Butter-intake decreases ectopic lipid deposition and increase glucose tolerance, compared to highly polyunsaturated oil, in the rat

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Attenuated gastric distress but no benefit to performance with adaptation to octanoate-rich esterified oils in well-trained male cyclists

We investigated the effects of modifying a normal dietary fatty acid composition and ingestion of high-fat exercise supplements on gastrointestinal distress, substrate oxidation, and endurance cycling performance. Nine well-trained male cyclists completed a randomized triple-crossover comprising a 2-wk diet high in octanoate-rich esterified oil (MCFA) or twice long-chain fatty acids (LCFA). Following the diets, participants performed 3-h of cycling at 50% of peak power followed by 10 maximal sprints while ingesting either 1) a carbohydrate (CHO)+MCFA-rich oil emulsion after the 2-wk MCFA-rich dietary condition (MC-MC, Intervention) and 2) after one of the LCFA-rich dietary conditions (LC-MC. Placebo) or 3) CHO only following a LCFA-rich diet (LC-CHO, Control). During the 3-h ride MCFA-adaptation decreased octanoic-acid oxidation by 24% (90% confidence interval: 14-34%). The CHO+MCFA-rich oil emulsion reduced endogenous fat oxidation by 61% (33-89%) and 110% (89-131%) in the MC-MC and LC-MC conditions, respectively, and MCFA-adaptation reduced endogenous-carbohydrate oxidation by 10% (-3-23%). MCFA-adaptation attenuated gastrointestinal distress and nausea during the sprints, but the effect of the oil emulsion was to lower sprint power by 10.9% (7.7-14.1%) in the MC-MC condition and by 7.1% (5.7-8.5%) in the LC-MC condition, relative to the LC-CHO control, every one unit increase in nausea decreased mean power by 6.0 W (3.2-8.8 W). We conclude that despite some attenuation of endogenous-carbohydrate oxidation and gastric distress following adaptation to a MCFA-rich diet, repeat sprint performance was substantially impaired in response to the ingestion of a CHO+MCFA-rich oil emulsion.

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Butter-intake improves glucose tolerance, compared to a highly polyunsaturated oil, in the rat

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Lymphatic recovery of exogenous oleic acid in rats on long chain or specific structured triacylglycerol diets

Specific structured triacylglycerols, MLM (M = medium-chain fatty acid, L = long-chain fatty acid), rapidly deliver energy and long-chain fatty acids to the body and are used for longer periods in human enteral feeding. In the present study rats were fed diets of 10 wt% MLM or LLL (L = oleic acid [18:1 n-9], M = caprylic acid [8:0]) for 2 wk. Then lymph was collected 24 h following administration of a single bolus of C-13-labeled MLM or LLL. The total lymphatic recovery of exogenous 18:1 n-9 24 h after administration of a single bolus of MLM or LLL was similar in rats on the LLL diet (43% and 45%, respectively). However, the recovery of exogenous 18:1 n-9 was higher after a single bolus of MLM compared with a bolus of LLL in rats on the MLM diet (40% and 24%, respectively, P = 0.009). The recovery of lymphatic 18:1 n-9 of the LLL bolus tended to depend on the diet triacylglycerol structure and composition (P = 0.07). This study demonstrated that with a diet containing specific structured triacylglycerol, the lymphatic recovery of 18:1 n-9 after a single bolus of fat was dependent on the triacylglycerol structure of the bolus. This indicates that the lymphatic recovery of long-chain fatty acids from a single meal depends on the overall long-chain fatty acid composition of the habitual diet. This could have implications for enteral feeding for longer periods.

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The recovery of C-13-labeled oleic acid in rat lymph after administration of long chain triacylglycerols or specific structured triacylglycerols

General information
13C-labeled 18 : 2n-6 recovered in brush border membrane phospholipids short time after administration.

The purpose of the present study was to examine the short-term effect of dietary specific structured triacylglycerols (MLM, M = 8:0, L = 18:2n-6), LLL and MMM on the fatty acid composition of brush border membrane (BBM) phosphatidylcholine (PC) and phosphatidylethanolamine (PE). Rats were administered intragastrically a bolus of ML*M, M*LM*, L*L*L* or M*M*M* (* = C-13- labeled fatty acid). Rats were decapitated 2 hours and 6 hours later, and the fatty acid composition and C-13-enrichment of BBM-PC and -PE were determined. C-13-enriched 18:2n-6 was observed in BBM-PC after intragastric administration of L*L*L* and ML*M, whereas no C-13-labeled fatty acids were recovered after administration of M*LM* or M*M*M*. Interestingly, no C-13-labeled fatty acids were detected in the BBM-PE fraction. This could be due to a lower turnover of PE than PC and to a different ratio of saturated and unsaturated fatty acids in the two phospholipid pools. Minor effects on BBM-PC and BBM-PE fatty acid profiles (mole-%) were observed. The present study demonstrated for the first time incorporation of C-13-labeled 18:2n-6 into BBM-PC 2 hours and 6 hours after intragastric administration of L*L*L* or ML*M. This emphasizes the influence of the dietary fatty acid on BBM fatty acid composition and the rapid incorporation of dietary long-chain fatty acids into intestinal enterocyte phospholipids. Medium-chain fatty acids in a single meal exert only a minor influence on the BBM phospholipid fatty acid profile.

