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Antioxidant and anti-inflammatory actions of red seaweed (*Grateloupia turuturu* and *Porphyra umbilicalis*) extracts linked to phytochemical characterization and cytotoxicity evaluation

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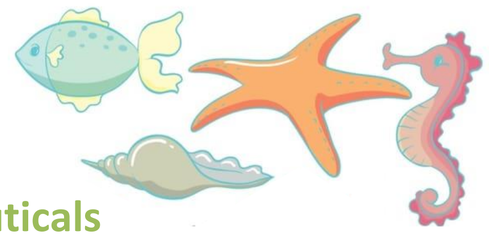
INTRODUCTION & AIMS

• The number of **functional foods** and **nutraceuticals**



from marine origin is increasing in the worldwide market [1].

• Specifically, the **red seaweeds**

Porphyra umbilicalis

Grateloupia turuturu

have shown their potential considering relevant **bioactive compounds** and **nutritional value** [1,2].

• Nevertheless, it is pertinent to explore knowledge gaps regarding their **phytochemical composition** and **bioactivities**.

The main objectives were to prepare *G. turuturu* and *P. umbilicalis* extracts to determine their phytochemical composition, evaluate their cytotoxicity and assess antioxidant and anti-inflammatory potentials, validating their use as functional food and nutraceuticals.

METHODS

Harvested from the Western Portuguese coast

Grateloupia turuturu

Porphyra umbilicalis

Hydroethanolic, infusion and decoction extracts

Phytochemical characterization

• **Total phenols content** was determined using Folin-Ciocalteu method [3].

• RP-HPLC-DAD analyses was used to determine the **phenolic profile**.

• **Myscoporine-like amino acids (MAAs) content** was determined using RP-HPLC-DAD and LC-DAD-ESI-MS.

• The phenol-sulfuric acid method was used for determining **total carbohydrates content** [4].

Antioxidant potential

• **ABTS$^{\bullet+}$, $^{\bullet}$OH** (salicylic acid) and **$^{\bullet}$NO** (Griess method) **scavenging activities** were determined [5,6].

Citotoxicity and anti-inflammatory activity

RAW 264.7 cells

CM ●– – – – – – – – – ▸○

CM + ESEA ●– – – – – – – – – ▸○

24 h

Cell viability assay
alamarBlue® assay [5,6]

Anti-inflammatory activity
Lipopolysaccharide stimulated cells
Griess method for $^{\bullet}$NO quantification [5,6]

CM – culture medium | ESEA – seaweed extract | ● – sample collection

RESULTS & DISCUSSION

Folin-Ciocalteu and HPLC data for phenolics

• Results showed a higher content in reducing compounds for aqueous extracts (~22-28 mg gallic acid equivalents (GAE) g^{-1} extract) compared to hydroethanolic extracts (~17-18 mg GAE g^{-1} extract).

• Chromatograms did not show the presence of typical terrestrial phenols.

MAAs and total carbohydrates contents

• *P. umbilicalis* extracts showed greater MAAs content, and porphyra-334 was the main MAA (Table 1).

• The aqueous extracts showed higher carbohydrate contents, with *P. umbilicalis* decoction exhibiting the highest level (~40% extract).

Table 1. Content of MAAs in *G. turuturu* and *P. umbilicalis* extracts (in mg g^{-1} extract).

Seaweed extract	MAAs concentration (mg g^{-1} extract)				
	Shinorine	Palythine	Porphyra-334	Aplysiapalythine A or Palythinol	TOTAL
GH	**3.96 ± 0.30**^{a}	0.65 ± 0.11^{a}	-	-	4.61 ± 0.32^{a}
GI	**6.23 ± 0.04**^{b}	0.57 ± 0.03^{a}	t	-	6.80 ± 0.05^{b}
GD	**5.43 ± 0.08**^{c}	0.55 ± 0.04^{a}	-	-	5.98 ± 0.09^{c}
PH	1.71 ± 0.01^{d}	0.39 ± 0.03^{b}	**18.35 ± 0.01**^{a}	0.41 ± 0.01^{a}	20.86 ± 0.03^{d}
PI	1.72 ± 0.02^{d}	0.21 ± 0.06^{c}	**21.64 ± 0.01**^{b}	0.39 ± 0.01^{a}	23.96 ± 0.06^{e}
PD	1.34 ± 0.02^{e}	0.12 ± 0.02^{c}	**17.85 ± 0.08**^{c}	0.31 ± 0.01^{b}	19.62 ± 0.09^{f}

GH, *G. turuturu* hydroethanolic extract; GI, *G. turuturu* infusion extract; GD, *G. turuturu* decoction extract; PH, *P. umbilicalis* hydroethanolic extract; PI, *P. umbilicalis* infusion extract; PD, *P. umbilicalis* decoction extract; t, trace. Different superscript letters within each column indicate statistically significant ($p < 0.05$) differences. Data in **bold** show the predominant MAA in each seaweed extract ($p < 0.0001$).

