Edible Halophytes – A novel Source of Functional Food Ingredients?

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INTRODUCTION

In recent years, edible halophytes have received more attention due to their ability to tolerate a wide range of salinities. In Australia, halophytes have been used in a broad range of "applications" by Indigenous Communities: as food in traditional cuisine, livestock feed, and for soil bioremediation. However, very limited scientific information on their nutritional profile and potential bioactivity is available.

AIM

To assess the nutritional value and potential bioactivity of Australian indigenous edible halophytes Seapurslane (SP) (*Sesuvium portulacastrum*), Oldman Saltbush (SB) (*Atriplex nummularia*) and Seablite (SBL) (*Suaeda arbusculoides*) leaves (Fig. 1).

Figure 1: Australian Indigenous edible halophytes (AIEH). 1: *S. portulacastrum*; 2: *A. nummularia*; 3: *S. arbusculoides*

METHODOLOGY

Proximate composition
- Standard AOAC methods (AOAC, 2000).

Lipid content and composition
- Extraction and analysis by GC-MS according to Ryckebosch et al. (2012) and (Chua et al., 2018) with slight modifications.

Antioxidant capacity
- Total Phenolic Content (TPC, Folin-Ciocalteu assay; Phan et al., 2019).
- DPPH radical scavenging capacity (Moore and Yu, 2008).

RESULTS

Proximate composition

SB and SP contained more (p<0.05) fibre than commercial Australian grown baby spinach which is from the same plant family and was used as a reference (Table 1).

Table 1: Proximate composition of AIEH leaves

		Seapurslane (SP)	Seablite (SBL)	Oldman SB	Spinach	
Australian Native Leaves			Mean ± SD			Daily Intake
Protein	% (w/w)	6.4 ± 0.04	6.4 ± 0.1	20.1 ± 0.18	32.1 ± 0.3	50 g
Fat	% (w/w)	1.3	1.1	2.7	3.4	70 g
Carbohydrate						
Soluble Carbohydrates-Glucose	% (w/w)	4.4 ± 0.1	2.0 ± 0.1	3.6 ± 0.1	2.7 ± 0.1	90 g
Starch	% (w/w)	13.6 ± 0.1	0.3 ± 0.02	2.1 ± 0.03	0.1 ± 0.01	310 g
Fibre	% (w/w)	40.4 ± 0.1	16.2 ± 0.1	41.5 ± 0.2	33.4 ± 0.1	30 g
Moisture	% (w/w)	63.3	77.1	4.7	72.2	
Ash	% (w/w)	0.9 ± 0.02	1.2 ± 0.02	2.9 ± 0.04	2.5 ± 0.03	

Daily intakes (FSANZ, 1991); Data are mean ± SD, n=3.

Minerals and Trace elements

Minerals and trace elements are summarized in Table 2 and 3. The studied plants are promising in regard to their minerals and trace elements (especially SBL, which had the highest contents of Ca and Fe).

Table 2: Minerals in AIEH leaves

	Macro Elements (g/ 100 g DW)					
Plant Species	Ca	Mg	Na	K	P	S
Seapurslane (SP)	0.6 ± 0.01	0.7 ± 0.00	8.0 ± 0.03	1.0 ± 0.03	0.2 ± 0.00	0.3 ± 0.00
Seablite (SBL)	3.0 ± 0.02	1.2 ± 0.00	15.0 ± 0.19	1.9 ± 0.04	0.1 ± 0.00	2.4 ± 0.02
Oldman SB	1.4 ± 0.03	0.9 ± 0.01	4.1 ± 0.02	4.0 ± 0.04	0.3 ± 0.00	0.6 ± 0.01
Spinach	1.0 ± 0.02	1.7 ± 0.01	2.7 ± 0.08	5.8 ± 0.06	0.6 ± 0.00	0.4 ± 0.00
DRI	1.2 g AI	0.35 g EAR	1.3 g AI	4.7 g AI	700 mg RDA	NA

Table 3: Trace elements in AIEH leaves

	Micro/ Trace Elements (mg/ 100 g DW)								
Plant Species	Fe	Zn	Mn	Cu	Ni	Mo	Se	Sr	B
Seapurslane (SP)	18.8 ± 0.5	0.3 ± 0.01	1.6 ± 0.1	0.4 ± 0.01	0.1 ± 0.01	0.01 ± 0.0	0.01 ±0.0	4.4 ± 0.1	2.9 ± 0.2
Seablite (SBL)	45.6 ± 0.6	0.5 ± 0.03	0.4 ± 0.01	0.1 ± 0.02	0.2 ± 0.02	0.1 ± 0.01	0.04 ±0.01	24.5 ± 0.5	5.4± 0.2
Oldman SB	11.7 ± 0.4	7.3 ± 0.2	3.5 ± 0.03	0.6 ± 0.03	0.1 ± 0.01	0.2 ± 0.02	0.1 ± 0.01	7.5 ± 0.2	5.1 ± 0.2
Spinach	29.5 ± 1.1	6.0 ± 0.1	8.1 ± 0.1	0.9 ± 0.1	0.1 ± 0.01	0.1 ± 0.0	0.1 ±0.0	6.1 ± 0.1	3.6 ± 0.2
DRI	8 mg RDA	11 mg RDA	2.3 mg AI	700 µg EAR	1 mg UL	34 µg EAR	45 µg EAR	1-5 mg RDA	20 mg UL

