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8th International Conference on FOOD DIGESTION

P15

Adult and older adult *in vitro* digestion of α-tocopherol fortified yogurt using DIDGI®

Jean-Michel Fernandes[a,b], Olivia Ménard[c], Marie-Françoise Cochet[c], Jordane Ossemond[c], António Augusto Vicente[a,b], Ana Cristina Pinheiro[a,b], Didier Dupont[c]

[a] CEB - Centro de Engenharia Biológica, Universidade do Minho, Portugal

[b] LABBELS – Associate Laboratory, Braga/Guimarães, Portugal

[c] INRAE l'Institut Agro - STLO, Rennes, France

Introduction

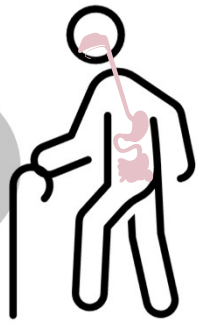
Older adult population is ageing

- ☐ Decreased metabolism
- ☐ Reduced ability to digest and adsorb food nutrients
- ☐ Nutritional deficiencies and malnutrition

Tailored Functional Foods for the older adult population

Aiming to improve nutraceutical and bioactive compounds delivery extent and functionality

How do these products digest in older adults ?



Objectives

- Adapt *in vitro* dynamic digestion protocols to better suit older adult' gastrointestinal [illegible]on parameters (Me[illegible]ard et al., 2023)
- Understand how adult and older adult digestive parameters modulate the digestion of α-tocoferol fortified yogurts

Methods

Fortified yogurt production

- Fat-free natural stirred yogurt
- Oil-in-Water nanoemulsions (w/ lecithin and sunflower oil) encapsulating α-tocoferol

Dynamic *in vitro* digestion - DIDGI® for adults and older adults

- Older adult protocol comprised prolonged gastric emptying and acidification with decreased enzymatic activity a[illegible]er biliary salts con[illegible]tra[illegible]on

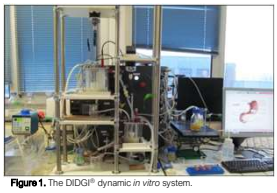


Figure 1. The DIDGI® dynamic *in vitro* system.

	Adult	Older adult
Gastric emptying $t_{1/2}$	70 min	98 min
Pepsin (U/mL)	2000	1200
Pancreatin (%)	7	5.5
Bile salts (%)	4 (0 - 30 min) 2 (30 min - end)	2.7 (0 - 30 min) 1.3 (30 min - end)

Influence of protocol on digestibility and release kinectics

- Analysis of nanoemulsions' particle size distribution during digestion
- Determination of α-tocopherol release kinetics and bioaccessibility

Results

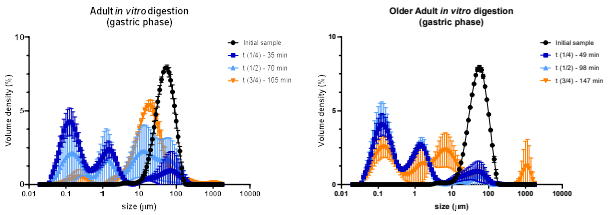


Figure 2. Particle size distribution stability during the gastric phase of the *in vitro* digestion using the adult and the older adult protocol. Samples were diluted in SDS to avoid aggregation effects.

- Samples' stability was similar between protocols until $t_{(1/4)}$.
- Aggregation effects were more pronounce in the adult protocol after $t_{(1/2)}$.
- Adult protocol was substantially more effective in degrad[illegible]g and homogenizing the gastric content.

- Superior α-tocopherol concentrations at initial stages of the intestinal phase were obtained using the older adult protocol.
- Gastric digestion by-products on adult protocol (i.e., higher content of peptides and amino acids) may have hindered initial α-tocopherol release.
- α-tocopherol release kinetics were greatly affected by the applicat[illegible]fferent digestion parameters, a[illegible]ering[illegible]s release extent and profile.

