

Effect of pretreatments on quality parameters and nutritional compounds of dried Galega kale (*Brassica Oleracea* L. var. *Acephala*)

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Introduction

Galega kale (*Brassica Oleracea* L. var. *Acephala*) is a quite common vegetable in several countries, mainly used in soups.

Beneficial properties in *Brassica* vegetables have been attributed to the presence of bioactive compounds as phenolic compounds, ascorbic acid and other antioxidants.

Drying has been practiced to increase the shelf-life of easily perishable products; however, the use of high drying temperatures can cause colour deterioration, and compromise flavour, texture, functionality and nutritional contents.

Pretreatment with steam or water blanching, isolated or combined with chemical treatments, may be strategies to improve nutritional attributes and sensory properties, after drying and during long-term storage.

The main objective of this work was to evaluate the effects of different pretreatments on quality parameters and nutritional compounds of dried Galega kale.

Methods

Pretreatments application:

- To) No treatment; WB) water blanching at 98 °C, 1 min; BC WB) sodium bicarbonate, 1 min + water at 98 °C, 1 min; MS WB) sodium metabisulfite, 1 min + water at 98 °C, 1 min; SB) steam blanching at 101.325 Pa, 1 min; BC SB) sodium bicarbonate, 1 min + water steam at 101.325 Pa, 1 min; MS SB) sodium metabisulfite, 1 min + water steam at 101.325 Pa, 1 min.

