

Anti-diabetic properties of seaweed extract using the adipocyte cell model 3T3-L1

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Introduction

Obesity is a major public health problem, arising from an imbalance in energy homeostasis which leads to excessive growth of adipocyte tissue¹. Adipocytes accumulate excess fat and their differentiation is considered a key process in the growth of adipose tissue, and the development of obesity, although it also plays a role in normal development and function of the adipose tissue^{2,3}. Obesity can also lead to secondary complications like type-2 diabetes mellitus, a serious metabolic disorder with increasing number of patients every year³.

Seaweed is known for its bioactive ingredients⁴. In this study, different types of *Fucus vesiculosus* extracts were analyzed in terms of their antioxidant activity as well as anti-obesity and anti-diabetic effects using 3T3-L1 preadipocytes as a cell line model.

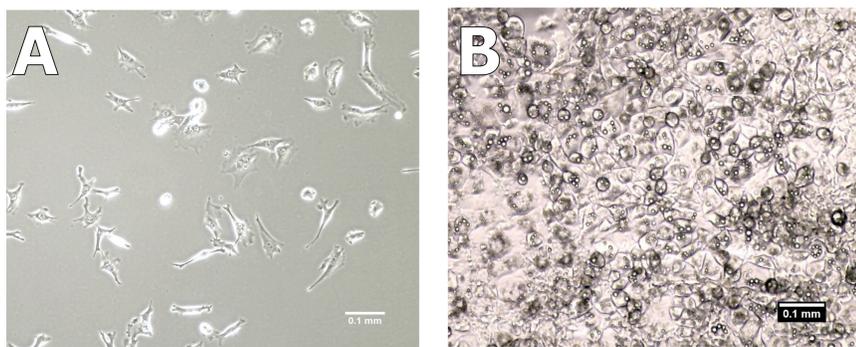


Figure 1. Differentiation of 3T3-L1 cells is induced chemically. Image A shows normal cells before differentiation and image B shows cells that have been differentiated and maintained as adipocytes for 5 days.

Methods and results

Chemical based antioxidant and anti-diabetic assays:

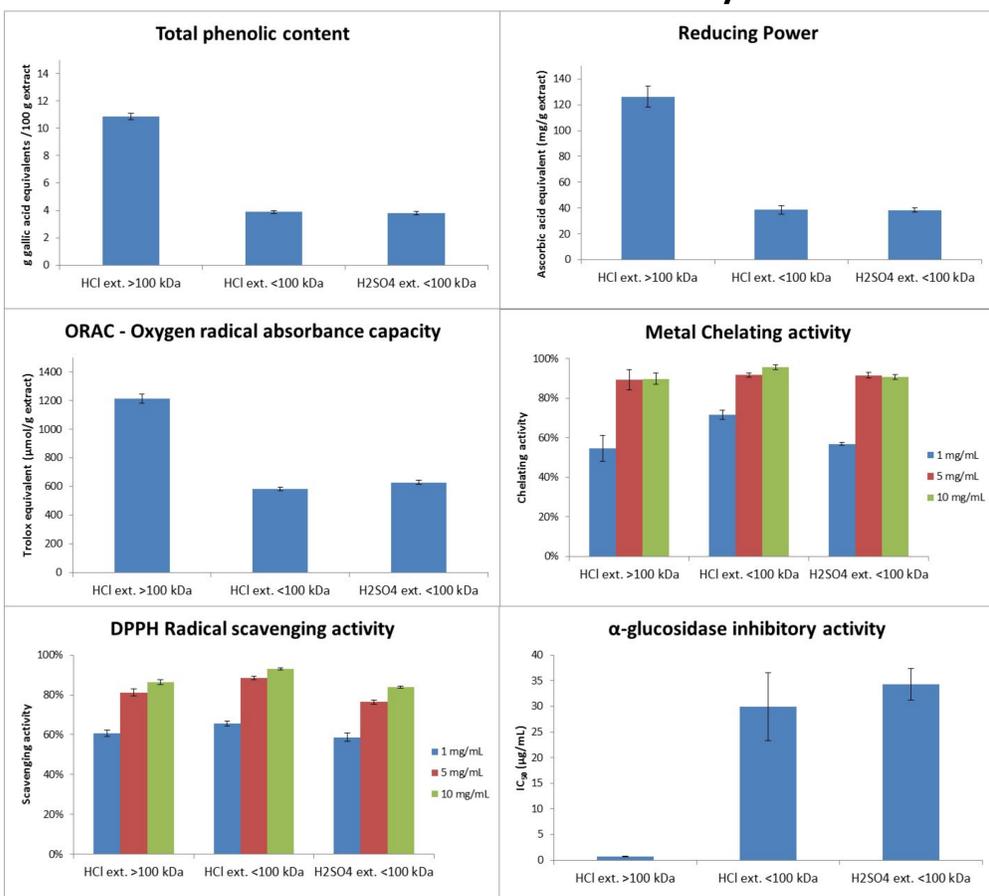


Figure 2. The total phenolic content of the samples was analyzed as well as their antioxidant capacity using 4 different antioxidant activity assays. The anti-diabetic effect of the samples was evaluated chemically by the α -glucosidase assay.

