Sex and Age Variation in the Skin Color of Irish Children[1]

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Studies of human skin color, as measured by reflectance spectrophotometry, have shown conflicting conclusions regarding the effects of sex and age variation. In light-skinned populations, both male and female adults have been found to be the darker sex (e.g., Rigters-Aris 1973, Sunderland et al. 1973). During childhood and adolescence the situation is even more complex, with both sexes being darker depending on the age-range sampled and the wavelength of measurement (e.g., Garn, Selby, and Crawford 1965, Rigters-Aris 1973, Smith and Mitchell 1973). Few studies have attempted to assess the nature of sex and age variation simultaneously. Here, we report on a preliminary survey of sex and age effects on the skin color of Irish children, aged 4 to 14 years, with special attention to sex-age interaction and physiologic factors.

Our data consist of skin reflectance measures taken on 329 schoolchildren in the town of Longford, County Longford, the Republic of Ireland, as part of a growth study (Relethford, Lees, and Byard 1978, Lees, Byard, and Relethford 1979, Relethford and Lees 1983). Measurements were taken with both E.E.L. and Photovolt reflectometers at the upper inner arm site during a one-month period (June 1977) selected to minimize environmental and seasonal variation. Basic descriptive statistics for the entire sample have been published elsewhere (Lees, Byard, and Relethford 1979); additional data by sex are available on request from the senior author. Data from the two machines gave similar results, and only the E.E.L. results are given here. The sample consists of 274 males, aged 4.2 and 13.8 years (mean = 10.1 years), and 39 females, aged 4.0 to 12.7 years (mean = 7.8 years). While the female sample is small relative to the male sample, we feel these are adequate sample sizes for a preliminary study of a single homogeneous population. The difference in mean age between the sexes is statistically significant ($t = 6.81$, $P < 0.001$), indicating that any conclusions regarding sex differences in skin color must take into account possible effects of age variation.

As shown in table 1, the E.E.L. machine samples the visible spectrum with nine filters corresponding to the blue (601, 602, 603), green (604, 605, 606), and red (607, 608, 609) portions of the spectrum. The results of the t tests between the sexes show that males have darker skin at the blue and red wavelengths, with the opposite pattern in the green range of the spectrum. Only one filter (606, in the green range) shows a significant sex difference ($P < 0.05$).

Differences in the age of the two samples and correlation of skin reflectance with age may obscure or enhance sex differences. To examine this possibility, we regressed skin reflectance on age for both sexes. For neither sex were any significant departures from linearity detected. For males, only two filters show significant regressions, both showing darkening with age: 608 ($R^2 = 0.027$, $P < 0.001$) and 609 ($R^2 = 0.016$, $P < 0.05$). This trend toward darkening with age in the red range of the spectrum suggests an increase in melanin production (most apparent in the red filters) due to hormonal changes (Kalla 1974). For females, only two filters show significant regressions, both of which indicate darkening with age in the green range of spectrum: 605 ($R^2 = 0.143$, $P < 0.05$) and 606 ($R^2 = 0.200$, $P < 0.01$). The green range includes the absorption bands for oxy-hemoglobin and reduced hemoglobin and thus shows variation in blood flow to the greatest extent (see Harmse 1964). Thus the present study suggests an increase in blood flow with age for females.

Given that there is significant age variation in females for the green filters and that the ages of the samples are significantly different, the observed sex differences (greatest in the green range) could be influenced by age variation. To test this, we corrected for age variation using linear regression for all filters. The resultant sex differences are reported in table 1. All three green filters show a significant sex difference after age correction, suggesting that age differences in the two samples acted to obscure sex differences in the raw data.

In many studies males are darker than females, presumably because of more melanin and a greater blood supply (Edwards and Duntley 1939). In the present study, the reversal of sex differences in the green range of the spectrum runs counter to this suggestion, since the results suggest greater blood flow in females. Several explanations of this finding relate to sex differences in physiologic changes during growth. Given the fact that females mature earlier than males, females in the age-range studied (mid-childhood to early adolescence) would be expected to show more evidence of prepubescent hormonal activity. The pituitary gland has been noted to be responsible for the production of the melanocyte-stimulating hormone (Marshall 1960). This effect, however, should be apparent across the visible spectrum and particularly in the red range rather than only in the green range. This may, however, be responsible for the small negative regressions on age for filters 608 and 609 in males.

