Faculty of Agriculture **Fayoum University**

BIOLOGICAL AND CHEMICAL STUDIES ON SOME BIOLOGICALLY ACTIVE MARINE NATURAL EXTRACTS

By

ALYAA SHAHAT ALI ABDALLAH

B.Sc. in Agric. (Food science and technology) , Fac. Of Agric., Fayoum University, 2015

A Thesis Submitted in Partial Fulfillment

of the Requirement for the Degree of

Master of Sciences

In

Agriculture Sciences

(Biochemistry)

Department of Agriculture Biochemistry

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ABSTRACT

The global health crisis is increasingly marked by the prevalence of metabolic syndrome and obesity, posing significant socioeconomic challenges. This study underlines obesity as a key risk factor for various chronic diseases such as type 2 diabetes, dyslipidemia, hypertension, and cardiovascular disorders. The pharmacological therapies for obesity, emphasize a range of adverse effects besides their therapeutic potential. In response to these challenges, the research highlights the growing interest in natural products as alternative anti-obesity agents. These natural solutions are explored as potential complements or alternatives to conventional pharmacological treatments, offering a new perspective in the ongoing battle against obesity and its associated metabolic disorders. Thus this study aimed to investigate the anti-obesity activity of two marine organisms, Soft Coral (*Sarcophyton* sp.) and Macroalgae (*Ulva lactuca*) extracts on the biochemical and histological evaluation in obese rats fed high-carbohydrate high-fat diets (HCHFD) to prevent of obesity and related metabolic disorders.v

This research presents a detailed analysis of the anti-obesity effects of marine organisms, specifically Soft Coral (*Sarcophyton* sp.) and Macroalgae (*Ulva lactuca*), through an *in vivo* study on rats. The experiment was structured to assess the impact of these marine extracts on obesity-related parameters in four groups of rats: Control, High Carbohydrate-High Fat Diet (HCHFD), Soft Coral/ Macroalgae, and Soft Coral/ Macroalgae +HCHFD, each consisting of 10 subjects. Important parameters like insulin levels, insulin resistance, fasting glucose levels, and lipid profile parameters such as cholesterol, triglycerides, HDL-cholesterol, and LDL-cholesterol. Furthermore, serum levels of obesity-related biomarkers leptin, irisin, resistin, and adiponectin were carefully measured and analyzed. The bioactive extracts underwent chemical analysis to isolate and identify the compounds contributing to their efficacy.

The results reveal that Soft Coral (*Sarcophyton* sp.) has a significant potential to maintain normal glucose and insulin levels and to prevent an increase in insulin resistance in a high-carbohydrate, high-fat diet group. The combined treatment of Soft Coral and HCHFD shows a mitigating effect, albeit to a lesser extent than Soft Coral alone. Macroalgae (*Ulva lactuca*) demonstrates a significant potential to maintain normal glucose and insulin levels and to prevent an increase in insulin resistance in a high-carbohydrate, high-fat diet. The combination of Macroalgae and HCHFD also exhibits a mitigating effect on diet-induced metabolic disturbances, though to a lesser extent than Macroalgae alone. These findings underscore the potential therapeutic benefits of marine organisms in managing obesity-related metabolic disturbances, particularly in moderating the effects of unhealthy diets. The chemical analysis of the bioactive extracts from marine organisms led to the isolation and structural elucidation of one pure compound from soft coral *Sarcophyton* sp. extract and identified as 24-methyl-cholest-5-en-3β-ol, and ten compounds from seaweed *Ulva lactuca* extract through using liquid-chromatography–electrospray ionization–tandem mass spectrometry (LC-ESI-MS/MS).

Overall, the study's findings provide promising insights into the use of marine-derived natural products as potential anti-obesity agents. This research contributes to the growing body of evidence supporting the efficacy of natural substances in managing obesity and metabolic disorders, underscoring their potential as complementary or alternative treatments to conventional pharmacological approaches. The research discusses these findings in detail, providing a comprehensive understanding of the role of marine organisms in combating obesity-related health issues.

Keywords: Metabolic syndrome, obesity, Marine natural product, soft coral *Sarchophyton sp,* Macroalgae *Ulva lactuca*, anti-obesity, leptin.