Gut microbial conversion of food polyphenols and their impact on intestinal metabolism and enthothelial stress: a combined *in vitro* approach

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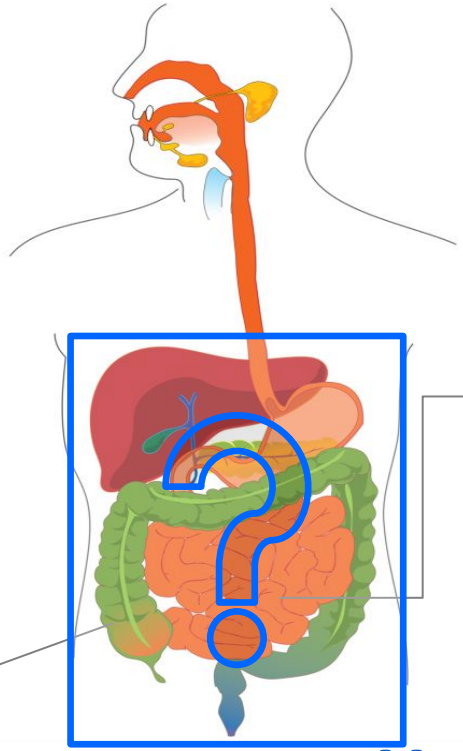
Polyphenols

Various health benefits

Can the health benefits be achieved?

Bioavailability

90–95%
Microbiota



Only 5–10% is absorbed

Major fractions

How ?