Antioxidant activity

• Aqueous extracts demonstrated the greatest ABTS$^{\bullet+}$ scavenging activities, being greater for *P. umbilicalis* decoction (97 mmol trolox equivalents g^{-1} extract).

• Antioxidant actions against $^{\bullet}$OH were more accentuated for hydroethanolic extracts (55-57% inhibition).

• *G. turuturu* aqueous extracts developed the highest protection against $^{\bullet}$NO (54-56% inhibition).

Citotoxicity and anti-inflammatory activity

• *P. umbilicalis* infusion extract had an IC_{50} of 0.43 mg mL^{-1}, while other extracts showed IC_{50} values above 0.75 mg mL^{-1}.

• The highest anti-inflammatory activity was shown in *P. umbilicalis* hydroethanolic extract (Fig. 1).

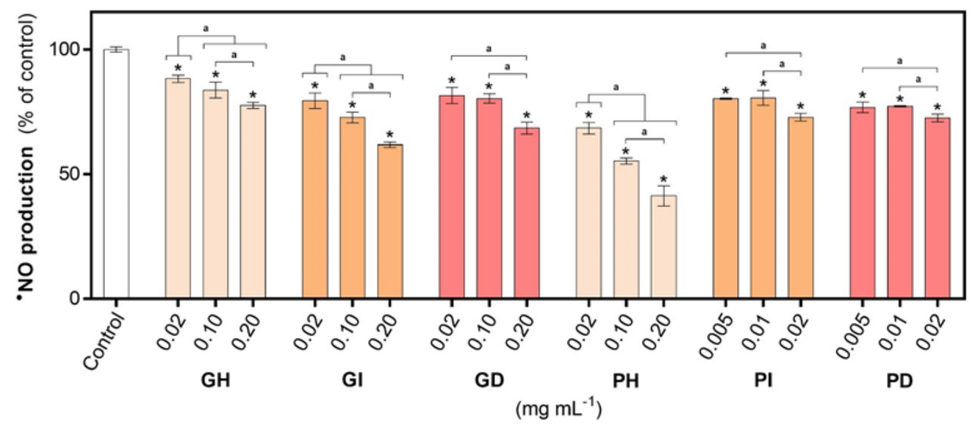


Fig 1. Anti-inflammatory activity of the *G. turuturu* and *P. umbilicalis* extracts on RAW 264.7 cells upon stimulation with lipopolysaccharide. *G. turuturu* extracts: hydroethanolic (GH), water infusion (GI) and water decoction (GD) and *P. umbilicalis* extracts: hydroethanolic (PH), water infusion (PI) and water decoction (PD). *$p < 0.05$, significant differences relative to control; $^{a}p < 0.05$, significant differences between concentrations of the same extract.

• MAAs and carbohydrates are believed to be the main compounds accountable for the reported antioxidant and anti-inflammatory activities.

• *G. turuturu* and *P. umbilicalis* demonstrated their potential as functional food and source of bioactive compounds.

REFERENCES

[1] J. Cotas, A. Leandro, D. Pacheco, et al., Life, 10 (2020).
[2] A. Lähteenmäki-Uutela, M. Rahikainen, M. Camarena-Gómez, et al., Aquaculture International (2021).
[3] S. Cofrades, I. López-López, L. Bravo, et al., Food Science and Technology, 16 (2010) 361.
[4] E. Plouguerné, C. Hellio, E. Deslandes, et al., Botanica Marina, 51 (2008) 202.
[5] C. Martins-Gomes, M. Taghouti, J. Schäfer, et al., Journal of Functional Foods, 43 (2018) 154.
[6] M. Queiroz, D. Oppolzer, I. Gouvinhas, et al., Fitoterapia, 120 (2017) 146.