

## CHAPTER I

### INTRODUCTION

Chili (*Capsicum* spp.) is one of the popular seasonings in Thailand. Fruits of chili possess many colors including red, yellow, orange, purple, brown and green. Chili is an important ingredient of daily diets due to its particular characteristics such as pungency, aromas and flavors. Chili can also be used as food decoration. Moreover, it also provides a major source of bioactive compounds and nutritional components [1, 2]. The nutrients in chili are previously reported as polyphenols, amino acids, proteins, fibers, vitamins and minerals. Among these components, polyphenol is the major antioxidant, which can be commonly found from fruits and vegetables. Chilies consist of five domesticated species, including *C. annuum*, *C. frutescens*, *C. chinense*, *C. baccatum* and *C. pubescens*. However, two species, *C. annuum* and *C. frutescens*, are mainly consumed and simultaneously grown in Thailand.

Sweet pepper is a cultivar of *C. annuum* species. This type of chili can produce different fruit colors, including red, yellow, orange and green. Sweet pepper is a source of bioactive compounds such as carotenoids, flavonoids and phenolics [3, 4]. These compounds can potentially promote health benefits against various non-communicable diseases such as atherosclerosis, cancer, diabetes and cardiovascular disease [5, 6]. The different colored sweet peppers have been reported to contain different nutrient compositions [3, 4], which, in turn, could alter health promotion.

In previous studies, phenolics and flavonoids in plants such as tea, grape seed, peanut, soybean and lotus exhibited biological property against lipase [7], the enzyme that degrades triglyceride into free fatty acids and glycerol. Thus, lipase inhibition could reduce rate of fat absorption into body, one of the main pathways to control obesity. However, the information regarding biological properties against obesity of chili is limited. Without any identified pathways, previous *in vivo* studies (animal model and human study) suggested that chilies could decrease energy intake and increase energy expenditure [8]. Even though chilies were reported as sources of

many bioactive compounds, fundamental knowledge on biological mechanism regarding reduced rate of fat absorption through inhibition of key enzyme, lipase, that control obesity by chilies components has not yet been reported. The investigation in this biomolecular perspective, thus, might lead to an understanding on detailed mechanism of alternative route of obesity prevention by chilies.

Additionally, previous studies also suggested that *C. annuum*, *C. chinense*, *C. pubescens* and *C. baccatum* could inhibit  $\alpha$ -amylase and  $\alpha$ -glucosidase, the key enzymes that control obesity and diabetes [9-11]. It also suggested that capsaicin, a significant bioactive compound in chilies, was responded for reduced plasma glucose level [12]. However, the inhibitory activities were varied, depending on extraction conditions and investigated environments. Besides, no information on these enzyme activities is found on *C. frutescens*, and the inhibition of capsaicin against these two enzymes had not yet been reported.

Lastly, it was found that *C. annuum*, *C. baccatum* and *C. pubescens* could inhibit angiotensin-converting enzyme (ACE), the enzyme that control hypertension in renin-angiotensin-aldosterone system (RAAS) [11]. Besides, capsaicin in peppers could reduce high blood pressure in animal model [13]. However, the comparison on ACE inhibitory activity of *C. annuum* and *C. frutescens* has not yet been reported, and the ACE inhibition of capsaicin is not available.

Therefore, chilies can be the potential sources of bioactive components with medicinal properties. Although various researches have been studied on antioxidant activity, anti-lipase, anti- $\alpha$ -amylase, anti- $\alpha$ -glucosidase and anti-ACE activity of chili, little information regarding sweet pepper is available. Thus, the investigation of sweet pepper extracts (*C. annuum*), on their inhibitory properties against lipase,  $\alpha$ -amylase,  $\alpha$ -glucosidase and ACE is an interesting topic, which could be useful for further development in functional food, supplement or even drug discovery. Besides, this information can provide fundamental knowledge on anti-obesity, anti-diabetic and anti-hypertension of sweet pepper through inhibition of key enzymes that control these particular diseases.

## **CHAPTER II**

### **OBJECTIVES**

#### **General objective**

To investigate the extracts of different colored sweet peppers (*C. annuum*) on the inhibitory properties against lipase,  $\alpha$ -amylase,  $\alpha$ -glucosidase and ACE (angiotensin-converting enzyme).

#### **Specific objectives**

1. To investigate extraction solvents including hexane, ethyl acetate and ethanol that might affect of biological properties against lipase,  $\alpha$ -amylase,  $\alpha$ -glucosidase and ACE of sweet peppers.
2. To investigate the effect of maturity stages and fruit colors of sweet peppers on biological properties against lipase,  $\alpha$ -amylase,  $\alpha$ -glucosidase and ACE.
3. To investigate phytochemicals including volatile compounds, carotenoids, flavonoids and phenolic acids of four colored sweet peppers.

#### **Expected results and benefits**

The results obtained from this study will provide information as follows:

1. The optimized extraction solvents that provide sweet pepper extracts with high biological properties against lipase,  $\alpha$ -amylase,  $\alpha$ -glucosidase and ACE.
2. Maturity stages and fruit colors of sweet peppers that possess a rich source of anti-lipase, anti- $\alpha$ -amylase, anti- $\alpha$ -glucosidase and anti-ACE agents.
3. The quantity and type of volatile compounds, carotenoids, flavonoids and phenolic acids of four colored sweet peppers.

The information from this study including the potential role of sweet peppers against obesity, diabetes and hypertension through key enzyme inhibitions

will provide alternative routes for prevention of these diseases and potentially lead to future development of functional foods and nutraceuticals.