

p-benzoquinone causes alteration of the structure of hemoglobin and loss of its oxygen binding capacity in smoker's blood

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Cigarette smoking has been identified as the most important source of morbidity and mortality worldwide. Generally the life expectancy of smokers is nearly 14 years less than nonsmokers. Apart from causing the various life-threatening diseases, cigarette smoke (CS) is also known to produce hypoxia. Chronic hypoxia may be a cause of early aging, morbidity and premature death. Also, smoking during pregnancy causes reduced availability of oxygenated blood to the fetus resulting in intrauterine hypoxia and various risks for the unborn child. Earlier we had shown that p-benzoquinone (p-BQ), derived from p-benzosemiquinone of CS in the smoker's lungs, gets into the blood stream and forms covalent adducts with serum albumin resulting in alteration of its structure and ligand binding capacity. Here we show by mass spectrometric analyses that in smoker's blood p-BQ forms covalent adducts with cysteine 93 residues in both the β chains of hemoglobin (Hb) producing Hb-p-BQ adducts. UV-Vis spectra and CD spectra analyses show that upon complexation with p-BQ, the structure of Hb is altered. Compared to nonsmoker's Hb, the content of α -helix decreased significantly in smoker's Hb ($p=0.0224$). p-BQ also induces aggregation of smoker's Hb as demonstrated by SDS-PAGE, dynamic light scattering and atomic force microscopy. Alteration of Hb structure in smoker's blood is accompanied by loss of oxygen binding capacity. Our results provide the first proof that p-BQ is a cause of hypoxia in smokers.

Biography

Arunava Ghosh completed his Bachelor of Science degree in Zoology and Master of Science degree in Environmental Science from Calcutta University. He has completed his PhD from Calcutta University in Biotechnology in 2013. In his Doctoral research, he investigated the effects of smoke exposure on protein modification and emphysematous lung damage. At present he is carrying out Post-doctoral studies in Dr. Robert Tarran's lab at Marsico Lung Institute/UNC CF Center, University of North Carolina at Chapel Hill as Postdoctoral Research Associate (TCORS School of Medicine). His present research endeavors are focused on the effects of New and Emerging Tobacco Products on lung.

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