

# Fermentation of sugar kelp *Saccharina latissima* – effects on sensory properties, and content of minerals and metals

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## Background

Commercial production of sugar kelp is establishing in Denmark, and the innovative Danish food sector explores potentials for refining taste and nutritional value of sugar kelp, while at the same time improving shelf life of products. Fermentation is an ancient technique for preserving food and feed, and for moderating taste and texture of foods. Fermentation of seaweeds for generating novel food products has yet only been described for few red algae.

## Aim

In this study we explored the effects of fermentation of sugar kelp on:

- sensory properties – taste, smell, texture and visual impression
- content of protein, minerals and harmful metals
- pH and microbiology

## Methods

Sugar kelp (*Saccharina latissima*) was heat treated and fermented using lactic acid bacteria (LAB). Taste, smell and texture of the fermented product was compared to fresh sugar kelp and two commercial seaweed products (nori and wakame). Tissue contents of dry matter, nitrogen, and selected minerals and trace metals of the fresh and fermented sugar kelp were quantified and compared.

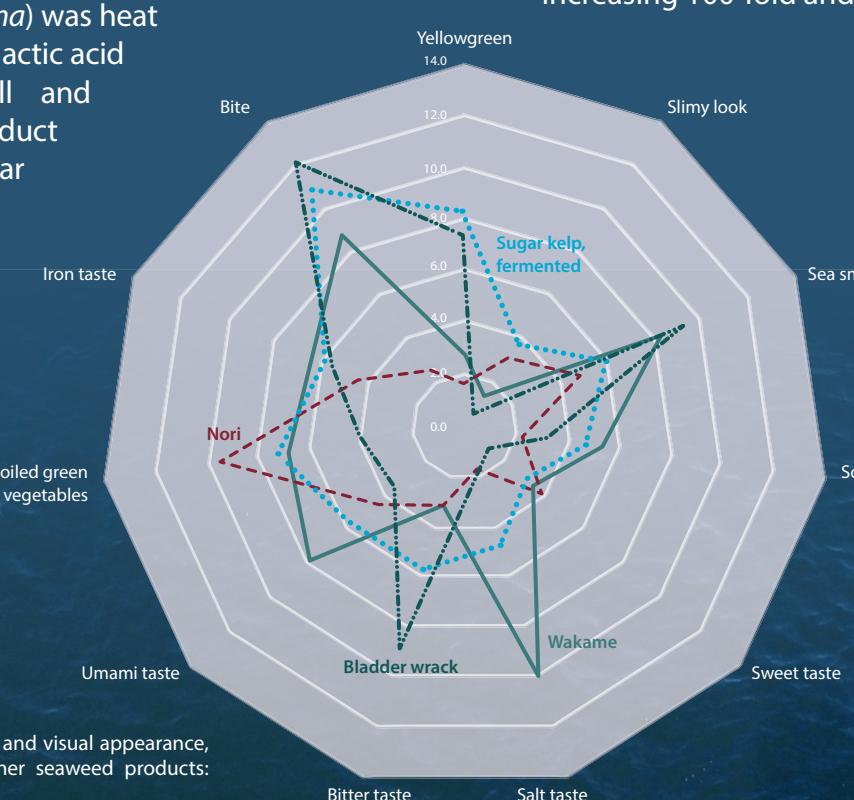


Figure 2. Evaluation of taste, smell, texture and visual appearance, comparing fermented sugar kelp and other seaweed products: wakame, nori and fresh bladderwrack.

## Conclusion

LAB fermentation of sugar kelp showed promising for broadened the food market for seaweeds as the fermented product had a milder taste, improved visual impression and smell, and a reduced content of harmful trace metals.

