NEW UNDERSTANDING OF PATHOGENESIS AND MECHANISM OF EMPHYSEMA AND ITS PREVENTION

Shuvojit Banerjee, Palash Maity, Dhruba Joyti Chattopadhyay, Alok K. Sil, and Indu B. Chatterjee

OBJECTIVE

To demonstrate that apoptosis of alveolar air cells, a major cause of cigarette smoke-induced emphysema, occurs in the guinea pig model.

RESULTS:

Hematoxylin and eosin stained lung tissue sections obtained after exposure to air and cigarette smoke

EFFECT OF ANTIOXIDANT ON CS-INDUCED APOPTOSIS AND EMPHYSEMATOUS CHANGES

Oxy-blot analysis using anti-DNPH antibody

CONCLUSION:

Cigarette smoke causes apoptosis and emphysematous change in the guinea pig lung, which is prevented by antioxidant like ascorbic acid and black tea.
Publication:

1. **Shuvojit Banerjee**, Palas Maity, Subhendu Mukherjee, Alok K. Sil, Koustubh Panda, Dhrubajyoti Chattopadhyay & Indu B. Chatterjee*

   **Black tea prevents cigarette smoke-induced apoptosis and lung damage.** Journal of Inflammation 2007, 4:3 (14 February 2007)

2. **Shuvojit Banerjee**, Anup Misra, Dhruba J. Chattopadhyay and Indu B. Chatterjee

   **Black Tea as an Antidote for Cigarette Smoke-Induced Oxidative Damage of Proteins** (Review).

3. Hirak K Patra; **Shuvojit Banerjee**; Utpal Chaudhuri; Prabir Lahiri; Anjan Kr. Dasgupta,


   **Small Cationic Protein from a Marine Turtle has Defensin-like fold and Anti-bacterial and Anti-viral Activity.** (Proteins. 2006 Aug 1;64(2):524-31.)

5. Anup Mishra, Ranojoy Chattopadhyay, **Shuvojit Banerjee**, Dhruba J. Chattopadhyay and Indu B. Chatterjee

Conference/Workshop Attended:

• Oral presentation by Shuvojit Banerjee entitled 'Aqueous extract of cigarette tar induced oxidative damage of proteins and DNA is accounted by its p-Benzosemiquinone content' organized by the Society of Biological Chemists (India) Kolkata Branch from 9-11 April, 2004.

• Oral presentation by Shuvojit Banerjee entitled 'BLACK TEA PREVENTS CIGARETTE SMOKE INDUCED OXIDATIVE DAMAGE AND EMPHYSEMATOUS CHANGE IN THE GUINEA PIG LUNG "One day symposium on Excitements in Modern Biology' at department of Biochemistry Calcutta University, September 24, 2005 organized by Society of Biological Chemists (Kolkata Chapter).

• Poster presentation by Shuvojit Banerjee entitled "Role of apoptosis in emphysema: Prevention by vitamin C" on National symposium on MMDDA-2005 at Saha Institute of Nuclear Physics, Calcutta during November 16-18, 2005. This poster awarded for best poster.

• Poster presentation by Shuvojit Banerjee entitled "Role of apoptosis in emphysema: Prevention by vitamin C" on National symposium on International symposium on Translational Research: Apoptosis and Cancer organized by University of Kerala and Rajiv Gandhi Centre For Biotechnology, Thiruvanthapuram, India, University of Texas, MD Anderson Cancer Center, Houston, Texas, USA and Society of Biotechnologists India (SBTI).
Black tea prevents cigarette smoke-induced apoptosis and lung damage

Shuvojit Banerjee, Palas Maity, Subhendu Mukherjee, Alok K Sil, Koustubh Panda, Dhrubajyoti Chattopadhyay and Indu B Chatterjee*