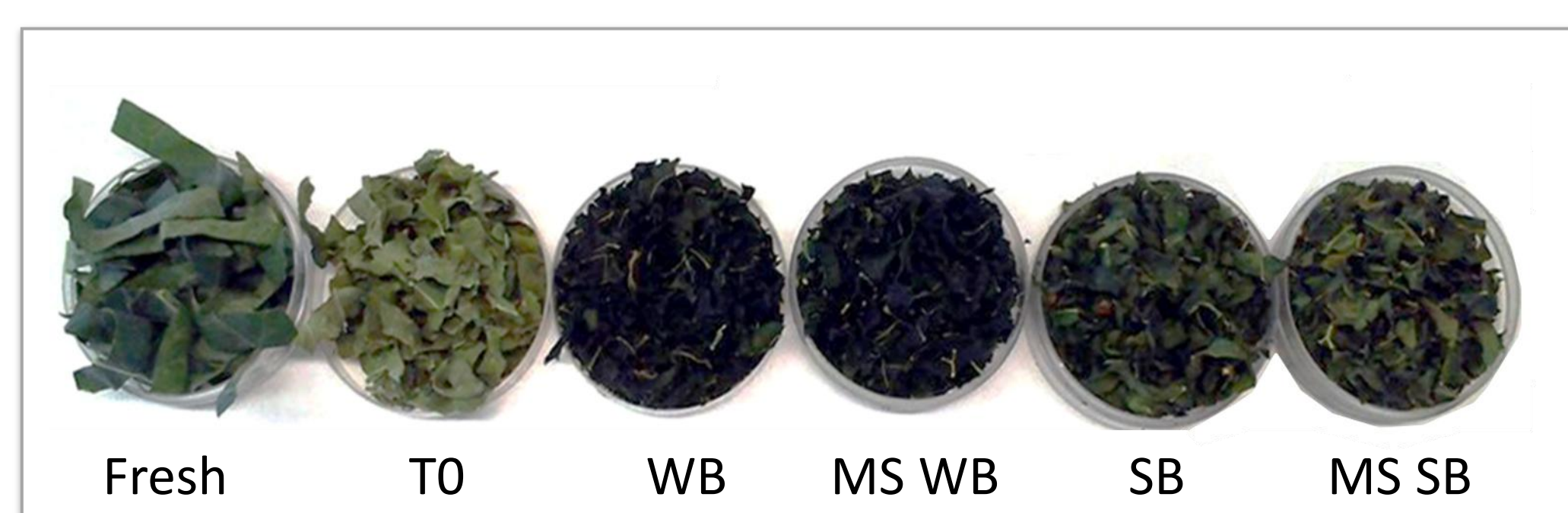
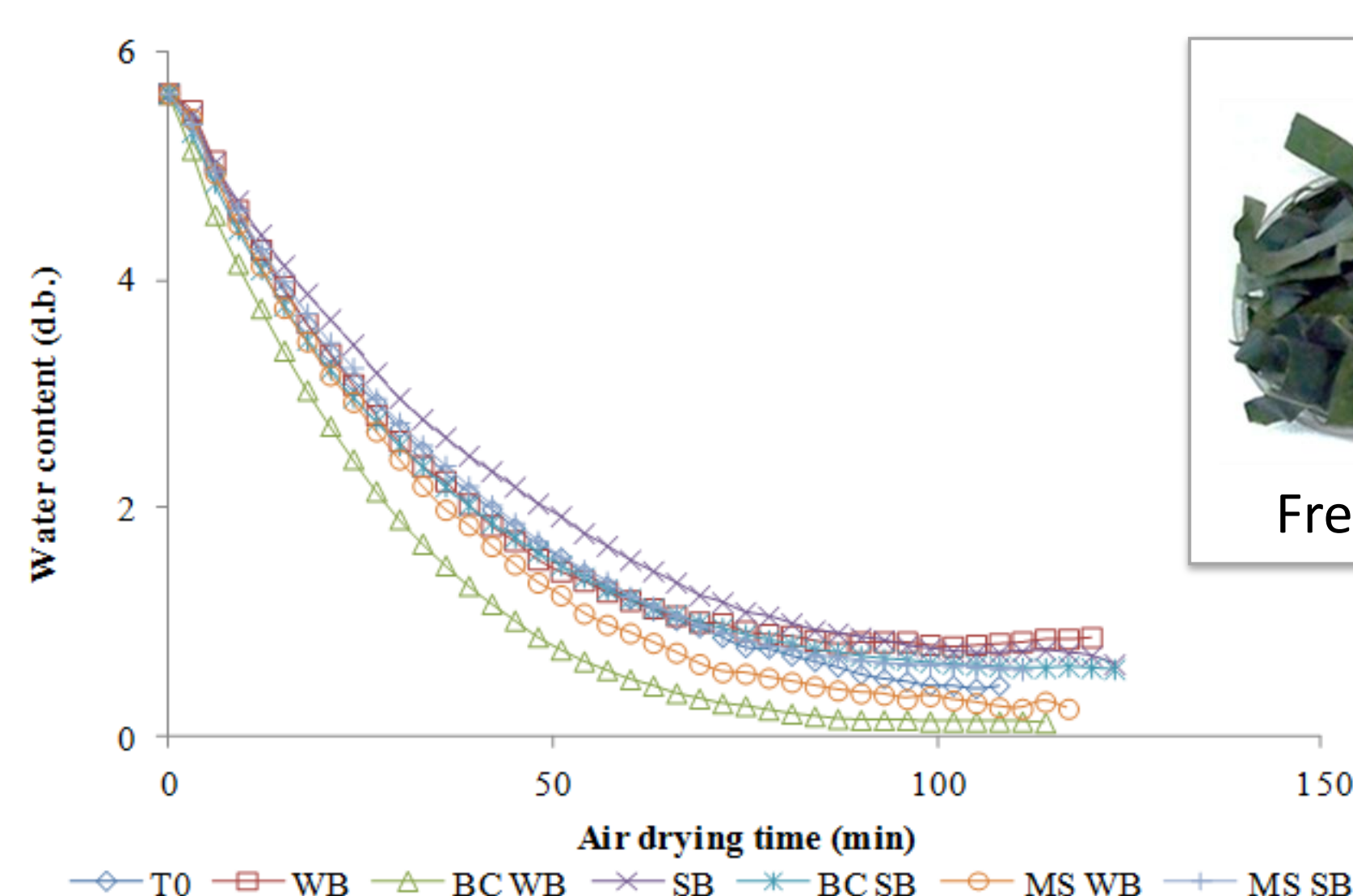
Drying experiments at 55 °C and air velocity of 1.20 ± 0.09 m/s.