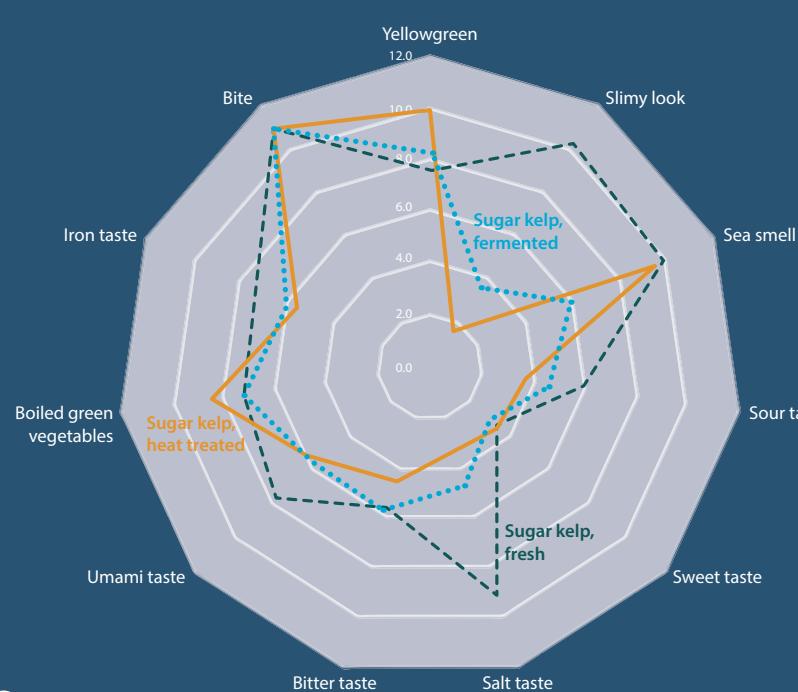


Figure 1. Development in taste, scent, texture and visual appearance of sugar kelp during processing steps from fresh sugar kelp over heat treatment to fermented sugar kelp.

## Results

- Heat treatment and fermentation caused a reduced saltiness and umami flavour of the sugar kelp, a less slimy visual appearance and a reduced smell of sea, whereas the texture and protein content was unchanged compared to the fresh sugar kelp.
- The fermented sugar kelp had a stronger bite than nori and wakame, a stronger smell of sea and a more salty, iron and umami rich taste than nori, but less umami and salt taste than wakame.
- Fermentation caused no change in protein content, but significantly reduced the contents of cadmium (-36%), mercury (-35%), sodium (-15%) and magnesium (-21%) in the sugar kelp (Table 1).
- In the fermentation process, the pH was reduced to 4.5 within 40 hours, with LAB counts increasing 100-fold and no *Bacillus cereus* present.

Table 1. Concentrations of minerals and metals in the fresh and fermented sugar kelp. Data are given as average ± standard error (n = 3).

Mineral/metal	Fresh	Fermented	Unit
<b>Essential macro- and trace minerals</b>			
Iron (Fe)	292.71±17.00	291.96±18.69	µg g <sup>-1</sup> DM
Iodine (I)	2.63±1.61	0.92±0.32	mg g <sup>-1</sup> DM
Potassium (K)	69.88±3.25	59.62±0.90	mg g <sup>-1</sup> DM
Magnesium (Mg)	6.39±0.08 <sup>a</sup>	5.05±0.12 <sup>b</sup>	mg g <sup>-1</sup> DM
Nitrogen (N)	3.57±0.26	3.03±0.08	% of DM
Sodium (Na)	22.97±0.71 <sup>a</sup>	19.51±0.74 <sup>b</sup>	mg g <sup>-1</sup> DM
Selenium (Se)	0.12±0.02	0.11±0.02	µg g <sup>-1</sup> DM
Zink (Zn)	58.30±8.02	73.64±4.13	µg g <sup>-1</sup> DM
Na:K (molar ratio)	0.55±0.01	0.56±0.01	No unit
<b>Harmful metals</b>			
Arsenic (total) (As)	39.059±1.037	36.750±0.73	µg g <sup>-1</sup> DM
Cadmium (Cd)	3.03±0.08 <sup>a</sup>	1.96±0.04 <sup>b</sup>	µg g <sup>-1</sup> DM
Mercury (Hg)	0.023±0.001 <sup>a</sup>	0.015±0.002 <sup>b</sup>	µg g <sup>-1</sup> DM
Lead (Pb)	0.82±0.12	0.91±0.04	µg g <sup>-1</sup> DM

Significant differences in mineral concentration between the three products are indicated by letters (a,b) (p < 0.05).



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