FLUORIDE IN HAIR

Although fluoride in blood and urine is ordinarily the most accurate indicator of current or recent fluoride exposure, hair samples have the advantage of revealing longer-term exposure as well as being easy to collect and store. Hair analysis is also used to ascertain body levels of certain vital nutrients as well as toxic accumulations of other elements of environmental concern including arsenic, cadmium, lead, mercury, and selenium, but applications to fluoride appear to have been quite limited. In this issue of *Fluoride*, two research groups in Poland report on hair F analysis to determine accumulation levels of fluoride in humans and rats.[1,2]

In the human investigation[1] (pages 196-204), 548 hair samples were obtained from children and adults living in five counties of the low-fluoride Ciechanów region of Poland. Information supplied by the participants was then used to correlate hair fluoride levels, determined by a carefully validated method, with various criteria of fluoride exposure including water fluoride content in relation to geographic and seasonal data, habits of tea drinking and fish consumption, tooth-brushing frequency, and other factors. Unfortunately, only mean hair fluoride levels were reported, so correlations with potential individual fluoride-related medical conditions, such as kidney dysfunction, gastrointestinal distress and osteoarthritic conditions, are not available.

The mean hair F figures in the five low-fluoride counties ranged only from 1.81 µg/g (ppm) to 2.32 µg/g, suggesting little difference overall in fluoride exposure. Results from the urban and rural areas were also essentially no different from one another (2.0 vs 2.1 µg/g, respectively). On the other hand, lower F levels in the water supplies correlated with lower hair F levels, although differences in diet, tea drinking, and tooth brushing did not or did so only slightly. The similar hair F levels in the five counties apparently reflect virtually identical water F, relatively unpolluted air, and nearly the same overall levels of fluoride ingestion.

In the other part of this study, F levels in 71 hair samples from workers in various divisions of the electrolysis department of the aluminum plant in Konin were radically elevated, ranging from 113.7 to 5459.8 µg/g. For the actual electrolysis workers, employed for an average of 11.7 years, the mean hair F level was very high at 2828.1 µg/g. Not surprisingly, ambient F concentrations in the electrolysis unit areas were higher than allowed by Polish air-quality standards for the workplace. The authors do not report on the health of any of these workers, although such information would certainly be desirable to have.

In the animal investigation[2] (pages 174-181), oral and inhalatory intake of F by rats was investigated to determine whether a correlation exists between F accumulation in dorsal hair, bones, and teeth. According to the authors, after 6 months, with 20 ppm F in the drinking water or 8.7 mg HF/m^3 in the air for 2 hr/day, "no differences in appearance, behavior, and weight gain between both groups of exposed animals and controls were noticed…." However, more F

accumulated in the hair, bones and teeth of the HF-exposed rats after 6 months than in the 20-ppm F water group. Positive correlations were also found between F levels in bone and washed or unwashed hair, leading the authors to conclude that "even unwashed hair may serve as a passive indicator of [F] exposure, especially to gaseous fluorine compounds."

The results of this study, as in the other one, "indicate that hair may be useful in evaluation of environmental or occupational exposure to fluoride." The primary value of hair F analysis is that it can serve as an indicator of long-term exposure, whereas F levels in blood and urine ordinarily more accurately reflect contemporary exposure.

These investigations have clearly demonstrated and confirm the obvious value of hair F analysis as an unobtrusive way to determine the body burden of fluoride. It is puzzling, therefore, why it is apparently so rarely used clinically. I personally have had hair analyses for a wide range of elements such as chromium, copper and zinc, but I have been unable to find any laboratory, at least in the United States, that determines hair F. Are physicians unaware of the potential value of hair F analysis? Could there be political policy concerns, rather than scientific or practical reasons, why it is not widely available?

Certainly with today's growing evidence of increased fluoride exposure and intake, being able to know the total body burden of fluoride and not just the current or transient fluoride concentrations in blood and urine, has become potentially more important than ever.

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REFERENCES

1 Kokot Z, Drzewiecki D. Fluoride levels in hair of exposed and unexposed populations in Poland. Fluoride 2000;33:196-204.
2 Stolarska K, Czarnowski W, Urbanska B, Krechniak J. Fluoride in hair as an indicator of exposure to fluorine compounds. Fluoride 2000;33:174-81.