Tab. 2 & 3: DRI- dietary reference intakes, RDA-recommended dietary allowance, AI-adequate intake, UL-tolerable upper intake level, EAR- estimated average requirement, NA- not available (Otten et al., 2006); data are mean ± SD, n=3

Fatty acid methyl ester profiles

The fatty acid profiles consisted mainly of palmitic, stearic, oleic, linoleic and α-linolenic acids. The tested SP and SB samples were rich in polyunsaturated fatty acids (PUFA) as shown in Table 4.

Table 4: Fatty acid profiles in the tested samples (as % of total fatty acids)

FA (%)	Common Name	Seapurslane (SP)	Seablite (SBL)	Oldman SB
C16:0	Palmitic acid	25.8 ± 0.8	35.5 ± 0.6	24.8 ± 0.4
C18:0	Stearic acid	6.1 ± 1.2	11.0 ± 1.3	4.8 ± 0.2
∑ SFA		31.9	46.5	29.6
C18:1(n-9)	Oleic acid	19.6 ± 2.0	23.5 ± 1.8	7.2 ± 0.3
∑ MUFA		19.6	23.5	7.2
C18:2(n-6)	Linoleic acid	27.7 ± 4.1	18.6 ± 2.7	20.2 ± 0.1
C18:3(n-3)	α-linolenic acid	20.7 ± 0.8	11.4 ± 0.2	43.0 ± 0.8
∑ PUFA		48.4	30.0	63.2
∑ PUFA / ∑ SFA		1.5	0.6	2.1
n-6/n-3		1.3	1.6	0.5

Data are mean ± SD; n=3; SFA: saturated fatty acids; MUFA: monounsaturated fatty acid(s).

Antioxidant Capacity

SP had the highest (p<0.05) TPC and DPPH radical scavenging capacity which was comparable to baby spinach (Fig. 2).

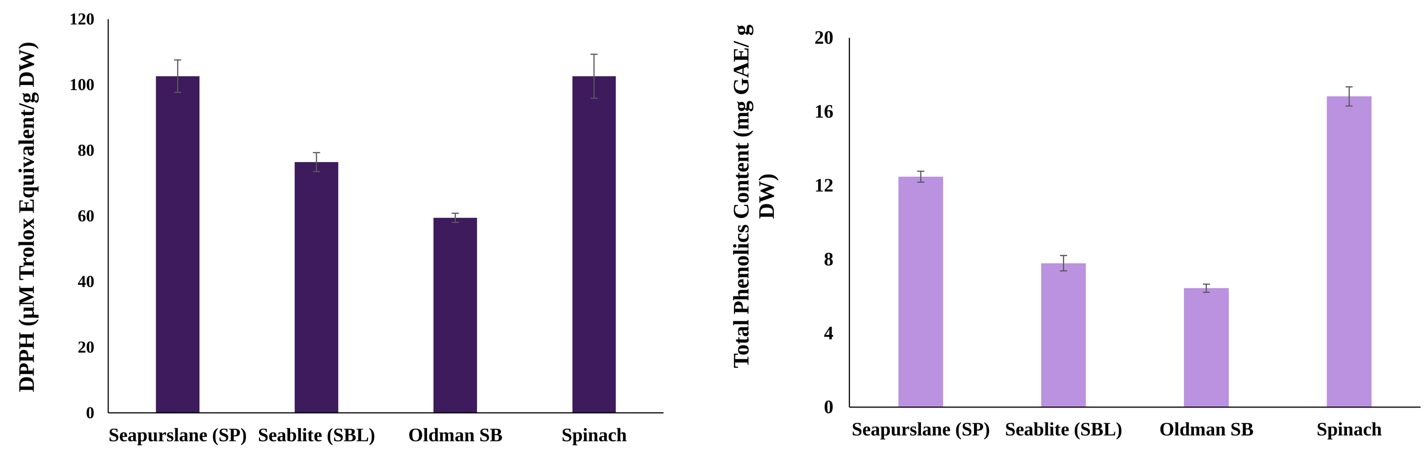

Figure 2: TPC and DPPH in AIEH leaves; data are mean ± SD, n=3.

CONCLUSION

The findings of the present study provide important nutritional information about Australian grown edible halophytes and their potential application as a functional food ingredient (e.g. alternative/novel source of dietary fiber).

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Acknowledgements

The University of Queensland Acknowledges the Traditional Owners and their custodianship of the lands on which UQ operates. The authors acknowledge the Traditional Owners of the lands on which the AIEH species were harvested and respect the knowledge and experience the Traditional Owners hold regarding the care, harvest and use of these plants.

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QAAFI Queensland Alliance for Agriculture and Food Innovation

The Queensland Alliance for Agriculture and Food Innovation (QAAFI) is a research institute of The University of Queensland (UQ), supported by the Queensland Department of Agriculture and Fisheries.

Queensland Government