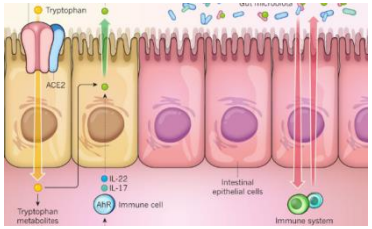
FOOD BIOACTIVES

POLYPHENOLS

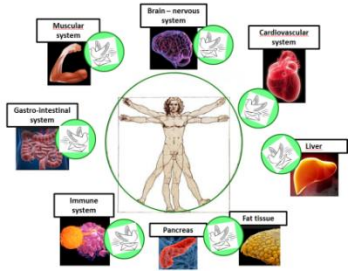
IN VIVO

DIGESTION

ABSORPTION

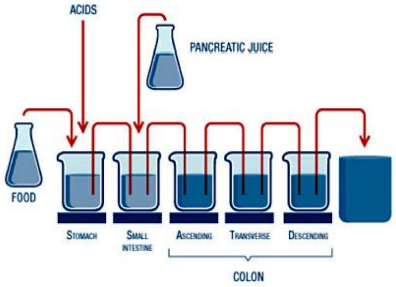


BIOACTIVITY

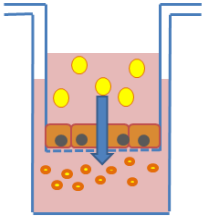


IN VITRO

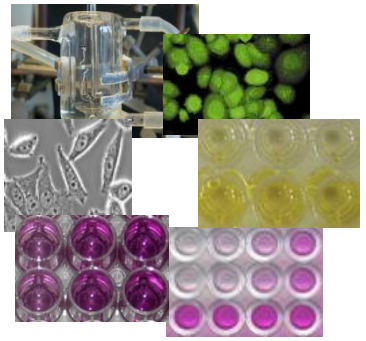
SIMULATORS



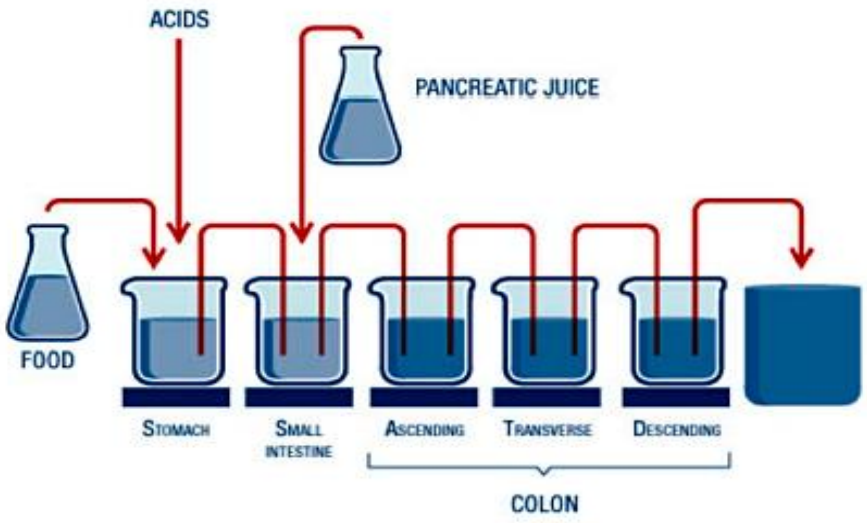
CACO-2 cells



BIO-ASSAYS



SHIME® … since 1993



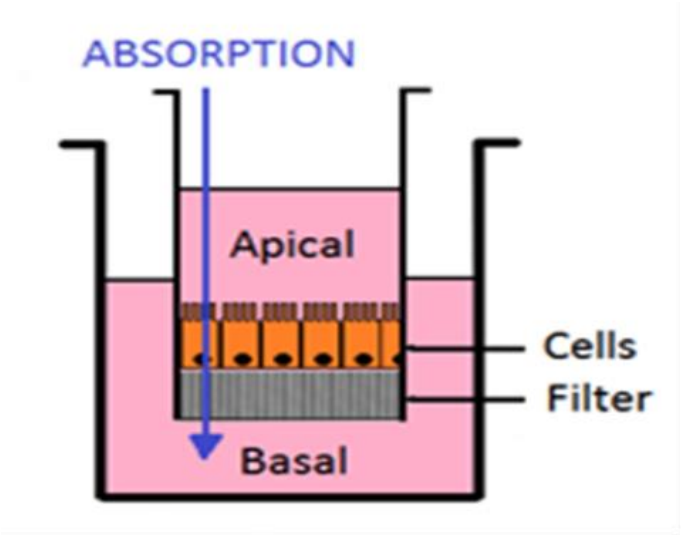
CMET ProDigest

- Long-term
