Changes in serum thiocyanate concentration on stopping smoking

The serum thiocyanate concentration is one of several variables used to substantiate the extent of exposure to tobacco smoke in smokers. Thiocyanate is used because of its comparatively long biological half-life, which is generally considered to be two weeks. This figure is based on the findings of Pettigrew and Fell, who measured serial thiocyanate concentrations at fairly long intervals in one person who had stopped smoking. I performed a similar study in six subjects to obtain a more exact determination of the half-life of thiocyanate and a more precise description of the thiocyanate concentration curve.

Subjects, methods, and results

Three healthy men and three healthy women who had smoked cigarettes for from six to 20 years stopped smoking completely. The initial concentration of thiocyanate was determined once within five days before they stopped smoking. After they stopped smoking four or five fasting specimens of blood were taken from each of the subjects, with the last samples being taken 26, 30, 35, 39, and 44 days after they stopped. The samples were obtained in the morning at fixed times for each person with the subjects sitting. A tourniquet was applied for a maximum of one minute and removed after insertion of the needle. Specimens were drawn into Vacutainers (Becton, Dickinson) and centrifuged after 45 minutes. The resulting serum was divided into two aliquots, one of which was analysed that day. The other was kept at −50°C for serial analysis until all the specimens had been taken from that particular subject. Thiocyanate concentrations were analysed according to the method described by Butts et al, which was modified for use with a Technicon SMA 12/60 Auto-Analyzer. Storage of the specimens did not affect the result, and so the serial measurements that showed the smaller methodological error were used for evaluation.

The figure shows the changes in thiocyanate concentrations in all subjects. The time at which half of the difference between the initial and final values (smoking and non-smoking values) is reached is considered to be the half-life. The absolute values initially and finally were 130 and 52, 148 and 69, 155 and 54, 155 and 48, 146 and 25, and 186 and 46 μmol/l. The biological half-life of thiocyanate was determined to be 6-8 (SD 0-9) days.

Changes in serum thiocyanate concentrations in six subjects after they stopped smoking. Initial and final concentrations (smoking and non-smoking values) were plotted as 100%, and 0%, respectively.

standard deviation of about one day in the range of values near the half life (50%) is relatively small. Towards non-smoking concentrations (0%), however, values were considerably dispersed, which is not uncommon with biological variables of this type.

In my study I considered the thiocyanate concentrations 26-44 days after smoking was stopped to be non-smoking values. This would appear to be justified as a median thiocyanate concentration of 51 μmol/l was found in a cohort of non-smokers.

The biological half life of thiocyanate (six days) by far exceeds that of nicotine (30 minutes), cotinine (30 hours), and carboxyhaemoglobin (four hours).

The results of this study refer to cigarette smokers. On the basis of comparative measurements conducted previously, similar results can be expected in people who smoke cigars and pipes.

I thank Mr J Millert and Mr D Krüger for conducting the analyses and the participants for their cooperation.

Comment

In epidemiological studies data on smoking obtained by questionnaires are increasingly being found to be insufficient, and objective measurements of the true exposure to smoke are needed. This requires, however, a more detailed knowledge of the properties of these "objective indicators." One such property is the half-life of biological variables.

The mean biological half life of thiocyanate found in this study (about six days) is considerably lower than the value of about 14 days determined by Pettigrew and Fell, who measured the thiocyanate concentration one, three, four, five, and six weeks after their patient stopped smoking. These relatively long intervals between measurements, in particular during the first three weeks, and the fact that only one subject was studied should be considered in assessing the reliability of this longer value for the half life of thiocyanate.

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