The Effect of Hair Color on the Incorporation of Codeine into Human Hair

The purpose of this study was to determine if codeine, as a model compound for abused drugs, would be incorporated into black, brown, blond, or red hair as a function of melanin concentration. Male and female Caucasians with black (n=6), brown (n=12), blond (n=8) or red hair (n=6) and non Caucasians with black hair (n=12), aged 21-40 years of age were administered oral codeine phosphate syrup in a dose of 30 mg three times a day for five days. Twenty-four hours after the end of the treatment period, a 30 mg codeine dose was administered and the subject's plasma area under the concentration time curve (AUC) for codeine was determined. Codeine and melanin were measured in the first 3 cm of hair closest to scalp prior to and 1,4,5, 6,and 7 weeks after dosing. The quantitative and qualitative melanin profiles were determined for each subject's hair to provide an objective measure of hair color. The plasma concentrations of codeine were measured to eliminate differences in the bioavailability and clearance of codeine as factors that might account for the differences in codeine hair concentrations. The mean hair codeine concentrations 5 weeks after dosing were 1,429 pg/mg in black hair; 208 pg/mg in brown hair; 99 pg/mg in blond hair; and 69 pg/mg in red hair. In black hair, codeine concentrations were 2,564 pg/mg for Asians and 865 pg/mg for Caucasians. Similar concentration relationships were observed at weeks 4, 6, and 7. A strong relationship between the hair concentrations of codeine and melanin was observed. These data demonstrate that the interpretation and reporting of hair test results for codeine are influenced by hair color. After this dosing protocol, the proposed federal guideline cut-off of 200 pg/mg of codeine would result in 100% of subjects with black hair and 50% of subjects with brown hair being reported as positive, and subjects with blond or red hair would be reported as negative. The incorporation of these drugs into hair should be studied carefully in humans to ensure the appropriate interpretation of drug concentrations. Rollins, D.E., Wilkins, D.G., Kruger, G.G., Augsburger, M.P., Mizuno, A., O'Neal, C., Borges, C.R. and Slawson, M.S. Journal of Analytical Toxicology, 27, pp. 545-551, 2003.

http://www.drugabuse.gov/DirReports/DirRep504/DirectorReport1.html