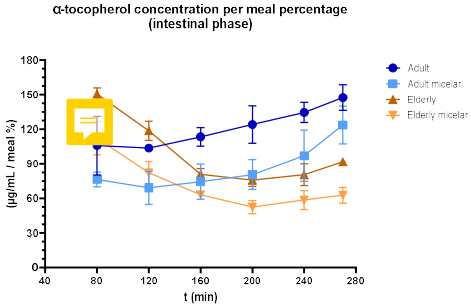


Figure 3. α-Tocopherol release kinetics during the intestinal phase of the in vitro digestion using adult and older adult protocols. .

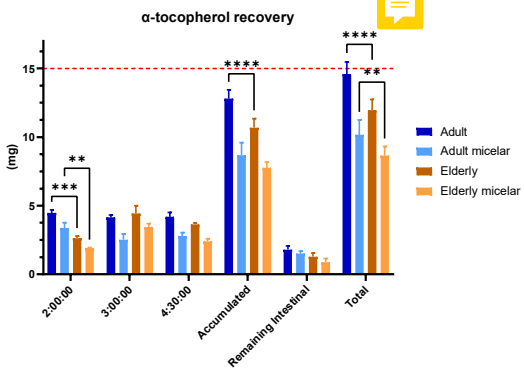


Figure 4. α-Tocopherol recovery from the digesta and micellar phase of samples delivered from the intestinal reactor. Red dotted line indicates the total amount of α-tocopherol added into the fortified yogurts. Statistically significant differences are indicated by ** ($p < 0.01$), *** ($p < 0.001$) and **** ($p < 0.0001$).

- α-tocopherol was entirely recovered using the adult protocol (i.e., 14.60 ± 0.89 mg), whereas in the older adult it was not (i.e., 11.96 ± 0.7[illegible] mg)
- O/W nanoemulsions produced and the selected food matrix granted high stability to α-tocopherol (i.e., 97.3 ± 5.9 and 79.8 ± 5.2 % for the adult and older adult protocol, respectively)
- α-Tocopherol release balance was greatly affected by the protocol applied until 2 h, however release balance attained at the end of the digestion was similar in both pr[illegible]
- Bioaccessibility of the delivered samples throu[illegible]he intestinal phase of the *in vitro* digestion ranged between 60.54 ± 7.38 and 78.90 ± 8.88 %

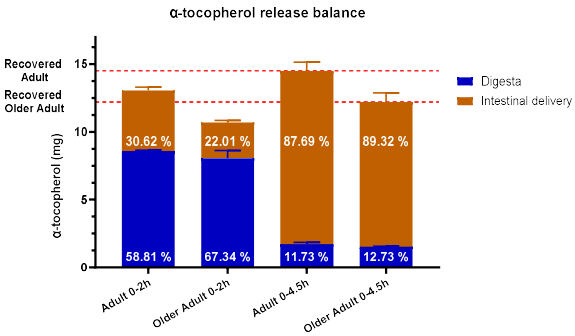


Figure 5. α-Tocopherol release balance of adult and older adult models at 2 and 4.5 h. Blue bar indicates the amount of α-tocopherol within the intestinal reactor, whereas orange bar indicates the amount of α-tocopherol delivered from the intestinal reactor. Red dotted lines indicate the total amount of α-tocopherol recovered when using the adult or older adult model.

Conclusions

- The adult protocol was substantially more effective in degrading and homogenizing the gastric content, despite the similar degradation of the fortified yogurt at earlier stages of digestion.
- Gastric phase duration and the obtained by-products from gastric digestion interfere with the consequent intestinal degradation and with the release of the bioactive compound of interest.
- Bioaccessibility of the delivered samples throughout the intestinal phase of the *in vitro* digestion ranged between 60.54 ± 7.38 and 78.90 ± 8.88, only presenting statistically significant differences at 3 hours which could be attributed to the prolonged gastric emptying on the older adult protocol.
- The adaptations to the in vitro dynamic protocol caused significant impact on the fortified yogurt proteins' hydrolysis during the gastric phase and on the α-tocopherol release rate and extent.

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