

Review

# Marine Algae as a Potential Source for Anti-Obesity Agents

Chu Wan-Loy<sup>1</sup> and Phang Siew-Moi<sup>2,3,\*</sup>

<sup>1</sup> School of Postgraduate Studies, International Medical University, Kuala Lumpur 57000, Malaysia; wanloy\_chu@imu.edu.my

<sup>2</sup> Institute of Biological Sciences, University of Malaya, Kuala Lumpur 50603, Malaysia

<sup>3</sup> Institute of Ocean & Earth Sciences (IOES), University of Malaya, Kuala Lumpur 50603, Malaysia

\* Correspondence: phang@um.edu.my; Tel.: +60-3-7967-4610; Fax: +60-3-7969-6994

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**Abstract:** Obesity is a major epidemic that poses a worldwide threat to human health, as it is also associated with metabolic syndrome, type 2 diabetes and cardiovascular disease. Therapeutic intervention through weight loss drugs, accompanied by diet and exercise, is one of the options for the treatment and management of obesity. However, the only approved anti-obesity drug currently available in the market is orlistat, a synthetic inhibitor of pancreatic lipase. Other anti-obesity drugs are still being evaluated at different stages of clinical trials, while some have been withdrawn due to their severe adverse effects. Thus, there is a need to look for new anti-obesity agents, especially from biological sources. Marine algae, especially seaweeds are a promising source of anti-obesity agents. Four major bioactive compounds from seaweeds which have the potential as anti-obesity agents are fucoxanthin, alginates, fucoidans and phlorotannins. The anti-obesity effects of such compounds are due to several mechanisms, which include the inhibition of lipid absorption and metabolism (e.g., fucoxanthin and fucoidans), effect on satiety feeling (e.g., alginates), and inhibition of adipocyte differentiation (e.g., fucoxanthin). Further studies, especially testing bioactive compounds in long-term human trials are required before any new anti-obesity drugs based on algal products can be developed.

**Keywords:** obesity; algae; seaweeds; fucoxanthin; alginates; fucoidans; phlorotannins; pancreatic lipase inhibitors

## 1. Introduction

Obesity is a metabolic disorder characterized by excess body fat accumulation, with Body Mass Index (BMI) of more than 30 kg/m<sup>2</sup>, reflected by an increased waist circumference [1]. The disease is mainly due to excessive food intake, lack of physical activity and genetic factors. Based on a pooled analysis of BMI from populations of 200 countries, a recent study projected that by 2025, global obesity will surpass 6% in men and 9% in women [2]. Obesity has become a global threat to public health as it impairs quality of life and imposes a huge expenditure on healthcare cost. In obese individuals, there is an increased risk of developing type 2 diabetes, dyslipidemia, hypertension, cardiovascular (CVS) disease, non-alcoholic fatty liver disease (NAFLD) and certain types of cancer [3].

Excess fats (triacylglycerols) are stored in adipocytes, which may serve as endocrine cells that secrete biologically active mediators. Such mediators are known as adipokines/chemokines which include leptin, adiponectin, resistin, tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) and monocyte chemoattractant protein-1 (MCP-1). The adipokines may alter insulin sensitivity, glucose and lipid metabolism in muscles, liver and adipose tissues [4]. Obesity also induces a state of low-level inflammation,