Effects of Seaweed on the Digestibility of Carbohydrates

BSc (Hons) Food & Human Nutrition
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**Foo Qun Zhen Cherylyn (160715426), Matthew Wilcox, Peter Chater, Iain Brownlee, Jeffery Pearson*
Q.Z.C.Foo2@newcastle.ac.uk

(Wikipedia, 2017)

Introduction

Obesity is a condition linked with numerous negative health issues such as type 2 diabetes and cardiovascular disease. In recent years, research has shown that polyphenols (a compound found in seaweeds) may prolong the time it takes for blood glucose to rise after a meal. This prevents a sharp spike in blood glucose which is beneficial as having prolonged and elevated glucose levels in the body increases the risk of organ damage. In addition to that, seaweeds have also been associated with the reduced digestibility of carbohydrates in humans. This has potential applications in treating people with obesity as the total amount of nutrients absorbed by the body is reduced. Therefore in this study, the effects of Ascophyllum nodosum (as shown above) on carbohydrates digestion will be studied. Ascophyllum nodosum will be encapsulated in beads due to its unique taste and texture that many find unpleasant.

Aims

- To create seaweed encapsulated beads to protect polyphenols from being destroyed by chemicals in the digestive system
- To study the effects of encapsulated seaweed on the digestibility of carbohydrates by using an in vitro Model Gut System (MGS), to replicate processes that occur in the human gastrointestinal tract

Methods

Creation of Beads (Guo et al., 1989)

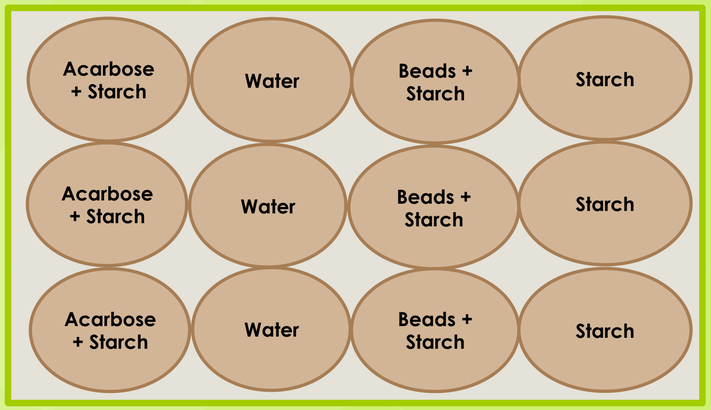
By experimenting with different methods and concentrations of solutions, it was found that 0.2g of seaweed in 0.8% DMB alginate produces the most ideal beads, which are round and upon agitation will not break apart. The methods described below are used to measure the effects seaweed beads have on carbohydrate digestion.

1) Beads were made with a syringe by dropping 0.8% DMB alginate containing seaweed into 102mM calcium chloride

Picture 1: Beads were made in a ratio of 2:3 alginate and Calcium Chloride.

2) 0.5g of beads were then gently blotted with a piece of tissue and added to a 12 well plate

Model Gut System (Houghton et al., 2014)



Picture 2: The plate arrangement shown above represents the model gut and the substances added in each well. Acarbose acts as an inhibitor of starch carbohydrates.

1) Artificial gastric contents (such as saliva, gastric juice, and bile) were added to the wells at 15/30 minutes intervals for 3 hours
2) 50ul of samples were taken at different intervals and added to 50ul Trichloroacetic acid (to stop further reaction)
3) Samples were then left in the fridge overnight at 4°C before being centrifuged at 10,000rpm for 10 minutes

Starch Analysis

1) 50ul of the supernatant were extracted and added to 950ul of 1% Potassium Chloride 75% Methanol solution before undergoing a second round of centrifugation
2) 50ul of 1mg/ml alpha-glucosidase was then added to the remaining 100ul mixture and incubated at 37°C for 2 hours (to further breakdown carbohydrates into simple sugar, glucose)
3) 300ul of GOPOD reagent was added to 10ul of sample in a 96-well microplate and incubated at 50°C for 20 minutes before being assayed at 510m

Results

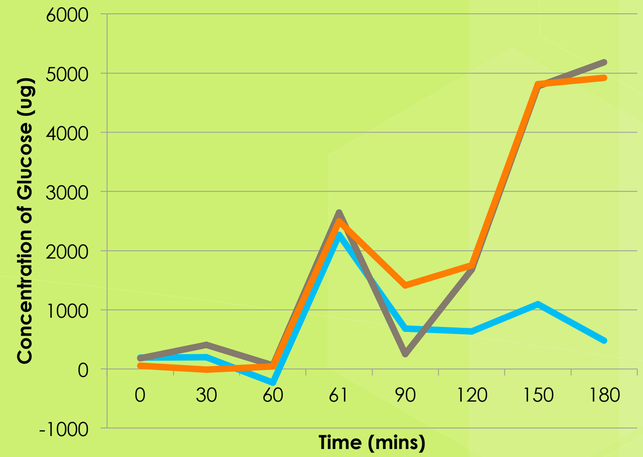


Figure 1 shows the results from starch analysis. The blue line represents acarbose + starch, while the brown line represents beads + starch. The orange line represents starch only.

Conclusion

Results obtained from the graph (as shown above) indicates that Ascophyllum nodosum encapsulated beads may not interfere with carbohydrate digestion. However, more research using different species and concentration of seaweed and alginate can be done to test the effects of seaweed on carbohydrates digestion.

References

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