Can capric acid-rich medium-long-medium chain type structured lipids to modulate the microbiota and metabolic alterations induced by a high-fat diet fed mice?

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What is about it?

Structured lipids (SL) are triacylglycerols that undergo restructuring or modification with respect to the composition profile of fatty acids in their structure and/or their positional changes attached to the glycerol backbone facilitated via chemical or enzymatic reactions catalyzed by lipases (triacylglycerol acyl hydrolases, EC 3.1.1.3).

This study explores the impact of capric acid-enriched medium-, long-, and medium-chain (MLM) structured lipids (SLs) on obesity complications and microbiota modulation in mice fed a high-fat diet (HFD). The SLs were synthesized using microbial lipase and grape seed oil (GSO), then microcapsules were produced as feed to model *in vivo*. Male C57BL/6J mice were assigned to different diets: control diet (CD), High-Fat Diet (HFD), control diet with GSO (CDGO), High-Fat Diet with GSO (HFDGO) (prevention and reversion groups), control diet with SL (CDSL), and High-Fat Diet with SL (HFDSL) (prevention and reversion groups).

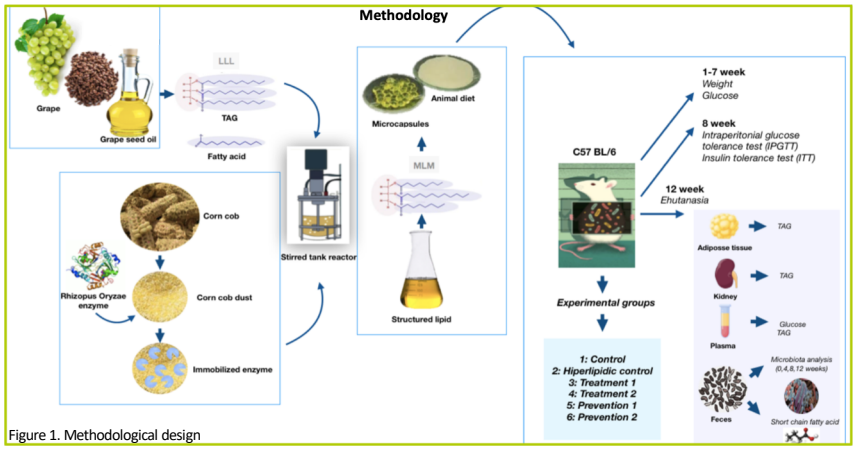

Figure 1. Methodological design

Results

Fatty acid profile shows higher saturated fatty acid (SFA) due incorporation degree of capric acid (C10), Mice on CD, CDGO, CDSL, and HFDSL showed decreased body weight gain compared to the HFD group. Organ weights (liver, heart, and testicles) were higher in mice on HFD compared to CD, CDSL, and HFDSL, microbiota analysis highlight higher expression of Bacteroidetes phylum in HFDGO and HFDSL groups as *Bacteroides, parasuterella,* and *blautia* genera and lowest F/B ratio while HFD group *Akkermansia, Lactococcus* suggesting a potential protective effect of SLs as a dietary supplementation with SLs.

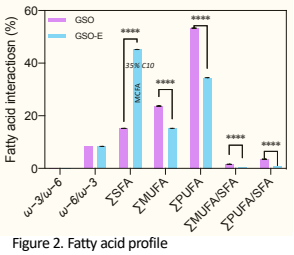

Figure 2. Fatty acid profile

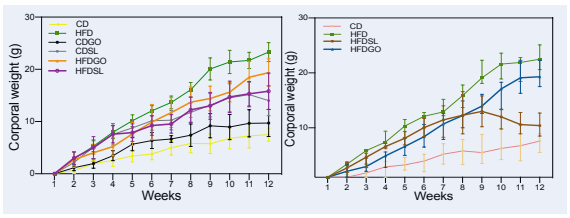

Figure 3. Weight gain

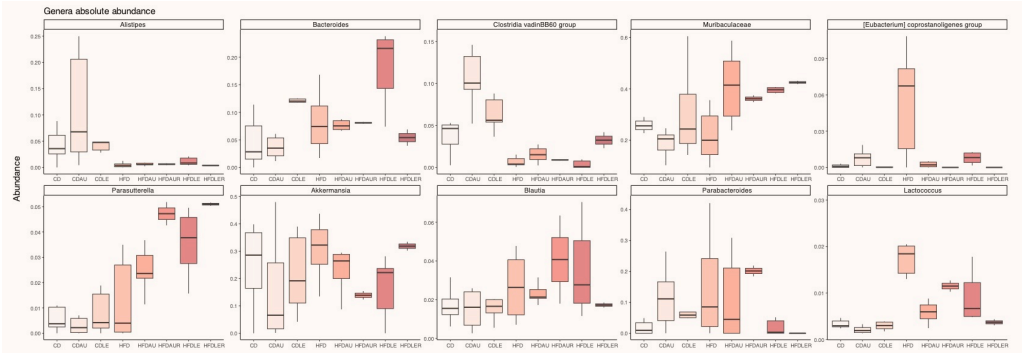

Figure 3. Genera abundance of treatments

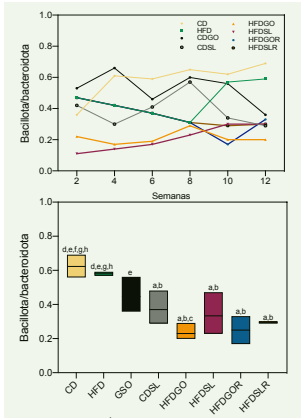

Figure 4. bacillota/bacteroidota ratio of treatments

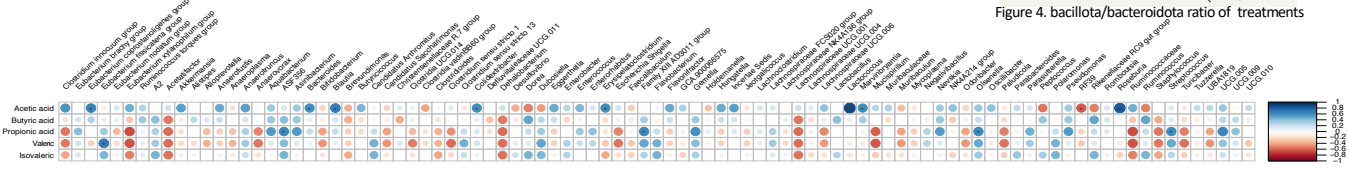

Figure 5. Correlation analysis between bacterial genera and short chain fatty acids

CONCLUSION:

Our results suggest a potential role for capric acid rich MLM in addressing metabolic imbalances associated with obesity. Furthermore, our investigation revealed the promising protective effects of CDSL and HFDSL in prevention and protection balance against developing of hepatic steatosis in mice underscoring the potential therapeutic benefits of capric acid-rich SL in preventing and ameliorating obesity-related complications. Results show that there is possible to modulate microbiota by lipids quality on intake. The data obtained from this study strongly indicate the exceptional anti-obesity properties of capric acid-enriched SL, particularly in formulations.

Future: clinical trials about capric acid-rich SL are under way in our laboratory.
Challenges: search and access to raw materials to develop structured lipids to industrial scale.

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