Address: Dr. B. C. Guha Centre for Genetic Engineering & Biotechnology, University College of Science, Kolkata 700019, India
Email: Shuvojit Banerjee - sb76@rediffmail.com; Palas Maity - palashmaity6@yahoo.co.in; Subhendu Mukherjee - subh812002@rediffmail.com; Alok K Sil - alokksil@yahoo.com; Koustubh Panda - pandak66@yahoo.co.uk; Dhrubajyoti Chattopadhyay - d_jc@sify.com; Indu B Chatterjee* - tbc123@rediffmail.com

* Corresponding author

Published: 14 February 2007
Received: 21 September 2006

Abstract

Background: Cigarette smoking is a major cause of lung damage. One prominent deleterious effect of cigarette smoke is oxidative stress. Oxidative stress may lead to apoptosis and lung injury. Since black tea has antioxidant property, we examined the preventive effect of black tea on cigarette smoke-induced oxidative damage, apoptosis and lung injury in a guinea pig model.

Methods: Guinea pigs were subjected to cigarette smoke exposure from five cigarettes (two puffs/cigarette) per guinea pig/day for seven days and given water or black tea to drink. Sham control guinea pigs were exposed to air instead of cigarette smoke. Lung damage, as evidenced by inflammation and increased air space, was assessed by histology and morphometric analysis. Protein oxidation was measured through oxyblot analysis of dinitrophenylhydrazone derivatives of the protein carbonyls of the oxidized proteins. Apoptosis was evidenced by the fragmentation of DNA using TUNEL assay, activation of caspase 3, phosphorylation of p53 as well as over-expression of Bax by immunoblot analyses.

Results: Cigarette smoke exposure to a guinea pig model caused lung damage. It appeared that oxidative stress was the initial event, which was followed by inflammation, apoptosis and lung injury. All these pathophysiological events were prevented when the cigarette smoke-exposed guinea pigs were given black tea infusion as the drink instead of water.

Conclusion: Cigarette smoke exposure to a guinea pig model causes oxidative damage, inflammation, apoptosis and lung injury that are prevented by supplementation of black tea.

Background

Cigarette smoking is a major cause for the increased incidence of Chronic Obstructive Pulmonary Diseases (COPD), worldwide. The pathogenesis of this disease is usually characterized by abnormal enlargement of airspaces of the lung accompanied by destruction of its walls [1]. This is a major and increasing global health problem, which is currently the 4th leading cause of death, and is projected to become the 3rd commonest cause of death and the 5th commonest cause of disability in the world by the year 2020 [2]. However, the cellular and molecular mechanism of COPD is not clear and there are no effective...
Black Tea as an Antidote for Cigarette Smoke-induced Oxidative Damage of Proteins

Shuvojit Banerjee, Anup Misra, Dhruba J. Chattopadhyay and Indu B. Chatterjee
Dr. B. C. Guha Centre for Genetic Engineering and Biotechnology and the Department of Biochemistry
University College of Science, Kolkata-700 019, India

ABSTRACT

Cigarette smoke is a complex mixture of about 4000 chemicals in the form of gases and particulate fraction (tar) containing nicotine, an addictive drug, and a host of other toxic chemicals, including nitric oxide, phenols, carcinogens as well as free radicals. The hazardous effect of smoking is a global public health problem of great concern. About one-third of the world’s population are direct or indirect (passive) smokers. In spite of statutory warnings and anti-smoking campaigns, smoking continues. So, a practical approach is to find a way to prevent the harmful effects of smoking. One of the prominent deleterious effects of cigarette smoke (CS) is the oxidative damage of biological macromolecules.

As tea polyphenols have strong antioxidant properties, we addressed the question whether it can prevent cigarette smoke-induced oxidative damage. In this volume, we have studied the effect of black tea (BT) on cigarette smoke-induced oxidative damage of proteins both in vitro and in vivo. The results indicate that BT prevents cigarette smoke induced oxidation of bovine serum albumin (BSA) and oxidative degradation of guinea pig lung, liver and heart microsomal proteins.

