Food and Nutritional Sciences Department

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The absorption and metabolism of seaweed polyphenols in humans

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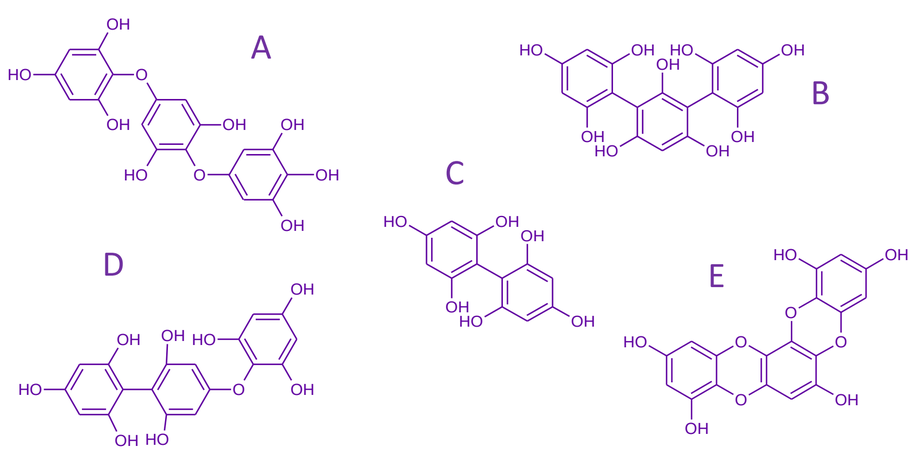
Seaweed polyphenols

Seaweeds are a rich source of polyphenolic compounds [1]. The types of polyphenols in seaweed show similarities to those found in land plants and include phenolic acids, tannins and flavonoids. In brown seaweeds, phlorotannins (oligomers and polymers of phloroglucinol units), which are unique to seaweeds of this type, can comprise 5 to 15 % of the dried weight [2].



Structures of phlorotannins: (A) trifuhalol A. (B) trifucol. (C) difucol. (D) fucophlorethol. (E) eckol.

Biological activities and bioavailability

Studies have suggested that seaweed consumption may deliver polyphenols to the circulation capable of expressing anti-inflammatory effects for both food and pharma applications [3, 4]. However, such studies have been hindered by the fact that, to date, little is known about the bioavailability of seaweed polyphenols.

Aim

The aim of this study is to investigate the absorption and metabolism of seaweed polyphenols in healthy subjects after ingestion of a food grade seaweed polyphenol extract.

References

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2. MA Ragan and JS Craigie, Can J Biochem 54 (1976); 66-73.
3. HE Moon, N Islam, BR Ahn, SS Chowdhury, HS Sohn, HA Jung and JS Choi, Biosci Biotechnol Biochem 75 (2011); 1472-1480.
4. I Wijesekara, NY Yoon and SK Kim, Biofactors 36 (2011);408-414.

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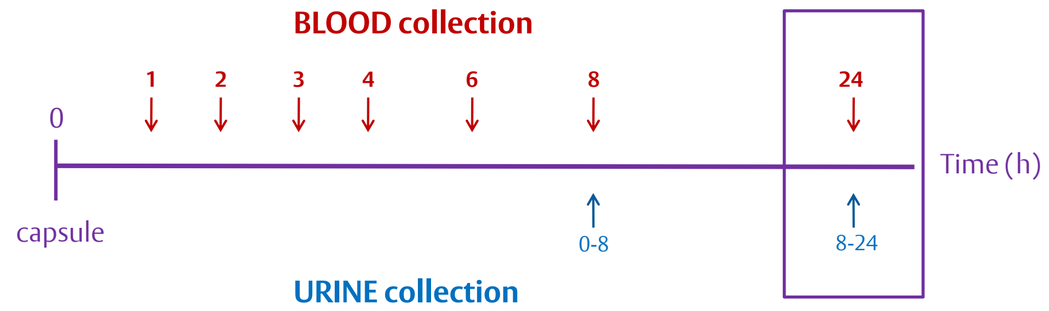
http://www.seaweedforhealth.org/swafax/

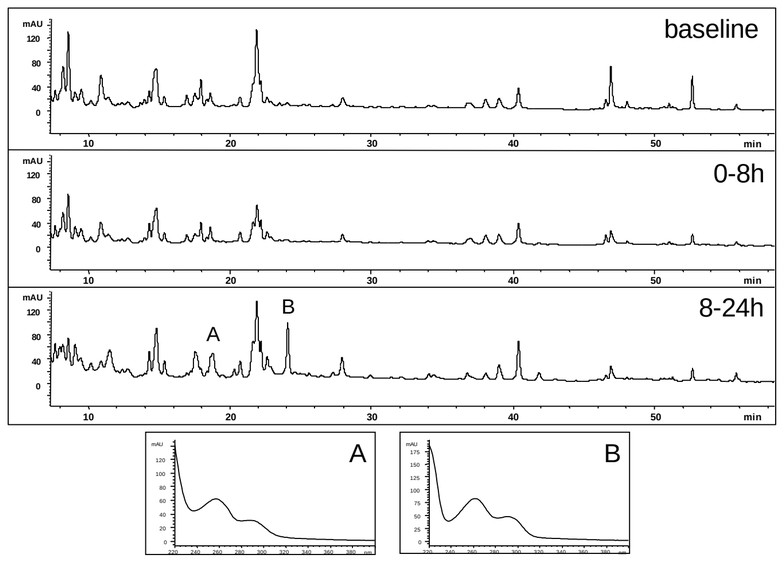
Study design

Volunteers followed a defined low polyphenol diet for 24h prior to and during the study day. Volunteers received the test material in the form of a capsule containing 100mg of polyphenols. Blood and urine samples were collected pre- and post-ingestion.



Urine analysis by HPLC-DAD

Urine samples were subjected to enzymatic treatment (glucuronidase/sulfatase) and aliquots were injected on HPLC-DAD



Peaks indicated as A and B were detected in urine samples collected at 8-24h after treatment. The two compounds show similar UV spectra characteristics and might therefore be structurally related.

Urine analysis by LC-MS

Urine samples were subject to enzymatic treatment (glucuronidase/sulfatase) and aliquots were injected on LC-MS (negative mode)

Table 1. LC-MS analysis of urine samples (negative mode)

sample	peak	RT (min)	$[M-H]^-$ (m/z)	MS^2 (m/z)	compound
urine 0-8h	1	20.6	375	331, 263, 145	peak B on HPLC-DAD
	2	20.9	347	329, 229, 185	peak B on HPLC-DAD
urine 8-24h	2	20.8	347	329, 229	peak B on HPLC-DAD
	3	15.7	224	180, 123, 100	peak A on HPLC-DAD
	4	15.8	292	246, 224, 100	peak A on HPLC-DAD
	5	10.2	369	299, 173	phloroglucinol trimer
	6	50.1	373	343, 305,272, 213, 179, 128	phloroglucinol trimer

In the sample 8-24h there were two m/z signals, 224 and 292, at 15.7 and 15.8 min RT, corresponding to peak Aon HPLC-DAD analysis. Also, we have a m/z signal at 347 (20.8 min RT) corresponding to peak B on HPLC-DAD analysis . The m/z signal at 347 was also present also in the sample 0-8h, together with a 375 m/z signal at 20.6 min RT. The m/z signals at 369 and 373 were only detected in the 8-24h sample, and could potentially be assigned to some trimeric phlorotannins with different types of linkages.

Ongoing work

Analysis of plasma samples for identification/quantification of seaweed polyphenols and/or metabolites