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Abstrakt:

ALPHA-CYCLODEXTRIN EFFECTS STARCH AND LIPID METABOLISM

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In recent years, an alarming increase in overweight, obesity and the following diseases has been observed. α-cyclodextrin (α-CD) shows potential for combatting overweight and obesity as studies have shown that addition of α-CD to a diet results in improved weight loss1 and prevents weight gain2. A limited number of studies propose two possible mechanisms for the weight regulating effect; α-CD can 1) significantly lower the postprandial glucose response after a starch-rich meal and 2) affect the metabolism of lipids3,4,5.

In this study the proposed mechanisms were investigated and it is shown that α-CD affects the metabolism of both lipids and carbohydrates. Hydrolysis of γ-CD as a well-defined representative of starch by porcine pancreatic α-amylase in the presence of α-CD was performed at 37°C, pH 6.5. It revealed that the presence of α-CD inhibited the enzymatic degradation in a dose-dependent manner. α-CD in a molar ratio of 1:1 showed a minor effect whereas using the ratio 5:1 (α-CD:γ-CD) the degradation rate decreased almost 50%.

A double-blind, randomized, crossover study was performed to confirm these results *in vivo.* 10 healthy subjects consumed white bread containing 50 g of digestible carbohydrate and plain water with or without 10 g of α-CD. Glucose levels were determined prior to and for 2 hours after consumption of each meal. Significant differences between glucose levels after the control meal and glucose levels after the meal containing α-CD (p = 0.013) were observed.

The effect of α-CD on lipid metabolism was investigated *in vitro*.Various amounts of α-CD were dissolved in 6 ml purified water and 4 ml of sunflower oil was added. After rigorously mixing, a phase separation was observed with an emulsion-like white substance consisting of oil and α-CD on top of a relatively clear water phase. 10% of α-CD to oil (w/w) was capable of emulsifying all of the oil. In order to see if the emulsion could occur with a standard meal, french fries were blended with water and α-CD was added. After centrifugation, a white emulsion was, once again, seen at the top. Lipid analysis, performed using the copper soap method, revealed a reduction of 95% of the free fatty acids in solution indicating that α-CD was capable of preventing degradation of most of the lipid.

1. Comerford, K. B., Artiss*,* J. D., Jen, C. K.-L., and Karakas, S. E.. *Obesity*, **2010**, 19(6), 1200-4.
2. Grunberger, G., Jen, C. K.-L., and Artiss, J. D.*, Diabetes/Metabolism Research and Reviews*, **2007**, 23(1), 56-62.
3. Artiss, J. D., Brogan, K.*,* Brucal, M., Moghaddam, M., and Jen, C. K.-L.. *Metabolism,* **2006,** 55(2), 195-202.
4. Buckley, J. D., Thorp, A. A.*,*Murphy, K. J., and Howe, P. R. C.. *Annals of Nutrition and Metabolism* , **2006**,50, 108-14.
5. Schmid, G., Reuscher, H., and Antlsperger, G*.* **2004**. Method for reducing the glycemic index for foods. United States, Wacker-Chemie GmbH. US 2004/0161526 A1: 1-9.