The Oxidative Damages Caused by Bacterial Growth in Foodstuffs

P. Sadighara¹ and A. Barin²

¹Department of Environmental Health, Faculty of Public Health, Tehran University of Medical Science, Tehran, Iran
²Department of Clinical Pathology, Faculty of Veterinary, Tehran University, Iran

*Corresponding author’s email: sadighara@farabi.tums.ac.ir

ABSTRACT

Obligate aerobes have respiratory metabolism with oxygen as the terminal electron acceptor. Therefore, they can produce ROS and oxidative damages in foodstuff which is contaminated. The egg yolks were incubated with different dilution of standard of E.coli and lipid peroxidation was assayed. The level of lipid peroxidation of high group (10⁷) was 0.061±0.01 as compared with control; 0.016±0.003. We concluded that pathogenic bacteria can induce oxidative damages plus other problems in food.

Keywords: Bacteria, food, oxidative stress

INTRODUCTION

250 different food-borne diseases have been described that bacteria are the causative agents of two thirds of food-borne disease outbreaks. The pathogenesis of bacteria causing food-borne poisoning depends on their capacity to produce toxins (exotoxin or endotoxin) after ingestion, in the digestive tract or before, toxins preformed in foodstuff (Yves et al., 2003). Meanwhile, they do produce reactive oxygen species (ROS) because of aerobic metabolism. Obligate aerobic bacteria have aerobic respiration and they use free oxygen as a final electron acceptor is known as obligate aerobes. O₂⁻ and H₂O₂ are unavoidable by product of the aerobic respiration. H₂O₂ can produce HO, a powerful oxidant that reacts with molecules, in Fenton reaction. ROS are generated in exponentially growing E. coli by the auto-oxidation of components of the respiratory chain (Storz and Imlay, 1999). ROS induce oxidative stress and damage to macromolecule such as DNA, lipids, proteins, carbohydrates and they cause mutation in genes in biological system and also have been attributed to artherosclerosis, Parkinson’s disease, Alzheimer’s disease, cancer and aging.

In foods; ROS attack polyunsaturated fatty acids and cause lipid peroxidation. It is a major cause of quality deterioration in food (Coupland and McClements, 1996). Lipid peroxidation, known as rancidity, is one of known effects of ROS that is studied for first time in 1820 (Swern et al., 1948). Lipid peroxidation changes type and concentration of molecular species in food (Mcclements and Decker, 2000).

In this study, oxidative damage of E.coli (ATCC25922) as aerobic bacteria in egg-yolks as foodstuff has been investigated.

MATERIALS AND METHODS

At first, a stock of egg-yolk was prepared. Standards of E.coli in different dilution (10⁵, 10⁶ and 10⁷) were added to stock. The samples were incubated at 37°C for 20h. After growth of bacteria, level of lipid peroxidation was evaluated. The formation of malondialdehyde (MDA) was measured according to the previous method (Sicinska et al., 2006). Briefly, the samples solution mixed with 20% trichloroacetic acid. Samples were centrifuged. Thiobarbituric acid was added to the supernatant and the samples were heated. The absorbance of the supernatant was measured at 532 nm, lipid per-oxidation was expressed in absorbance units. The statistical analysis was carried out by one way analysis of variance (ANOVA). P values ≤ 0.05 were considered significant.

RESULTS AND DISCUSSION

The results of experiments are shown in Table 1. The level of lipid peroxidation was analyzed with respect to OD measured at wavelength with spectrophotometer. There was significant difference between high group of E.coli and control.
Our results indicated that bacteria can produce higher MDA concentration and cause oxidative damage in high number in foodstuff. MDA is a product of lipid peroxidation that has been used as an indicator of oxidative stress. Consumption of MDA concentration foodstuffs has been associated with some problems. This component is highly reactive that can cause deterioration of biological molecules such as DNA (Lin and Yen, 1999), and it is mutagenic and tumorigenic (Zhang et al., 2001). It affects the function of mitochondria. MDA cross links with valuable amino acid, which in consequence reduces the nutritive value of food (Halam et al., 2003). Moreover, lipids are the major component of food. They can contribute in food flavor, aroma, color, shelf life and nutritional value. Lipid peroxidation is one of known effects of ROS in foodstuff, which containing fat such as meat, milk and egg products. Lipids are reservoir fat soluble vitamins and lipid peroxidation process damage to fat soluble vitamins.

In conclusion, in this study significant results were observed for high group ($10^7$) as compared to the control group and this survey elucidated the correlation between oxidative damage in food and growth bacteria.

## REFERENCES


