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Absorption of lipophilic micronutrients from smoothie

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Ultimate goal

Predict total absorption of a lipophilic bio-actives based on their distribution in lipoproteins.

This study

…tests usefulness of a chylomicron isolation protocol for subsequent bioavailability studies.

Background

Lipid soluble nutrients are packaged into chylomicrons immediately after absorption[1]. Biological effects can only occur if bioactive molecules are absorbed and transported to target tissues. Efficient absorption of functional food compounds is essential when considering development of functional food as well as food supplements, medicinal food, optimised food for the elderly population or cost-optimized food in developing nations.

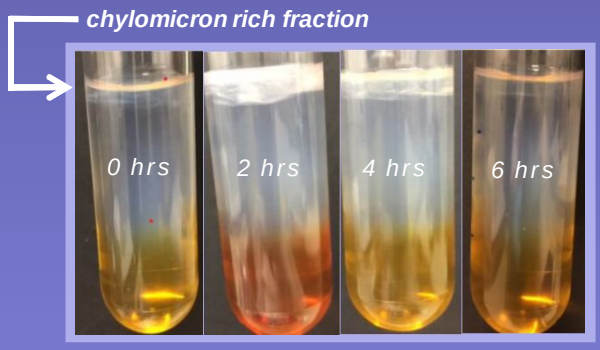


Figure 1: Chylomicron-rich fraction.
After smoothie consumption plasma was collected and chylomicrons were isolated via density gradient ultracentrifugation.

Materials and Methods

Participants (n=3) were on a carotenoid restricted diet for 24 h. After a 12 h overnight fast a carotenoid rich smoothie (36mg/500 mL) was consumed and blood was collected at 0, 2, 4 and 6 h. Chylomicrons were isolated from plasma via density gradient ultracentrifugation[2]. Carotenoids were extracted from plasma, chylomicrons and smoothie, identified and quantified by HPLC-DAD with a high sensitivity flow cell.

References
1) Reboul, E, Borel, P. (2011) Progress in Lipid Research, 50:388-402.
2) Brown, MJ, Ferruzzi, MG, Nguyen, et. al. (2004) American Journal of Clinical Nutrition, 80:396-403.

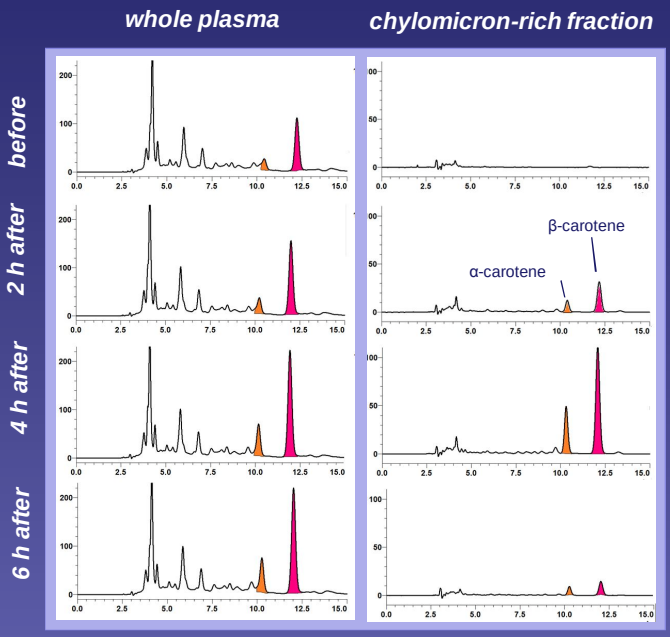


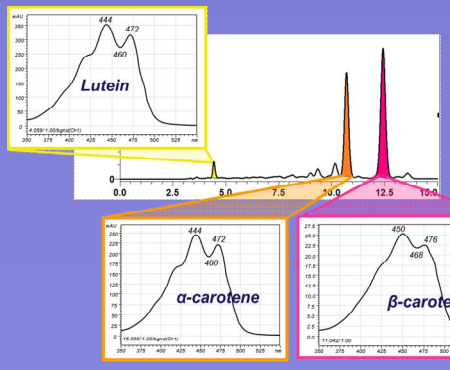
Figure 3: Carotenoid content in plasma and chylomicron-rich fraction. *Chylomicrons were isolated from fresh plasma after smoothie consumption and carotenoid content was identified by HPLC-DAD at 450 nm*

Results & Conclusion

Chylomicron-rich fraction contained no carotenoids at 0 h. Carotenoid content increased at 2, 4 and 6 h, indicating that chylomicron-rich fraction contained recently absorbed carotenoids derived from the smoothie. β-carotene content in chylomicrons peaked at 4 h with 50, 28 and 34 nmol/L in participants A, B and C (expressed as nmol/L plasma, i.e. carotenoid content in the chylomicron fraction present in 1L of plasma).

In contrast, β-carotene content in whole plasma was 351, 887 and 283 nmol/L at baseline and increased to 404, 994 and 776 ng/mL at 4 h, in participant A, B and C.

→ Isolated lipoprotein fractions may be a good tool for bioavailability research.



Smoothie:
Carrot juice (250 mL)
Mango (110 g)
Pineapple (40 g)
Orange juice (65 mL)
Lemon juice (5 mL)
Double cream 30 (mL)
→ 36 mg carotenoids in 500 mL smoothie

Figure 2: Carotenoid content in smoothie.
Using HPLC-DAD carotenoids were separated on a YMC carotenoid column and identified via their spectra.