- Location of metabolism
- Microbial community

Caco-2 cell culture

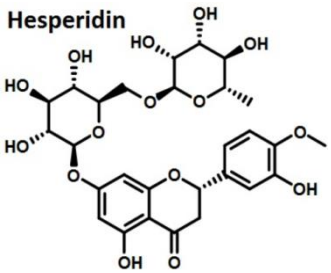
Transwell®

***In vitro* bioavailability and barrier studies**



BACCHUS
Cardiovascular benefits from food bioactives

Hesperidin-2S

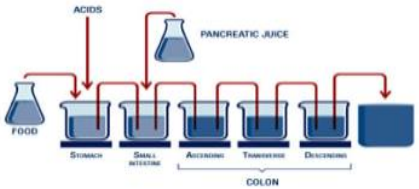


Same dose (500 mg/day)
Same product

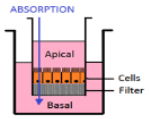
BioActor

IN VITRO

MICROBIAL CONVERSION: SHIME®



INTESTINAL TRANSPORT: Caco-2



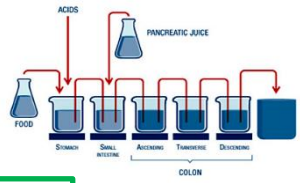
IN VIVO

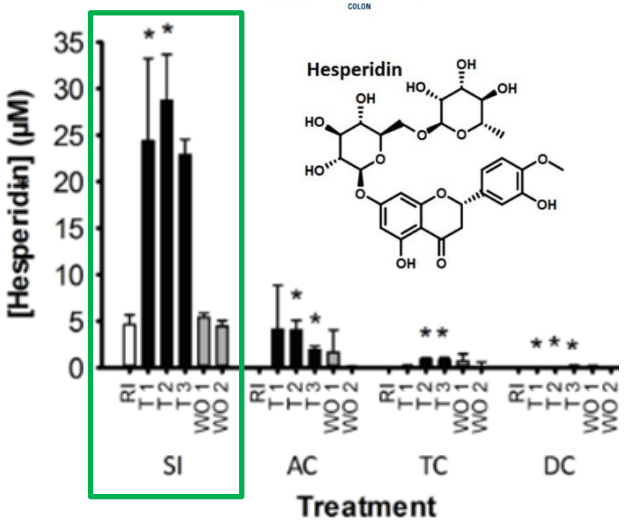
HUMAN INTERVENTION STUDY

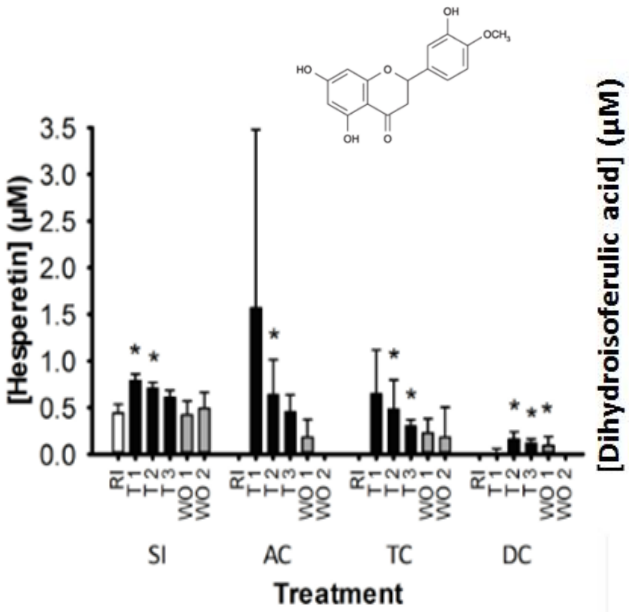
GHENT UNIVERSITY

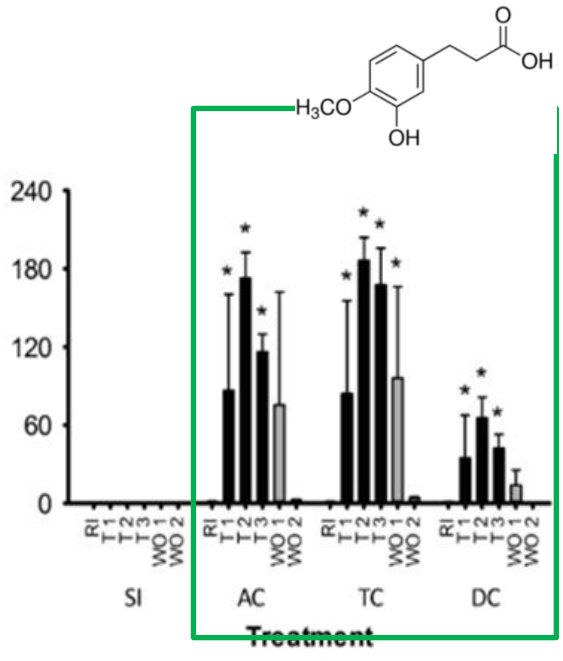
BIOAVAILABILITY

vito
vision on technology

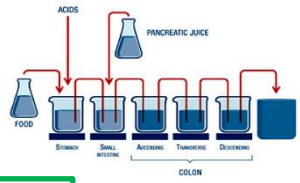


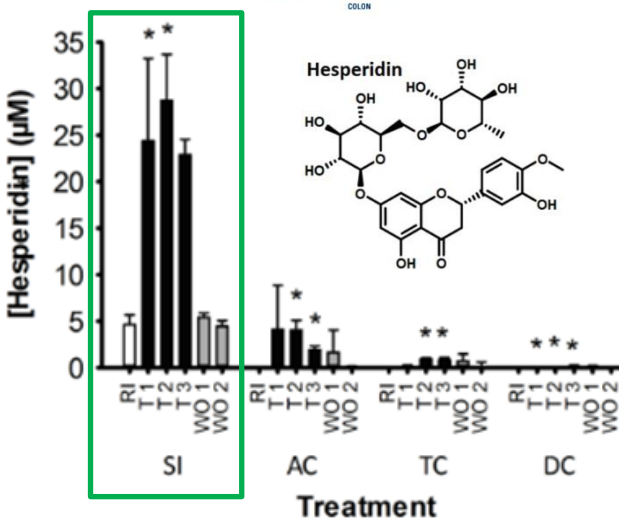


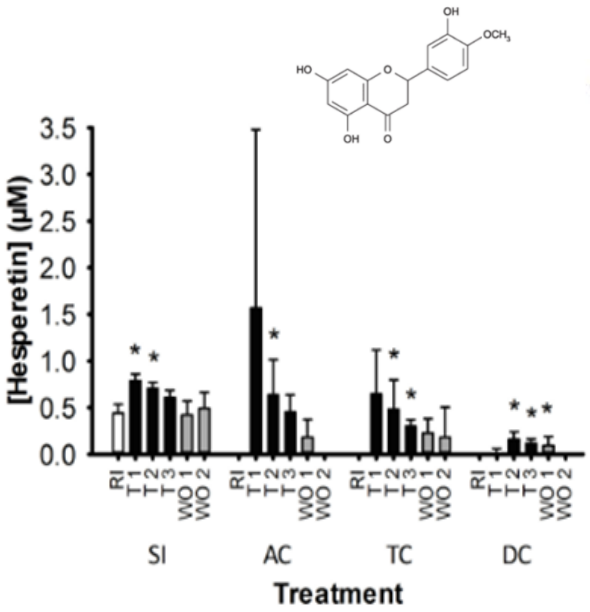


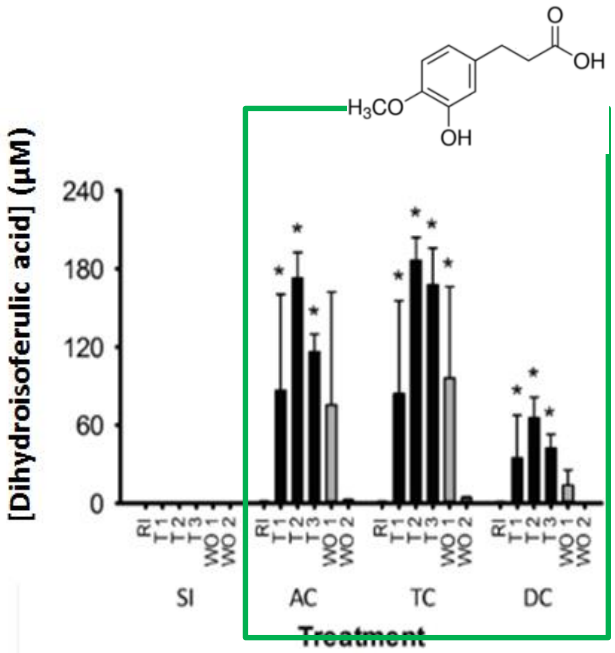


Van Rymenant et al. (2018*) Mol Nutr Food Res*





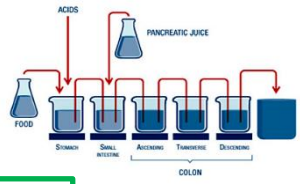