Another possible explanation is the increase in estrogen production during preadolescence in females, which results in an increase in the rate of hemoglobin oxygenation (Edwards 1953). The resultant increased cutaneous blood flow would make females darker than males in the green range and darker as they approach puberty, both of which are observed in the present study. Similar effects should be apparent in males because of increased testosterone (Edwards 1953) but may not be revealed because the number of males who have reached puberty is small in the present study. That sex differences in the green range persist after age correction is also explained by the age-range sampled, since few males old enough to show marked effects of increased hormonal activity were measured.

An increase in the amount of blood flow in females as revealed by reflectometry may also be explained by their having a greater number of subcutaneous capillaries (Rigters-Aris 1973). This suggests a greater amount of subcutaneous fat in females prior to adolescence, which is quite common (Tanner 1978). To test this hypothesis, t tests of sex differences were computed for three measures of subcutaneous fat: triceps, subscapular, and calf skinfolds, all log-transformed. For both raw data and age-corrected data, females are significantly fatter ($P < 0.001$). Sex differences were also computed for three measures of overall body mass (weight, upper arm circumference, and calf circumference). For the raw data, males are significantly larger for all measures ($P < 0.001$), but this difference is nonsignificant after age correction ($P > 0.40$). These results show that for our samples, females have more subcutaneous fat, both absolutely and relatively.

In sum, sex and age variation in our sample is most evident for those filters which indicate variation in the amount and/or flow of blood. The increased amount of blood in the skin of females seems to be due to an increased level of hormonal activity, a greater amount of subcutaneous fat, or both. Unfortunately, we do not have data on age at menarche which would aid in evaluating these hypotheses. Given the small samples

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TABLE 1

Sex Differences in Skin Reflectance

Filter	Wavelength (nm)	*T* Test of Sex Differences (M-F)	
		Raw Data	Age-corrected Data
601	425	−0.28	0.19
602	465	−0.42	−0.47
603	485	−0.85	−0.73
604	515	0.73	2.02*
605	545	1.76	3.69***
606	575	2.01*	4.19***
607	595	−0.28	1.05
608	655	−1.38	−0.94
609	685	−0.61	−0.76

Note: The direction of the t values indicates which sex is darker (+, females darker; −, males darker).
* $P < 0.05$, *** $P < 0.001$ (two-tailed test).

used in this study, the results cannot be extended to all light-skinned populations except in a suggestive manner. We note, however, the basic trends of sex and age variation found in our study to be similar to those in other studies and offer our explanations in the hope that future research will expand upon them.

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Kin and Casinos: Changing Family Networks in Atlantic City[1]

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Empirical studies of urban migration indicate that people often utilize family ties when attempting to exploit economic opportunities in the cities.[2] Migrants try to lessen the material, social, and psychic costs of migration by employing what Graves and Graves (1980) call a kin-reliant adaptive strategy.[3] Their relatives living in the cities provide potential migrants with information about jobs and actual migrants with lodging, contacts (for employment), and a ready-made social network to ease the trauma associated with a transition to city life. People also use family ties when arranging their short-term visits to the city in order to reduce the costs of the urban experience (Caldwell 1969:81–82). Their urban relatives may provide them lodging or information about entertainment in the city or accompany them on excursions.

Kinship networks often change when they are utilized in this fashion. In many cases the effective kin networks of visitors, migrants, and urban residents expand as a result of the activation of distant ties or increased bilateralization of relationships (Nukunya 1975:167–70; Vatuk 1972:196). The intensity of interaction within networks may also increase, particularly between urban residents and those to whom they are more distantly related. These changes suggest that people restructure their networks to take advantage of the potential material and social benefits of the cities.[4] When a city is also experiencing

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[2] Studies describing the use of kinship networks in migration are too numerous to cite here. Many cases are discussed by Graves and Graves (1980) and Johnson (n.d.).

[3] A kin-reliant strategy may entail heavy costs which make it unattractive to some (Graves et. al. 1982). These people may choose different adaptive strategies, peer-reliant (using ties of friendship) or self-reliant (Graves and Graves 1980). The degree to which each strategy is used by migrant groups varies with cultural background and socioeconomic status.

[4] An interactionist model such as that developed in Barth (1966), Blau (1964), and Schneider (1974) provides an excellent perspective from which the data can be analyzed.