In vitro starch and protein digestibility of legume enriched biscuits using static and Dynamic Duodenal Model

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Introduction
In vitro digestion models provide information regarding nutrient digestibility and can predict human metabolic response.In the present study in-vitro digestion of the main macronutrients of two legume-enriched wheat biscuits and a wheat biscuit was performed. The legume-enriched biscuits differ in their amino-acid composition, because they were formulated with different mixtures of legumes and seed flours, but they have same protein quantity.The aim of the study was to examine the influence of biscuits' composition in the digestibility of protein and starch.

Methods

Legume-enriched biscuits consisted of 14 and 14.5% protein, 36.2 and 36% starch.Wheat control contained 7,9% protein, 44.9% starch.All biscuits had similar sugar and lipid content of 10-11% and14-14,5%.The static protein digestion was adapted from INFOGEST2.0. In-vitro starch digestibility was determined with simulation of the intestinal phase. Digestion was also done with the Dynamic Duodenal Model (DDM) which mimics intestinal motility. Proteins and reducing sugars Determination was performed with Bradford Assay and DNS method, respectively.

Results
No statistically significant differences on protein digestion were observed between the samples. Static digestion of wheat and legume-enriched biscuits resulted in about 14% hydrolysed protein at the gastric and 60% after 120 minutes of intestinal digestion. In the DDM about 33% of the protein was digested for all biscuits.Starch digestion indicated that 8-14% of starch was hydrolysed.The three biscuit samples showed similar starch digestibility during Dynamic digestion, with 35-40% of total starch being hydrolysed at the end of the intestinal phase. It must be noted that non-reducing sugars, such as sucrose, cannot be determined byDNS Method.This method's limitation leads to the underestimation of total hydrolysed starch and may have affected the results.

Conclusions
The proteins of all three biscuits in static model showed similar digestion profiles and are mainly hydrolysed in the intestinal phase. Both starch digestion models yielded similar starch hydrolysis curves between the different samples. Static and dynamic models seem to provide different quantities of final hydrolysed nutrients but similar digestion profiles. Starch and protein digestibility under investigated conditions seemed to be unaffected by the biscuit formulation. However, in an in-vivo study consumption of these biscuits can cause different metabolic responses.