Conclusions

Results showed that 2 of the extracts expressed inhibitory activity of lipid accumulation in the cells without effecting the viability. Both of these extracts were smaller than 100 kDa. The extract which was larger than 100 kDa did not express inhibitory activity of the lipid accumulation. However, it had higher phenol content and expressed more activity in most of the chemical-based assays. This study provides supplemental information on the various biological activities of seaweed and gives reason to further investigate its anti-diabetic effects.

Cell based assays:

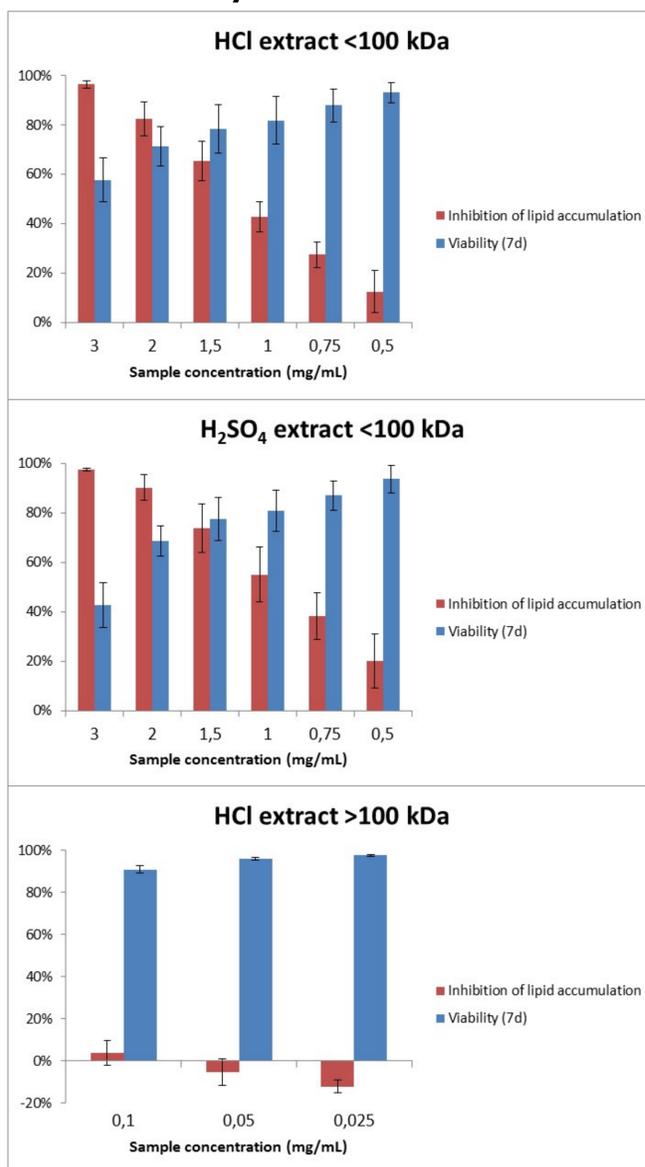


Figure 3. The inhibition of lipid accumulation in the cells was analyzed with 2 different assays, using AdipoRed reagent and OilRedO reagent. The viability of the cells after exposure to different concentrations of the extracts was analyzed using PrestoBlue reagent

References

- Song et. al. (2013). Blueberry Peel Extracts Inhibit Adipogenesis in 3T3-L1 Cells and Reduce High-Fat Diet-Induced Obesity. *PLOS ONE*, 8(7).
- Yang et. al. (2014). Anti-adipogenic Constituents from *Dioscorea opposita* in 3T3-L1 Cells. *Biological and Pharmaceutical Bulletin*, 37(10).
- Seo et. al. (2012). Extract from Edible Red Seaweed (*Gelidium amansii*) Inhibits Lipid Accumulation and ROS Production during Differentiation in 3T3-L1 Cells. *Preventive Nutrition and Food Science*, 17.
- Kim et. al. (2010). Fucoidan, a sulfated polysaccharide, inhibits adipogenesis through the mitogen-activated protein kinase pathway in 3T3-L1 preadipocytes. *Life Sciences*, 86.