CHAPTER I

INTRODUCTION

The first chapter contains two parts including the rationale and the objectives of this study. The details of each part are described as follows.

The rationale for the study

Age-related macular degeneration (AMD) is defined as an ocular disease leading to loss of central vision in the elderly [1]. The prevalence is likely to rise as a consequence of increasing longevity [2]. Nowadays, there is no available efficient pharmacological treatment for AMD [3, 4]. Therefore, AMD will have an enormous social and economic impact on the healthcare system. Oxidative stress is thought to play an important role in pathogenesis of AMD. Oxidative-mediated degeneration of retina pigments epithelial (RPE) cells is involved in the progression of this disease. With increasing age, the life-long exposure of RPE to light is likely to have a significant impact on RPE degeneration [5, 6]. The relationship between high level of light exposure and development of AMD especially later in life was reported [6]. UV light induced photo-oxidative stress has also been shown to be associated with AMD [7]. Ultraviolet light in the wave length of UV-B was also shown to cause human RPE cell damage [8, 9, 10, 11].

Some naturally occurring compounds such as flavonoids, vitamins and minerals may have a protective effect on oxidant-induced RPE cell damage through their antioxidant activities. Supplement of antioxidants including vitamin C, vitamin E, beta carotenes, and lutein to increase serum levels of these antioxidant nutrients may reduce risk of AMD [12, 13, 14]. Several epidemiologic studies have found correlation between the intake of food high in antioxidants and the decreased risk of AMD [13]. In this study, we pay a special attention to the effect of lutein on UV-B irradiation induced RPE cell damage. Because lutein can be found in high concentration in the macular region [15, 16, 17], its function is believed to protect retina against oxidative damage. In the macular, free radicals may be generated by

lengthy light exposure, high oxygen tension, and high metabolic rate [18]. Several small size clinical trials suggested that zeaxanthin and lutein supplement help to improve human visual function or visual performance [13, 19, 20]. In human, there was no clear association between UV-B exposure and AMD because lens absorb almost all UV-B, and only very small amounts of this waveband can reach the retina [21]. The adverse effects of UV-B radiation on the eye nowadays have received much attention, since human can be more prominent to expose to UV-B as ozone depletion and global climate changes influence surface radiation levels [22]. For the role of lutein and zeaxanthin, several studies attempted to investigate their mechanisms on the RPE protection by using various type of chemical-induced oxidative stress [23, 24]. Up to date, there is no direct evidence showing the protective effect of lutein against UV-B irradiation in RPE cells. Therefore, we are interested in investigating this aspect.

In this study, we tested the effect of lutein isolated from yellow silk cocoon in comparison with commercial lutein from marigold flowers. Silk lutein extract was provided by the Suranaree University of Technology. Yellow silk cocoon contains the caroteniods and major caroteniod is lutein. In the present work, we determined the protective effect and mechanisms of silk lutein extract on UV-B induced RPE cell damage. During typical silk processing, lutein in the color water fraction is removed from silk cocoon and mostly discarded into the wastewater. Thus, recovery and utilization of silk lutein will be beneficial in term of economics aspect. The potential mechanisms of silk lutein on RPE cells protection were demonstrated by monitoring intracellular reactive oxygen species (ROS) and lipid peroxidation, activity of antioxidant enzyme such as glutathione peroxidase, superoxide dismutase and catalase. The prominent protective effect against UV-B irradiation in RPE cells, it may encourage and the usage of lutein extracted from yellow silk cocoons as a dietary supplement and nutraceutical product for AMD prevention.

Objectives of the study

1. To determine the protective effect of silk lutein extract against UV-B mediated ARPE-19 cells death by measuring cell viability and cell apoptosis.

2. To investigate the potential mechanisms of silk lutein extract by determining intracellular ROS production, lipid peroxidation, and activity of antioxidant enzyme including glutathione peroxidase, catalase and superoxide dismutase activities in UV-B irradiated ARPE-19 cells.

3. To determine the effect of silk lutein extract on prevention of apoptosis cell death induced by UV-B in ARPE-19 cells.

Expected outputs of the study

Silk lutein extract can protect ARPE-19 cells from UV-B induced cellular oxidative stress in ARPE-19 cells.

Expected outcomes

The new source of lutein from silk yellow cocoons may be developed as the dietary supplements for prevention age related macular degeneration (AMD) disease.