Quality parameters

- Water activity: water activity meter
- Color properties: colorimeter
- Chlorophylls: absorbance reading at 665.2 and 652.4 nm
- Vitamin C: HPLC analysis, reverse phase C18-silica analytical column
- Total phenolic compounds: Folin-Ciocalteu method
- Total antioxidant capacity (TAOC): direct production of ABTS chromophore

Results and Discussion

Air-drying curves

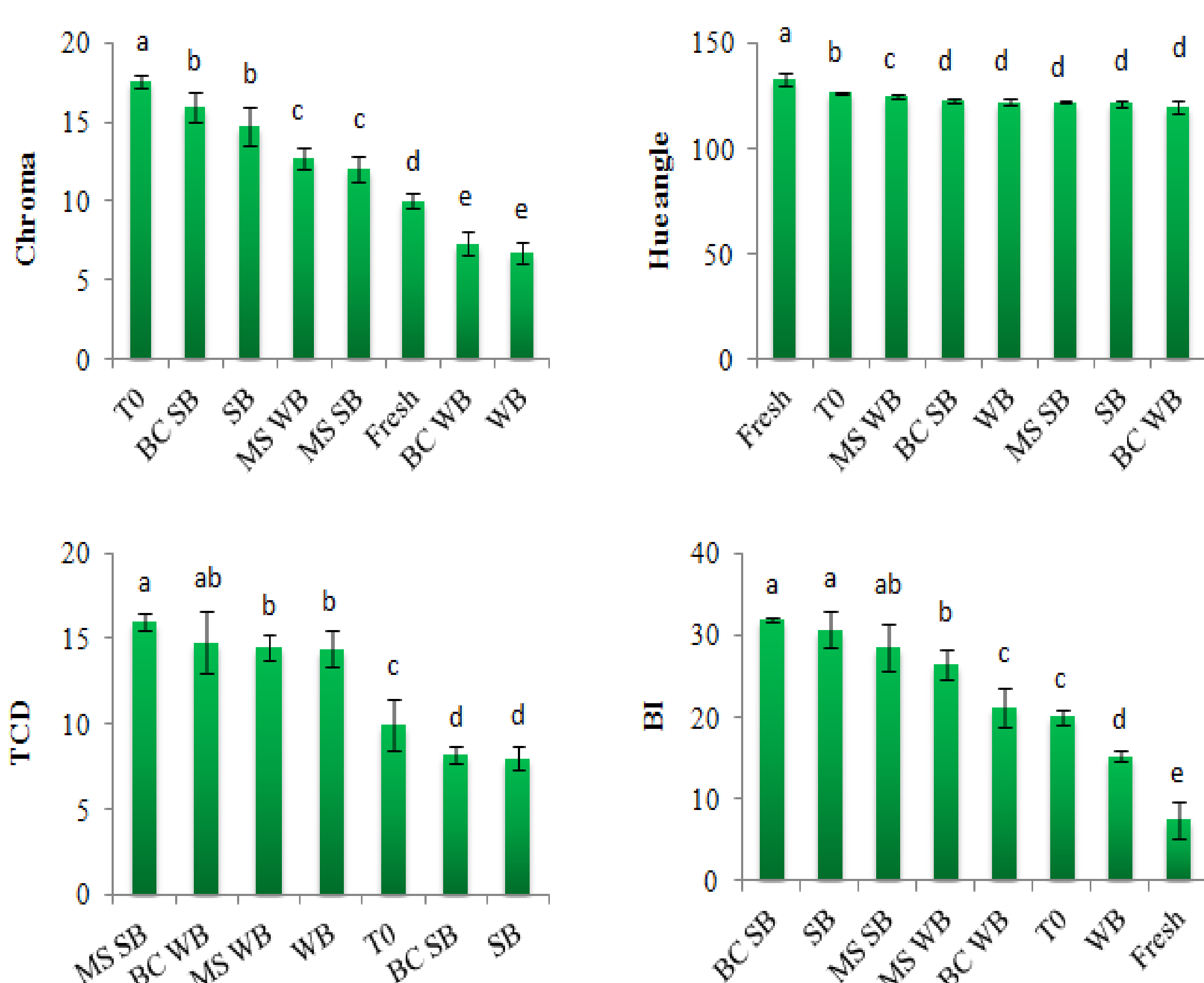


Final water content, water activity, drying rate and air relative humidity

Pretreatment	Final water content (d.b.)	Water activity (a _w)*	Drying rate (kg H ₂ O kg ⁻¹ dry matter min ⁻¹)	Air relative humidity (%)
TO	0.431 ± 0.003	0.333 ± 0.002 ^a	0.14	19.9 ± 2.9
WB	0.468 ± 0.006	0.295 ± 0.002 ^b	0.15	18.9 ± 0.9
BC WB	0.241 ± 0.001	0.298 ± 0.001 ^b	0.19	19.3 ± 1.3
MS WB	0.331 ± 0.005	0.312 ± 0.001 ^c	0.16	19.5 ± 1.6
SB	0.230 ± 0.002	0.314 ± 0.003 ^c	0.14	19.4 ± 0.3
BC SB	0.262 ± 0.002	0.312 ± 0.005 ^c	0.15	22.0 ± 1.2
MS SB	0.530 ± 0.003	0.310 ± 0.02 ^c	0.14	21.8 ± 2.2

* Values with the same letter were not significantly different (p>0.05).

