Can encapsulating seaweed with alginate help to manage blood glucose level?

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1. Introduction

Type II diabetes mellitus (DM) is a chronic medical condition resulting from abnormally high post-meal blood glucose level; caused by the resistance of body cells to the effect of the hormone (i.e. insulin) in absorption of glucose, and abnormal glucose release in the liver to provide glucose to body despite the raised level of blood glucose.

Prolonged high blood glucose levels cause complications related to DM such as nerve damage, kidney damage and loss of vision.

Brown seaweed is a type of marine plant that contains fibre known as alginate; as well as organic compounds known as polyphenols. These two types of active ingredients have shown to inhibit carbohydrate digestion in a laboratory model.

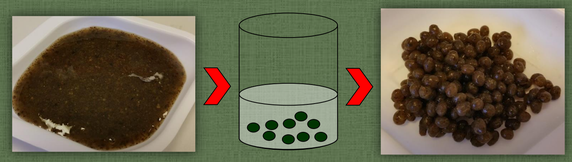
However, alginate has been used as an ingredient to encapsulate other plant polyphenols that are unstable in the condition of human digestive system to aid delivery of their potential health benefits during digestion.

2. Aim

The aim of this study was to investigate if there was an inhibitory effect on carbohydrate digestion of encapsulating seaweed using two types of alginate beads (i.e. DMB and GHB alginate beads).

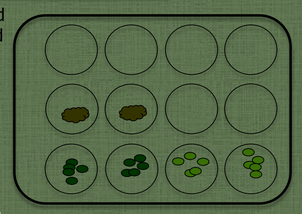
3. Methods

(a) Formulating seaweed-alginate beads



Dried brown seaweed powder and alginate powder were dissolved in water to form a solution. A syringe was used to draw the solution which was dripped it into calcium chloride solution to form the alginate beads.

(b) Model gut system stimulation



The human gut digestion was stimulated on a 12-well plate. Each well represents a digestive system. Starch was added into each well containing sample; and synthetic digestive juices with enzymes were added at different time points to stimulate digestion.

(C) Measuring the rate of carbohydrate digestion

The amount of glucose released from the digestion of starch was measured at different time points throughout the 180 minutes of the model gut.

4. Results (I)

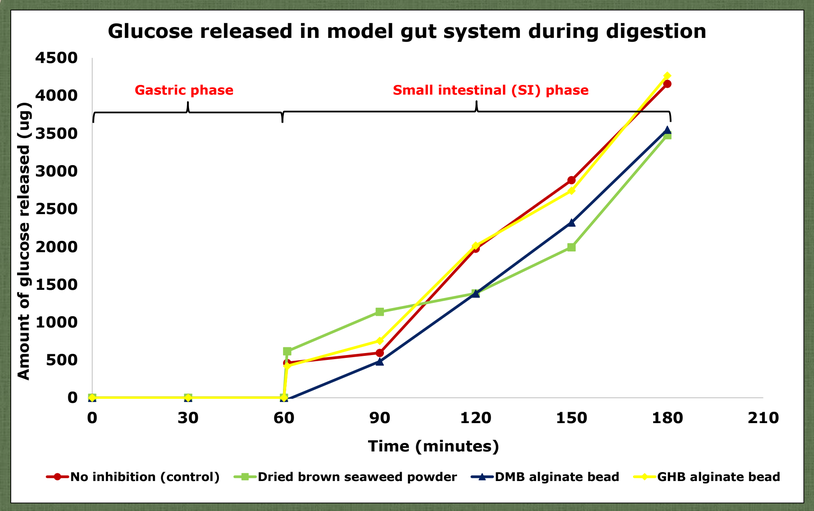


Figure 1: Amount of glucose released in model gut system during digestion

- The lower the amount of glucose released, the higher the inhibition rate on carbohydrate digestion
- Both dried brown seaweed powder and DMB alginate bead showed higher inhibition rates as compared to GHB alginate bead (Figure 1)
- Encapsulating seaweed powder with DMB alginate bead allow the inhibitory activity to be maintained during the SI digestion

4. Results (II)

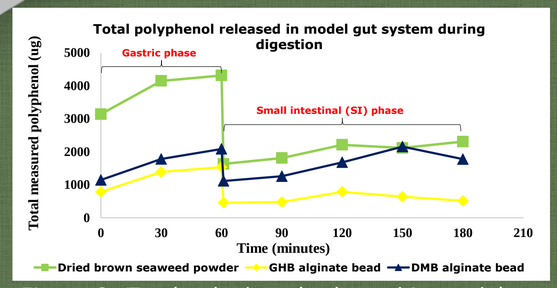


Figure 2: Total polyphenol released in model gut system during digestion

- Inhibition profile in SI phase on carbohydrate digestion (Figure 1) was related to amount of total polyphenol released in model gut digestion in the SI phase (Figure 2)
- GHB alginate bead showed lowest amount of total polyphenol released
- Both dried seaweed powder and DMB alginate bead showed similar release profile during small intestinal digestion

5.Conclusion

Carbohydrate digestion was affected by seaweed and encapsulated seaweed in DMB alginate bead. GHB alginate bead did not effect inhibition of carbohydrate digestion. Improving the total polyphenol release profile of the DMB alginate bead could potentially provide a higher inhibition level on carbohydrate digestion.

Reference: Sharifuddin, Y., Chin, Y., Lim, P. and Phang, S. (2015). Potential bioactive compounds from seaweed for diabetes management. Marine Drugs, [online] 13(8), pp.5447-5491.

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