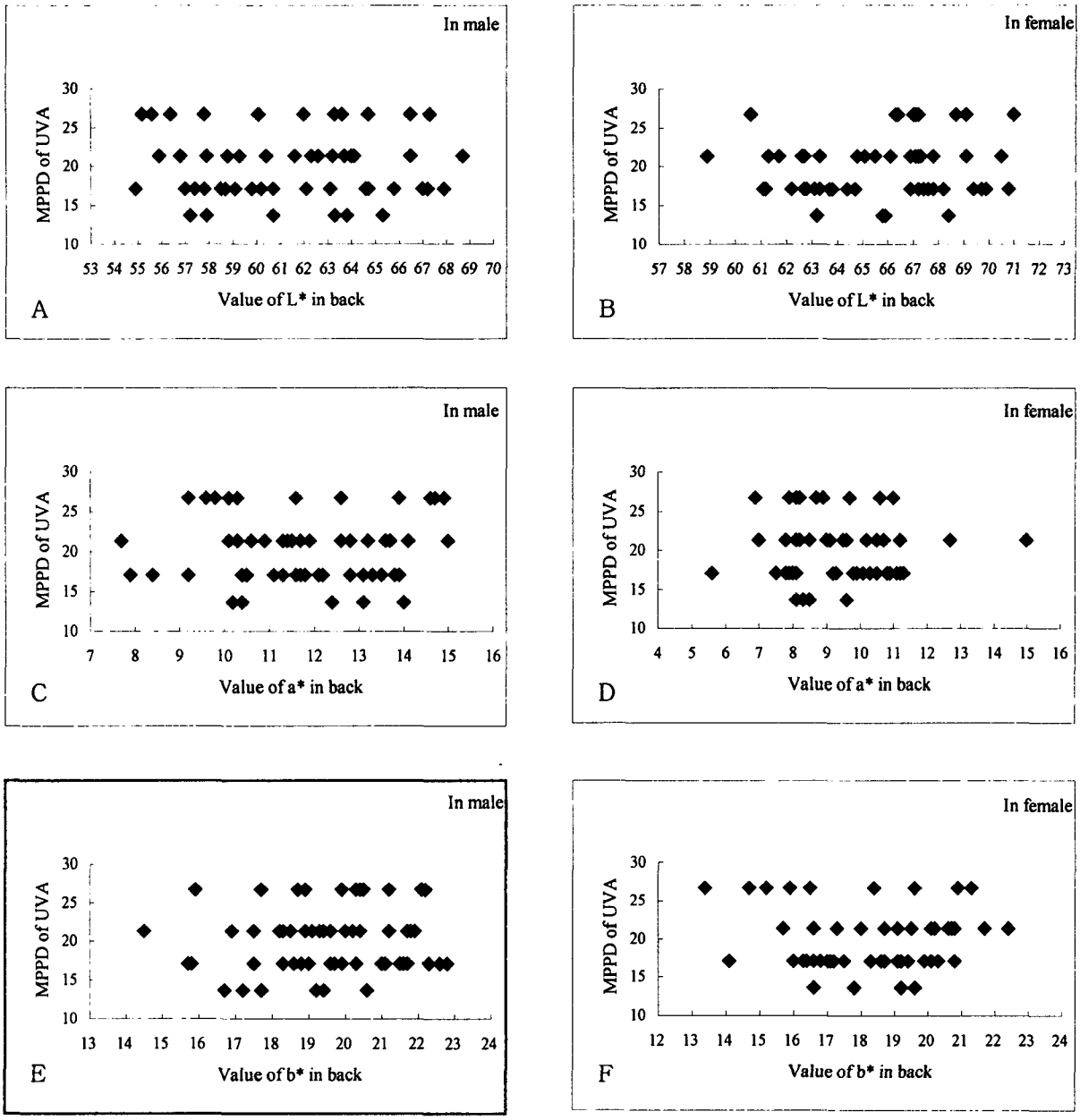

Figure 5. There was no correlation between constitutive skin color (L*a*b*) and MPPD of UVA in both male (A,C,E) and female (B,D,F).