Colour properties

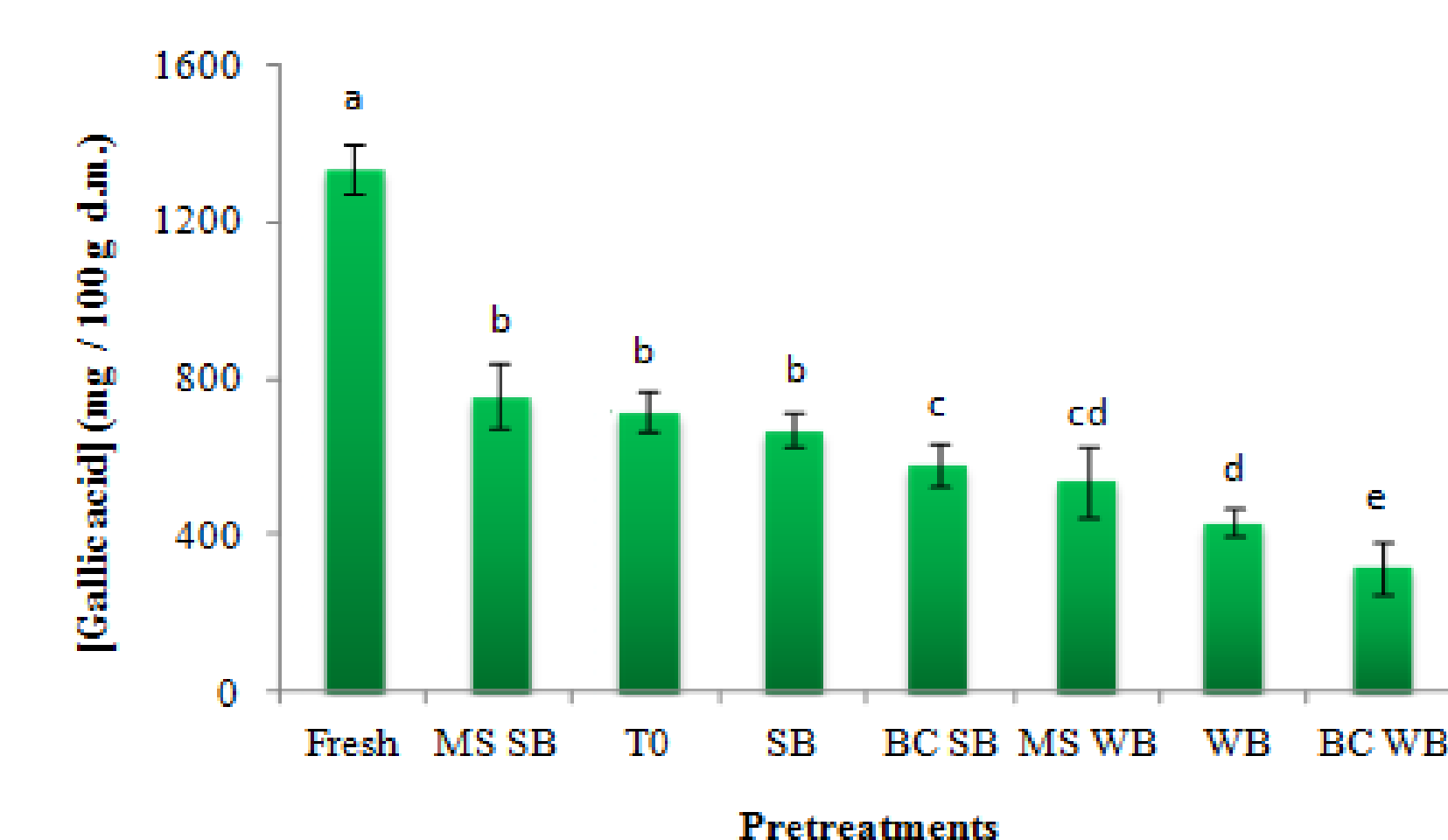


Vitamin C

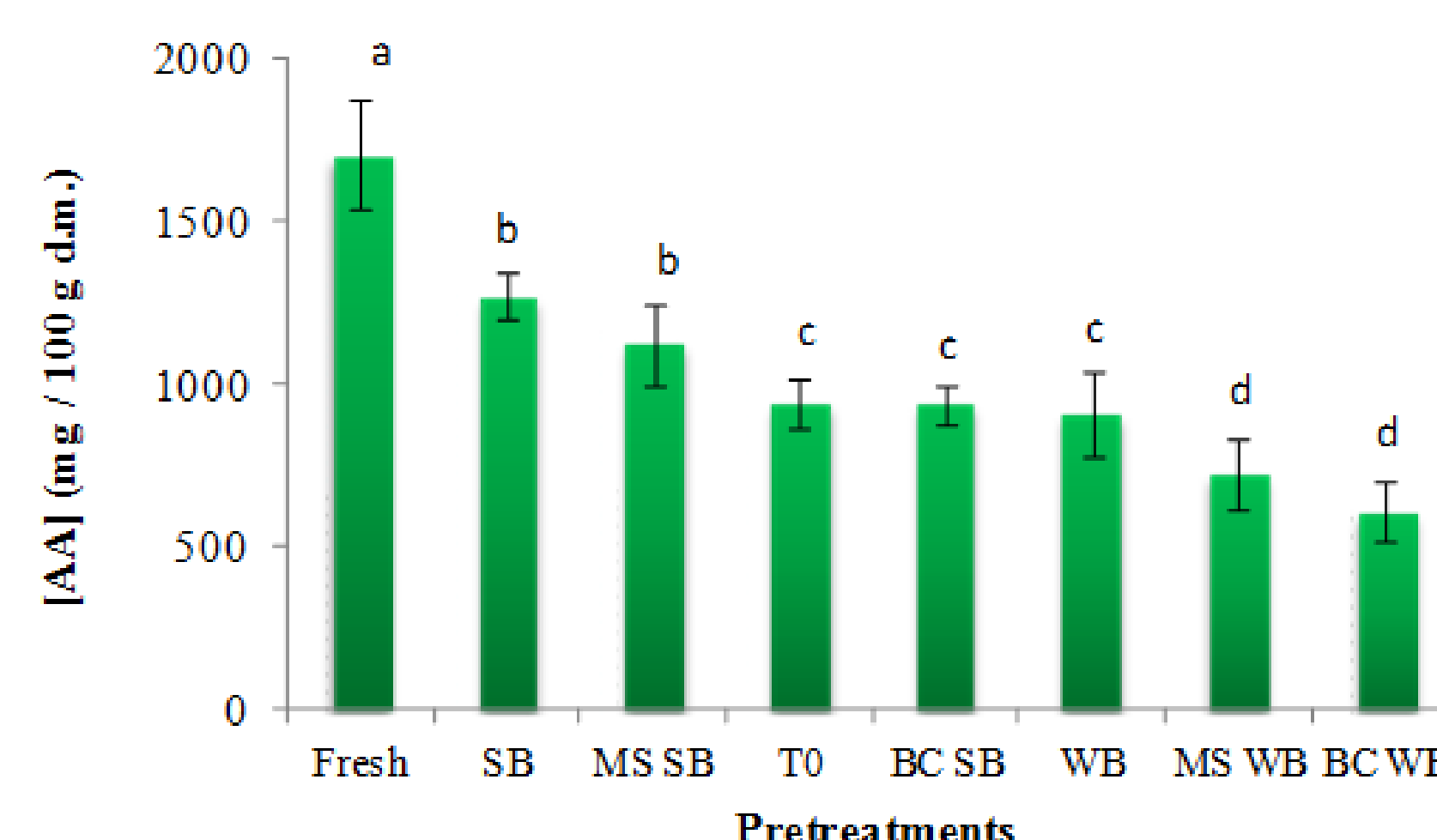
Pretreatment	[AA] (mg/100 g d.m.)	Retention (%)	[DAA] (mg/100 g d.m.)	Retention (%)	[Vitamin C] (mg/100 g d. m.)	Retention (%)
Fresh	960.0 ± 181.1 ^a	-	831.3 ± 59.0 ^a	-	1791.2 ± 127.8 ^a	-
TO	827.6 ± 65.8 ^a	86.2 ± 4.3	297.9 ± 46.9 ^b	35.8 ± 3.5	1125.5 ± 67.0 ^b	62.8 ± 2.4
WB	230.2 ± 150.4 ^c	24.0 ± 13.8	377.7 ± 247.0 ^{cd}	45.4 ± 24.7	607.9 ± 297.4 ^c	33.9 ± 18.8
BC WB	770.5 ± 115.8 ^{ab}	80.3 ± 7.6	213.8 ± 41.0 ^d	25.7 ± 3.1	984.3 ± 139.1 ^{bc}	55.0 ± 4.9
MS WB	375.8 ± 275.8 ^{bc}	39.1 ± 29.0	232.1 ± 182.1 ^{cd}	27.9 ± 17.7	732.87 ± 235.3 ^c	40.9 ± 15.4
SB	817.7 ± 205.5 ^{ab}	85.2 ± 13.5	438.5 ± 78.7 ^b	52.7 ± 5.9	1256.1 ± 280.4 ^b	70.1 ± 9.8
BC SB	347.2 ± 184.8 ^{bc}	36.2 ± 7.2	250.6 ± 124.4 ^d	30.2 ± 5.0	597.8 ± 307.4 ^c	33.4 ± 6.0
MS SB	629.2 ± 117.5 ^{ab}	65.5 ± 4.9	332.9 ± 165.7 ^{cd}	40.1 ± 8.0	1109.0 ± 72.4 ^b	61.9 ± 1.6

Values with the same letter were not significantly different (p>0.05). AA: ascorbic acid; DAA: dehydroascorbic acid; Vitamin C = AA + DAA.