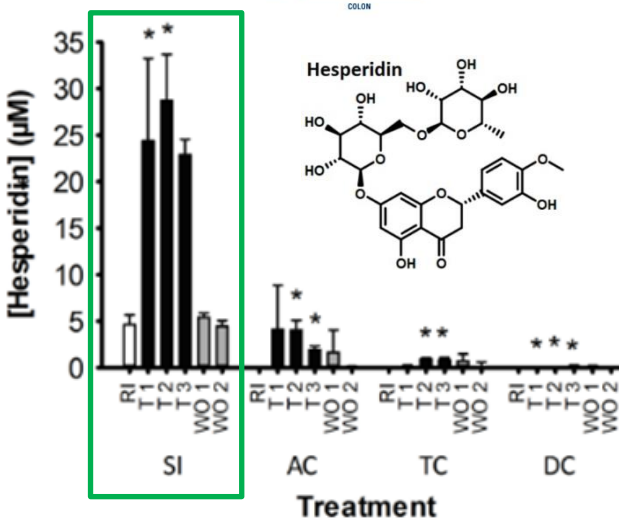


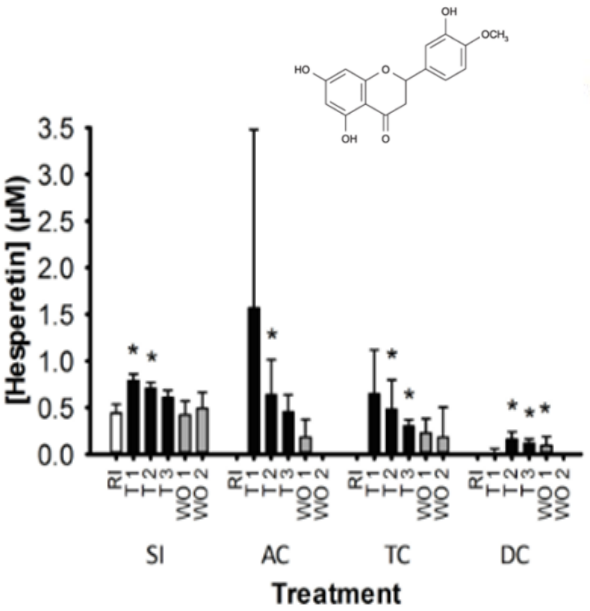
Concentration (% of total metabolites)

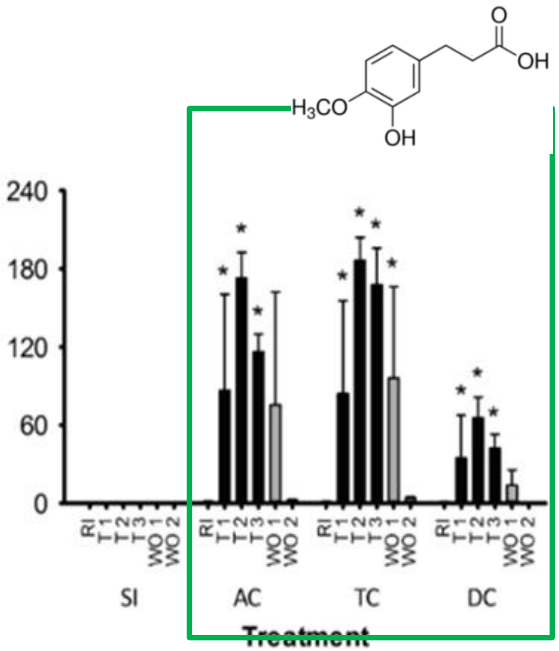
Vessel	Hesperidin	Hesperetin	DHCA	DHFA	DHIFA	4-OH-PA
SI	**95**	1.3	1	0	0	3
AC	3	1	**39**	0.8	**43**	13
TC	1	0	**39**	0.6	**45**	15
DC	1	0	7	0.5	**73**	19

Van Rymenant et al. (2018*) Mol Nutr Food Res*









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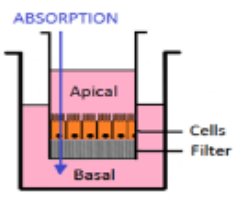