The protein oxidation and its prevention by BT were measured by immunoblotting of the dinitrophenylhydrazone derivatives of the protein
black Tea Prevents Cigarette Smoke-Induced Oxidative Damage Proteins in Guinea Pigs

Anup Misra, Ranajay Chattopadhyay, Shuvojit Banerjee, Dhruba J. Chattopadhyay and Indu B. Chatterjee

Dr. B. C. Guha Centre for Genetic Engineering and Biotechnology and the Department of Biochemistry, University College of Science, Kolkata-700019, India

ABSTRACT Cigarette smoke (CS) causes oxidative damage and tea polyphenols have strong antioxidant properties. Therefore, we studied the effect of a black tea (BT) infusion on CS-induced oxidative damage of proteins both in vitro and in vivo. In the in vitro experiment, bovine serum albumin (BSA) or a guinea pig tissue microsomal suspension was incubated with an aqueous extract of CS (CS-solution) in the presence or absence of the BT infusion. Protein oxidation was measured by immunoblotting of the dinitrophenylhydrazone derivatives of the protein carbonyls followed by densitometric scanning. Protein degradation was assessed by SDS-PAGE. BT prevented (P < 0.05) CS-induced oxidation of BSA and oxidative degradation of guinea pig lung, liver and heart microsomal proteins. This was also observed when the BT infusion was replaced by its components, i.e., flavonols, theaflavins, thearubigins and catechins. BT prevented microsomal protein degradation by inhibiting oxidative modification of the proteins. The antioxidant effect of BT was similar to that of green tea. In the in vivo experiment, partially ascorbate-deficient guinea pigs were subjected to CS exposure from 5 cigarettes/guinea pig • d for 7 d and given water or the BT infusion (20 g/L) to drink. Guinea pigs exposed to CS and given water had extensive oxidative damage accompanied by 39, 40 and 30% losses (P < 0.05) of microsomal proteins of lung, liver and heart, respectively. However, when the CS-exposed guinea pigs consumed the BT infusion instead of water, the oxidation of microsomal proteins was reduced (P < 0.05) —90, 97 and 70% in lung, liver and heart, respectively. Protein loss was reduced (P < 0.05) —92, 98 and 90% in lung, liver and heart, respectively. The results, if extrapolated to humans, would indicate that regular intake of tea may protect smokers from CS-induced oxidative damage and consequent degenerative diseases. J. Nutr. 133: 2622-2628, 2003.

KEY WORDS: • cigarette smoke • black tea • bovine serum albumin • guinea pigs • oxidative protein damage

Cigarette smoke (CS) causes many life-threatening diseases such as pulmonary and cardiovascular diseases as well as lung cancer and other malignancies (1—5). One of the prominent deleterious effects of CS is the oxidative damage of biological macromolecules including proteins and DNA (6—8). The oxidative damage is caused by stable oxidants present in the tobacco smoke. The stable oxidants are likely long-lived free radicals present in the CS (8,10,11). We recently identified the stable oxidants in the CS and demonstrated that they cause oxidative modification of the proteins. The antioxidant effect of BT was similar to that of green tea. In the in vitro experiment, partially ascorbate-deficient guinea pigs were subjected to CS exposure from 5 cigarettes/guinea pig • d for 7 d and given water or the BT infusion (20 g/L) to drink. Guinea pigs exposed to CS and given water had extensive oxidative damage accompanied by 39, 40 and 30% losses (P < 0.05) of microsomal proteins of lung, liver and heart, respectively. However, when the CS-exposed guinea pigs consumed the BT infusion instead of water, the oxidation of microsomal proteins was reduced (P < 0.05) —90, 97 and 70% in lung, liver and heart, respectively. Protein loss was reduced (P < 0.05) —92, 98 and 90% in lung, liver and heart, respectively. The results, if extrapolated to humans, would indicate that regular intake of tea may protect smokers from CS-induced oxidative damage and consequent degenerative diseases.