Digestion of CLA-enriched milk fatty acids studied in a dynamic in vitro gastrointestinal model

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Introduction

There has been a great deal of interest in the metabolic activity of the various isomers of conjugated linoleic acid (CLA). This increased interest has led to the production of synthetic CLA, both as free fatty acid and as triacylglycerol. However, lipid sources of similar fatty acid composition might not be biologically equivalent because of the structural characteristics of the lipids they contain. Although animal and human feeding trials have been carried out, very little is known about how different lipid forms of CLA are digested and metabolized.

Objective

The objective of this study was to measure the in vitro digestibility of 9c,11t-CLA either naturally present or technologically incorporated in milk, and compare it to the digestibility of other fatty acids (FA) in the milk.

Materials and methods

Production of milk with enhanced CLA

The first treatment (NAT) was milk naturally enriched with 9c, 11t-CLA (46 mg/g FA) obtained from a lactating dairy cow fed a total mixed ration supplemented with 4% safflower oil. The 2 other treatments consisted of synthetic CLA in the form of triacylglycerols (TAG) (Natural ASA) or free fatty acids (FFA) (Loders Croklaan) emulsified in milk that originally contained low level of 9c, 11t-CLA.

Analysis of milk fatty acid composition

Lipid extraction was performed using the method of Bligh and Dyer (1959). Fatty acids were methylated using CH3ONa for 5 min and BF3 for 30 min. Fatty acid methyl esters were then analyzed by gas chromatography using a 100-m × 0.25-µm CPSil 88 fused silica capillary column.

In vitro digestion

Gastric (0.25 ml/min), biliary (0.25 ml/min) and pancreatic (0.25 ml/min) secretions were delivered to the appropriate sections in TIM-1 model (Figure 1) through computer-controlled pumps. The jejunum and the ileum were both connected to a filtration unit (1.1 m2 × 200µm). Ileal delivery of chyme was collected during 360 min of digestion and subjected to FA analysis.

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Results

Results revealed that the digestibility of total milk FA was 79.6% (SD±2.6). Significantly, less 9c, 11t-CLA was absorbed in the system over the 6 hours when fed as TAG than when NAT was fed. CLA appeared to be highly digestible and therefore, any nutrition study should not be limited by availability of ingested CLA. The TIM-1 model could provide important data regarding the digestibility of FA according to their chain length, degree of saturation, lipid form, or their triglyceride positional distribution.

Conclusion

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