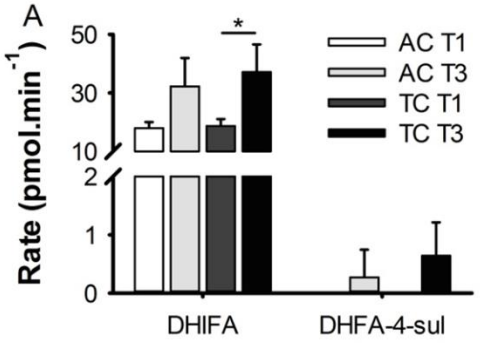

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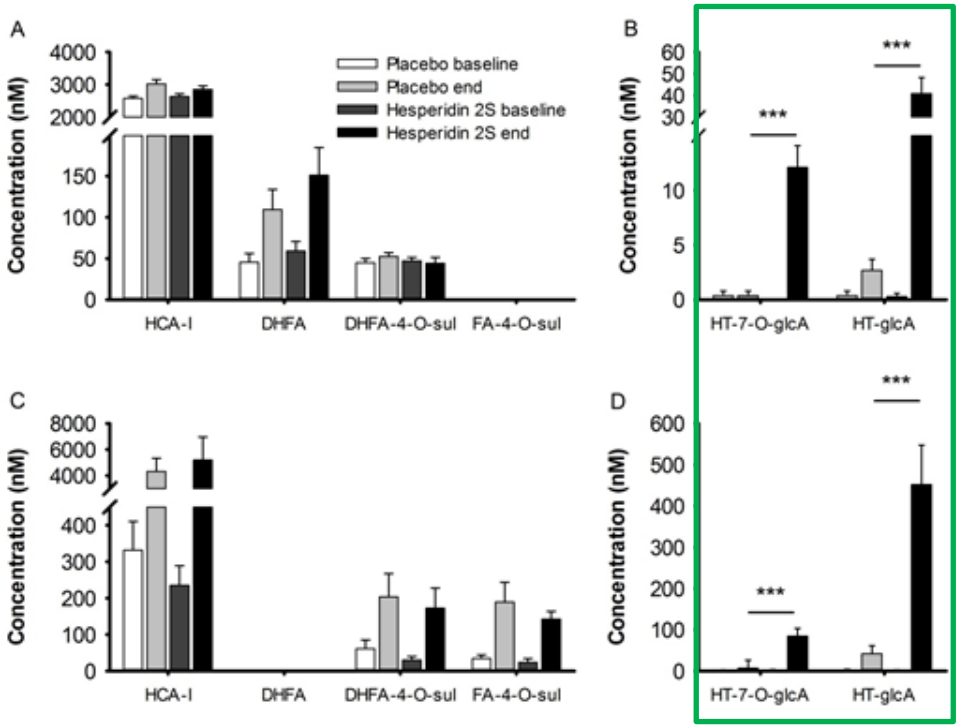

