

某大學大體解剖實驗室設置整體換氣系統前後醫學生甲醛暴露與口腔黏膜微細胞核發生率之比較

Effect of the formaldehyde exposure and micronucleus frequency in buccal mucosa cells of medical students after setting a ventilation system in a gross anatomy laboratory

中文摘要

醫學院學生上大體解剖實驗課有短期甲醛之暴露，甲醛為可疑人類致癌物，而微細胞核形成 (Micronucleus Formation) 是致癌作用的早期階段，可由微核發生率 (Micronucleus Frequency) 來作為基因毒物暴露之早期生物效應指標。某大學曾進行大體解剖實驗室空氣採樣，結果發現環境甲醛平均濃度為 0.84 ppm (平均數標準誤：0.21)。校方其後加大該實驗室空間，並加設整體換氣設備。為評估該整建工程改善甲醛濃度之效果，並在假設甲醛濃度降低下，探討其與口腔黏膜微核發生率之關係是否仍然存在，故進行本研究。本研究以 56 名醫學系二年級自願學生為研究對象，進行口腔黏膜細胞採樣，並完成自填式流行病學問卷。完成微核鏡檢與甲醛濃度的研究資料，以 Microsoft Excel 2000、SPSS 10.0 進行建檔與分析。

結果發現：整修後所有區域樣本幾何平均濃度 (平均數標準誤) 為 0.23 ppm (3.85E-02)，與整修前：0.84 ppm (0.21) 比較，整修後區域甲醛濃度已明顯降低 (t-test, $p < 0.001$)，但甲醛濃度由均勻分布變為前區較高的情形，前、中、後三區分別為 0.47 ppm (6.89E-02)、0.18 ppm (4.81E-02)、0.15 ppm (3.02E-02)。而整修前、後之個人甲醛平均暴露濃度分別為 0.79 ppm (0.14) 及 0.75 ppm (0.12)，雖然整修後之平均濃度稍低，但其差異未達統計上之顯著性 (t-test, $p = 0.24$)，顯示個人暴露量無法因此換氣系統的裝設而有效降低。另外，整修後微核發生率如下，暴露前 (學期初)：3.39+1.71 (0/00)、暴露中期 (學期中)：4.87+1.76 (0/00)、最後一次暴露 (學期末)：5.31+1.54 (0/00) 及離開暴露後第二週：4.10+0.97 (0/00)；離開暴露後第三週：3.29+0.58 (0/00)、離開暴露後第六週：3.19+0.80 (0/00)。比較暴露前後之微細胞核發生率，發現暴露中期與最後一次暴露皆和未暴露前達統計上顯著差異性 (paired t-test, $p < 0.001$)。而停止甲醛暴露後第二週、第三週與第六週與未暴露前比較，皆未達統計顯著差異 (paired t-test, $p = 0.08$ 、0.09、0.32)。另外，由多變項線性複迴歸推估模式，可預期甲醛累積暴露量、微核基值會影響微核發生率變化量；而甲醛累積暴露量和 X-ray 兩個變項，會減緩微核發生率下降趨勢，而微核基值較高者，會增加微核發生率下降趨勢。

英文摘要

Formaldehyde (FA) is a widely used industrial chemical. Sufficient evidence exists to

consider FA as an animal carcinogen. A possible causal role for FA may be considered likely for cancer of the oral and nasal cavities in humans. The purpose of this study is to compare the FA level and micronucleus frequency in exfoliated oral buccal cells of medical students after setting a general ventilation system (GVS) in a gross anatomy laboratory. The geometric mean of air concentration of FA (Std. Error of Mean) was 0.23 ppm (3.85E-02) after setting the GVS. FA concentration had decreased significantly compared with 0.84 ppm (0.21) before setting the GVS (t-test, $p < 0.001$). However the personal FA exposure were 0.79 ppm (0.14) and 0.75 ppm (0.12) before and after setting the GVS respectively (t-test, $p = 0.24$). In buccal cells, the micronucleus frequency (MNF) were significantly increased from 3.39/1000 to 4.87/1000 (pre-exposure and mid-term, t-test, $p < 0.001$) and 3.39/1000 to 5.31/1000 (pre-exposure and end of term, t-test, $p < 0.01$) after setting a GVS. And the MNF was decreased to the baseline value in 2 weeks after cessation of exposure. Effect of age, sex, smoking, passive smoking, drug use, x-ray, vitamin supplement, taking a cold, overnight, laboratory time-space activity and extra FA exposure from new furniture on the genotoxicity parameters analyzed were also evaluated. Multiple linear regression model of the dose-response effect evidenced that the two main effective factors to MNF were personal cumulative formaldehyde level and the baseline of MNF. In the MNF decline model, we got personal cumulative formaldehyde level and x-ray were disadvantageous to the MNF decline; oppositely the high MNF baseline were advantageous to the MNF decline.