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Transport of C-13-labelled linoleic and C-13-labelled caprylic acid in rat plasma after administration of specific structured triacylglycerols

The lymphatic transport of structured triacylglycerol consisting of medium and long chain fatty acids in rats has been investigated in several studies, but the following metabolism of the absorbed fatty acids carried in chylomicrons is less elucidated. In the present study we determined the transport of dietary C-13-labelled fatty acids in rat plasma to compare the chylomicron fatty acid metabolism after administration of specific structured, long chain and medium chain triacylglycerols. Rats were fed ML*M, M*LM*, L*L*L* or M*M*M* (L=linoleic acid, 18:2n-6, M=caprylic acid, 8:0, * = C-13-labelled fatty acid) by gavage. A maximum transport of 0.5% of the administered C-13-labelled 18:2n-6 was observed in
1mL rat plasma both after administration of L*L*L* and ML*M, while approximately 0.04% of the administered C-13-labelled 8:0 was detected in 1mL plasma following administration of M*M*M* or M*LM*. After L*L*L* administration C-13-labelled 20:4n-6 was observed in plasma, probably formed by elongation and desaturation of 18:2n-6 in the enterocyte or liver cells. Furthermore, C-13-labelled 16:0, 48:0, 18:1n-9 and 20:4n-6 were observed in plasma of rats fed M*M*M* and M*LM* due to transformation to long chain fatty acids in the enterocyte and/or the liver. The present study indicates similar chylomicron metabolism of specific structured triacylglycerols compared with long chain or medium chain triacylglycerols and reveals information of elongation and desaturation of the dietary fatty acids.

Minor amounts of plasma medium-chain fatty acids and no improved time trial performance after consuming lipids
Medium-chain triacylglycerols (MCT) have a potential glycogen-saving effect during exercise due to rapid hydrolysis and oxidation. However, studies comparing intake of carbohydrates (CHO) plus 80-90 g MCT with intake of CHO alone have revealed different results. The present study tested performance after consumption of specific structured triacylglycerol, consisting of a mixture of medium-chain fatty acids and long-chain fatty acids, to prevent the adverse effects observed by MCT (pure medium-chain fatty acids) regarding gastrointestinal distress. Seven well-trained subjects cycled 3 h at 55% of maximum O2 uptake during which they ingested CHO or CHO plus specific structured triacylglycerols. Immediately after the constant-load cycling, the subjects performed a time trial of similar to 50-min duration. Breath and blood samples were obtained regularly during the experiment. Fatty acid composition of plasma triacylglycerols, fatty acids, and phospholipids was determined. Performance was similar after administration of CHO plus specific structured triacylglycerol [medium-, long-, and medium-chain fatty acid (MLM)] compared with CHO (50.0 +/- 1.8 and 50.8 +/- 3.6 min, respectively). No plasma 8:0 was detected in the plasma lipid classes, but the amount of phospholipid fatty acids was significantly higher after CHO+MLM compared with CHO intake. The lacking time trial improvement after intake of medium-chain fatty acids might be due to no available 8:0 in the systemic circulation. A higher level of plasma phospholipid fatty acids in the CHO+MLM compared with the CHO group was probably due to endogenous phospholipid release into chylomicrons.
Recoveries of rat lymph FA after administration of specific structured C-13-TAG

The potential of the specific structured TAG MLM [where M = caprylic acid (8:0) and L = linoleic acid (18:2n-6)] is the simultaneous delivery of energy and EFA. Compared with long-chain TAG (LLL), they may be more rapidly hydrolyzed and absorbed. This study examined the lymphatic recoveries of intragastrically administered L*L*L*, M*M*M*, ML*M, and ML*L* (where * = C-13-labeled FA) in rats. Lymph lipids were separated into lipid classes and analyzed by GC combustion isotope ratio MS. The recoveries of lymph TAG 18:2n-6 8 h after administration of L*L*L*, ML*M, and ML*L* were 38.6, 48.4, and 49.1%, respectively, whereas after 24 h the recoveries were approximately 50% in all experimental groups. The exogenous contribution to lymph TAG 18:2n-6 was approximately 80 and 60% at maximum absorption of the specific structured TAG and L*L*L*, respectively, 3-6 h after administration. The tendency toward more rapid recovery of exogenous long-chain FA following administration of specific structured TAG compared with long-chain TAG was probably due to fast hydrolysis. The lymphatic recovery of 8:0 was 2.2% 24 h after administration of M*M*M*. This minor lymphatic recovery of exogenous 8:0 was probably due to low stimulation of chylomicron formation. These results demonstrate tendencies toward faster lymphatic recovery of long-chain FA after administration of specific structured TAG compared with long-chain TAG.

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Studies on the Metabolism of 13C-labelled Specific Structured Triacylglycerols in Rat and Human

Absorption og metabolisme af omestrede triglycerider

Vistisen, B., PhD Student, Department of Systems Biology
Hey, C., Main Supervisor
Mu, H., Supervisor
Hellgren, L., Examiner
Metabolism of interesterified fats
The metabolism of interesterified fats is investigated by synthesis of C13-labeled triglycerides with specified triacylglycerol structure and fatty acid profile. The absorption and metabolism into longer chain polyunsaturated fatty acids is investigated.

Høy, C., Project Manager, Department of Biochemistry and Nutrition
Vistisen, B., Project Participant, Department of Biochemistry and Nutrition

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