Arsenic, Cadmium and Lead Levels in Hair and Toenail Samples in Pakistan

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We collected toenail and hair samples from 160 subjects, 83 males and 77 females, residing in Lahore city and its suburban areas in Pakistan, and examined the concentrations of arsenic, cadmium, lead and other metals using inductively coupled plasma mass spectrometry (ICP-MS). The mean hair and toenail arsenic levels were 0.31 ppm and 0.70 ppm, respectively. The correlation coefficient between log-transformed values of hair and toenail arsenic levels was 0.16 ($p=0.051$). After excluding a subject with hair and toenail arsenic levels as high as 1.12 ppm and 4.72 ppm, respectively, the correlation coefficient was 0.27 ($p=0.001$). Arsenic levels observed in the present study were relatively higher than in most developed countries. Hair or toenail arsenic concentration was not affected by sex, area of origin, place of residence and education, but toenail arsenic levels increased with age ($p=0.029$). Fish consumption was inversely related to arsenic levels, suggesting that consumption of beans, which are the main staple of poor people living in the study area who cannot afford to eat fish frequently, may be the source of arsenic exposure among the residents of Lahore and its suburban areas. The mean hair and toenail cadmium levels in the present study were 0.08 ppm and 0.05 ppm, respectively. The correlation coefficient between log-transformed values of hair and toenail cadmium levels was 0.17 ($p=0.034$). Cadmium levels were lower compared to those reported from developed countries, including Japan. The mean hair and toenail lead levels were 3.53 ppm and 2.11 ppm, respectively. The correlation coefficient between log-transformed values of hair and toenail lead levels was 0.15, which was not statistically significant ($p=0.055$). When a female subject with toenail lead of 52.4 ppm was excluded, the correlation was 0.17 ($p=0.036$). Lead levels observed in the present study were similar to those reported from developed countries. In the present study, relatively high lead toenail values were observed among children. The levels of cadmium and lead in hair but not in toenails were higher among those living in central Lahore than among those living outside Lahore, suggesting that dust containing those heavy metals was attached to hair samples due to a typical urban environment with heavy traffic load, congested population and industrial activities.

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