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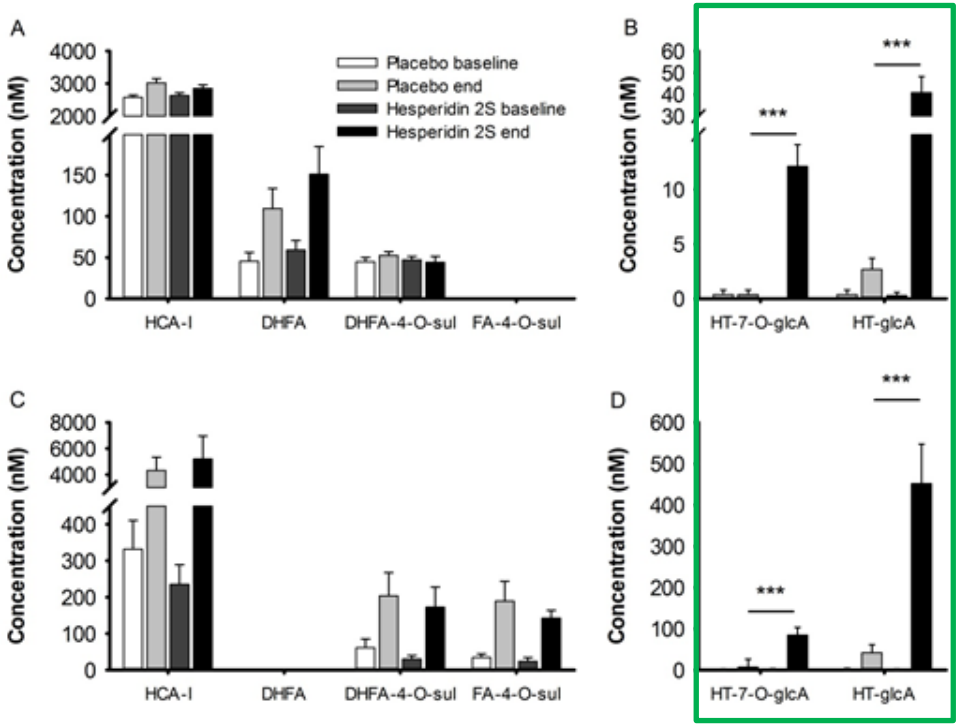


Conclusions:

* Similar metabolites, microbione dependent, phenolic selective transport

* **BUT:** *in vitro*: overestimation small phenolics

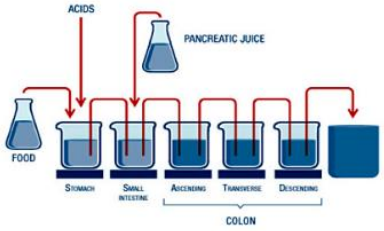
Solution:

Continuous absorption

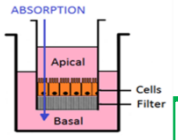
Van Rymenant et al. (2018*) Mol Nutr Food Res*

Food matrix and polymerisation

***Aronia* juice**



CONTROL 1 Weeks | PLACEBO 2 Weeks | TREATMENT 2 Weeks



Basal

SHIME recovery(%)

	SI	AC	TC	DC
Cyanidin-3-O-galactoside	6.7 ± 0.1^{c}	17 ± 1^{c}	–	–
Epicatechin	–	–	–	22 ± 0.9^{c}
Quercetin-3-O-rutinoside	5.4 ± 1.3^{c}	16 ± 8^{b}	–	–
Quercetin-3-O-galacatoside	6.0 ± 1.6^{b}	27 ± 6^{bc}	–	–
Quercetin-3-O-glucoside	–	–	–	–
Quinic acid	7.3 ± 2.8^{c}	–	–	–
Chlorogenic acid	5.7 ± 2.0^{c}	13 ± 1^{c}	–	–
Caffeic acid	–	21 ± 3^{c}	–	–
Hydrocaffeic acid	–	16 ± 4^{b}	7.8 ± 1.3^{b}	–

Anthocyanins
Phenolic acids:
PROXIMAL

Procyanidins:
DISTAL

Wu et al. *J. Funct. Foods* (2017)

Conclusions

- **Microbial digestion** strongly impacts **bioavailability** and **bioactivity** of polyphenols

- **Advanced models** may improve **physiological relevance**

Acknowledgement

BACCHUS
Cardiovascular benefits from food bioactives

CHINA SCHOLARSHIP COUNCIL

SEVENTH FRAMEWORK PROGRAMME

NU3 chem FOOD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GHENT UNIVERSITY

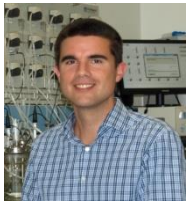
GHENT UNIVERSITY


Prof. Guy Smagghe


Prof. Katleen Raes

CMET


Prof. Tom Van de Wiele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Prof. Maria Glibetic

BioActor


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THANK YOU!

QUESTIONS?