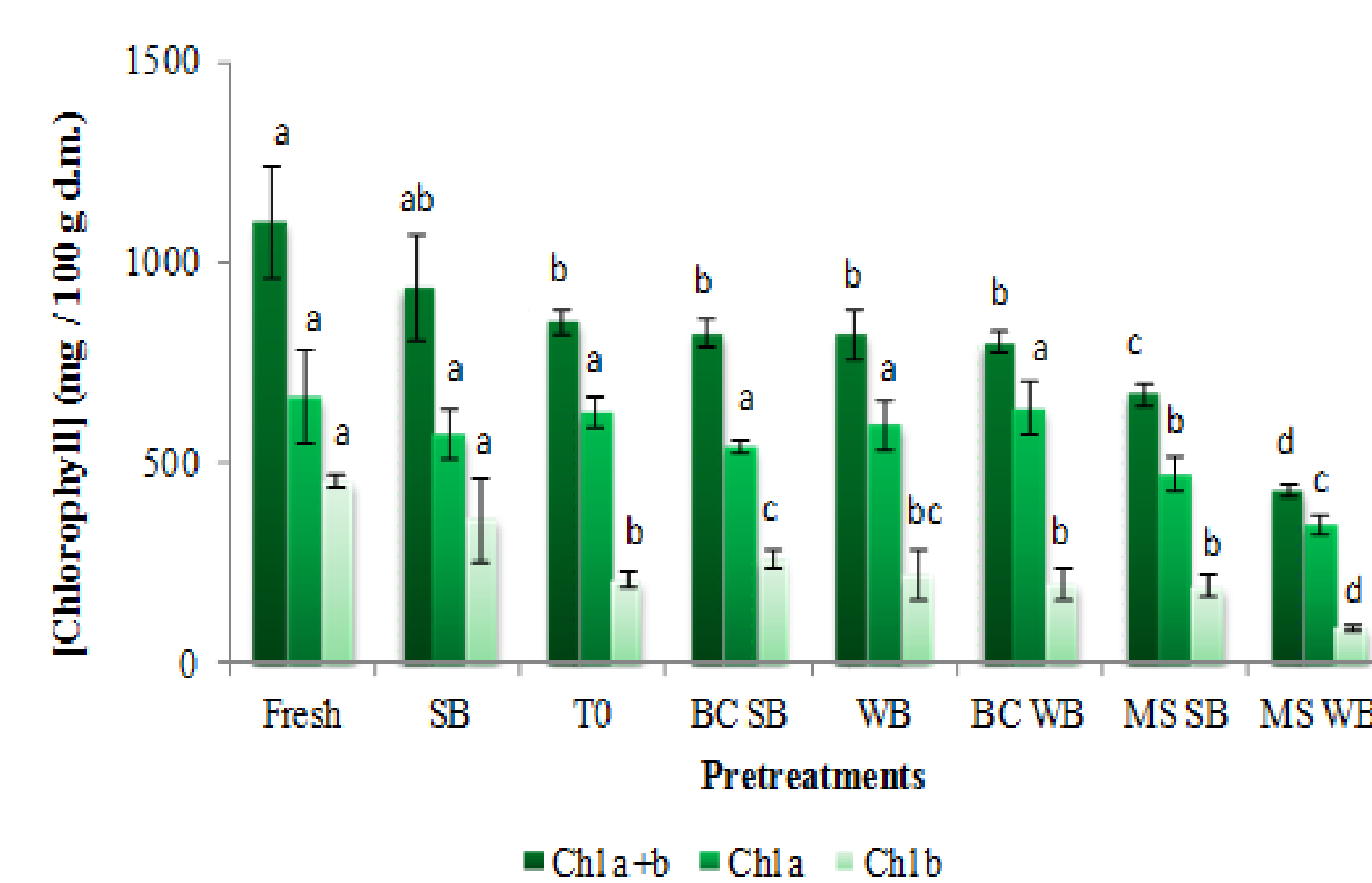
Total phenolic content



Total antioxidant activity



Chlorophylls



Conclusions

- Some pretreatments presented relevant benefits concerning the nutritional value of Galega kale and colour properties.
- Steam blanching for 1 min:
 - valuable approach to reduce deterioration of the majority of the parameters in study: vitamin C (7.3%), antioxidant activity (13.6%) and total chlorophylls (5%).
 - improved significantly the appearance of Galega kale after the drying process, reducing the TCD and browning index.
- Steam blanching combined with previous metabisulfite treatment provided chroma values similar to the fresh sample and improved the total phenolic compounds (results similar to the values achieved with steam blanching).

Acknowledgements

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