

论著

Cr(VI)对肝细胞线粒体ATP酶6和ATP酶8基因表达的影响以及与能量代谢障碍的关系

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摘要 目的 探讨Cr(VI)对肝细胞线粒体ATP酶6和ATP酶8基因表达水平与能量代谢的影响及其相互联系。方法 用Cr(VI) 2, 8和32 $\mu\text{mol} \cdot \text{L}^{-1}$ 分别处理体外培养的人胚L-02肝细胞24 h后,用细胞总RNA提取试剂盒分离RNA,线粒体ATP酶6和ATP酶8 mRNA表达水平用逆转录-荧光定量聚合酶链反应(qRT-PCR)测定;细胞ATP含量、线粒体呼吸链复合体酶V活性与细胞活性氧(ROS)含量分别用化学发光法、紫外分光光度法和荧光分光光度法检测。结果 与正常对照组相比,Cr(VI) 2, 8和32 $\mu\text{mol} \cdot \text{L}^{-1}$ 使ROS显著升高($P < 0.05$);与正常对照组相比,Cr(VI) 2 $\mu\text{mol} \cdot \text{L}^{-1}$ 可使ATP酶6和ATP酶8基因表达水平增高($P < 0.05$),Cr(VI) 8和32 $\mu\text{mol} \cdot \text{L}^{-1}$ 使之明显降低($P < 0.05$);而呼吸链复合体酶V活性及细胞内ATP含量均随Cr(VI)浓度的增加而显著降低($P < 0.05$)。ATP酶6和ATP酶8基因表达与呼吸链复合体酶V活性及细胞内ATP含量呈正相关($r=0.858, 0.795, 0.809, 0.766, P < 0.01$),与ROS水平呈负相关($r=-0.738, -0.801, P < 0.01$)。结论 Cr(VI)能诱导肝细胞ATP酶6和ATP酶8基因表达水平改变,导致线粒体呼吸链复合体酶V活性及细胞内ATP含量降低。

关键词 [铬](#) [肝细胞](#) [线粒体](#) [能量代谢](#) [腺苷三磷酸酶类](#)

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Effect of Cr(VI) on mitochondrial ATPase 6 and ATPase 8 genes expression and its relation with dysfunction of energy metabolism in hepatocytes

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Abstract

OBJECTIVE To explore the correlation between mitochondrial DNA ATPase 6 and ATPase 8 genes expression and dysfunction of energy metabolism in L-02 hepatocytes treated with hexavalent chromium(Cr(VI)). **METHODS** L-02 hepatocytes were treated with Cr(VI) 2, 8 and 32 $\mu\text{mol} \cdot \text{L}^{-1}$, respectively, for 24 h and then harvested. Total RNA was extracted from L-02 hepatocytes using RNA extraction kit. The quantitative reverse transcription polymerase chain reaction (qRT-PCR) was applied to detect the mRNA levels of ATPase 6 and ATPase 8 genes. The content of ATP was measured by bioluminescence technique. The activity of mitochondrial respiratory chain complex V and the level of cellular ROS were determined by ultraviolet spectrophotometry and fluorometric methods, respectively. **RESULTS** Compared with normal control group, ROS level significantly increased in Cr(VI) 2, 8 and 32 $\mu\text{mol} \cdot \text{L}^{-1}$ groups. Compared with normal control group, the expression levels of ATPase 6 and ATPase 8 genes in Cr(VI) 2 $\mu\text{mol} \cdot \text{L}^{-1}$ group firstly increased ($P < 0.05$), then they gradually decreased in Cr(VI) 8 and 32 $\mu\text{mol} \cdot \text{L}^{-1}$ groups, while the activity of mitochondrial respiratory chain complex V and cellular ATP level significantly decreased ($P < 0.05$). The relative analysis showed the complex V activity was positively correlated with ATPase 6 and ATPase 8 genes expression levels ($r=0.858, 0.809, P < 0.01$), and the cellular ATP level was yet positively correlated with ATPase 6 and ATPase 8 genes expression levels ($r=0.795, 0.766, P < 0.01$). But ROS level was negatively correlated with ATPase 6 and ATPase 8 genes expression levels ($r=-0.738, -0.801, P < 0.01$). **CONCLUSION** Cr(VI) can induce expression changes in mitochondrial encoding ATPase genes, and this might result in the decrease in the complex V activity and ATP synthesis.

Key words [chromium](#) [hepatocytes](#) [mitochondria](#) [energy metabolism](#) [adenosine triphosphatases](#)

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