

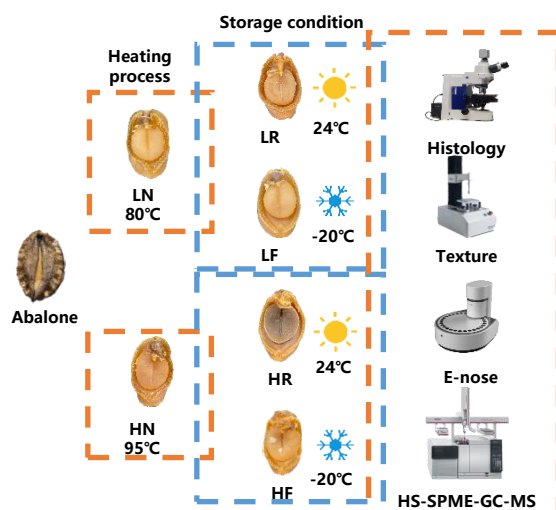
Effects of thermal processing and storage on physicochemical properties and volatile flavor compounds of dried abalone (*Haliotis discus hannai* ♀ × *H. fulgens* ♂)

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China is the largest producer and consumer of abalone in the world, with the emergence of large-sized hybrid abalone (*Haliotis discus hannai* ♀ × *H. fulgens* ♂), more and more attention has been paid to the process of dried abalone. However, there is still a lack of research on dried abalone from this species. This study investigates the effects of different heating temperatures (80°C and 95°C) and storage conditions (room temperature, frozen storage, and no-storage) on the physicochemical properties and volatile flavor compounds of dried abalones. The analysis includes proximate composition, amino acids, fatty acids, histology, texture, electronic nose (E-nose) technology and HS-SPME-GC-MS. This study provides a detailed and comprehensive analysis of the physicochemical and flavor characteristics of dried abalone (*H. discus hannai* ♀ × *H. fulgens* ♂), and provides valuable insights into process technology for dried abalone and offers a scientific basis for the advancement of the dried abalone industry.

Proximate composition contents

Table 1 Proximate composition and multi factor variance analysis

Components	LN	LR	LF	HN	HR	HF	P values		
							A	B	A×B
Moisture %	22.17±0.25 ^c	20.07±0.58 ^{ab}	20.07±0.91 ^{ab}	21.57±0.44 ^{bc}	19.17±1.21 ^a	19.97±0.64 ^a	0.068	0.000	0.922
Ash %	11.07±0.61 ^b	12.16±0.25 ^b	11.73±0.34 ^b	7.62±0.44 ^a	11.70±0.51 ^b	12.83±0.82 ^b	0.010	0.000	0.000
Protein %	47.44±0.48 ^a	50.95±0.25 ^b	52.82±0.39 ^c	53.14±0.31 ^c	53.68±0.57 ^c	50.75±0.28 ^b	0.000	0.000	0.000
Lipid %	1.01±0.09 ^{ab}	1.26±0.40 ^b	0.66±0.20 ^a	1.86±0.05 ^d	1.80±0.06 ^d	1.56±0.05 ^c	0.000	0.009	0.203
Carbohydrate mg/g	91.56±2.12 ^c	76.63±1.03 ^b	77.24±3.85 ^b	76.65±1.25 ^b	62.29±1.67 ^a	67.91±1.04 ^a	0.555	0.882	0.406
Collagen %	9.12±0.11 ^c	7.67±0.05 ^c	6.71±0.04 ^b	8.18±0.08 ^d	6.82±0.04 ^b	5.71±0.05 ^a	0.000	0.000	0.000
Cholesterol mmol/g	4.00±0.80 ^{ab}	8.86±0.72 ^c	3.26±0.67 ^a	5.55±0.57 ^b	4.15±0.21 ^{ab}	2.73±0.86 ^a	0.116	0.003	0.005

Histology and texture

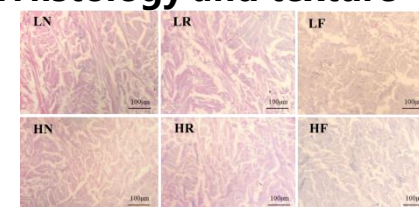


Fig.3. VG-stained tissue sections

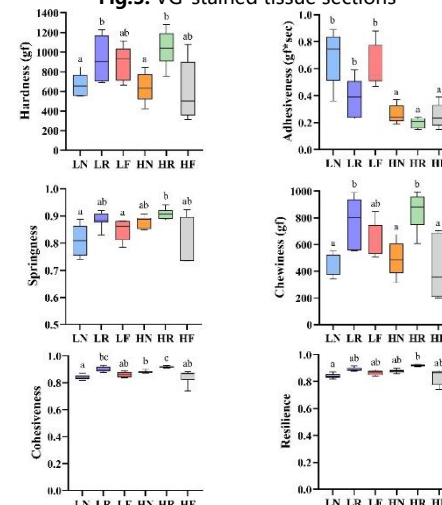


Fig.4. Comparison of textural properties

Amino acids and fatty acids levels

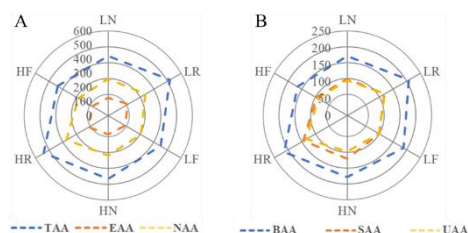


Fig.1. Radar diagram of amino acids

A: Total amino acids (TAA); Essential amino acids (EAA); Nonessential amino acids (NAA). B: Bitter amino acids (BAA); Sweet amino acids (SAA), Umami amino acids (UAA)

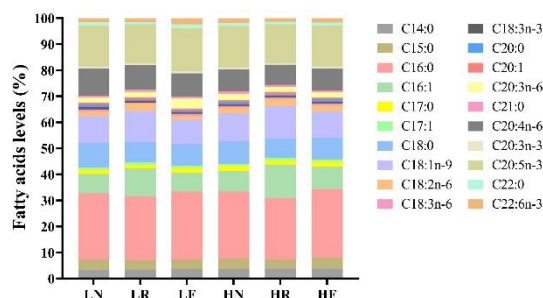


Fig.2. Stacking diagram of Fatty acids

E-nose and HS-SPME-GC-MS for flavor analysis

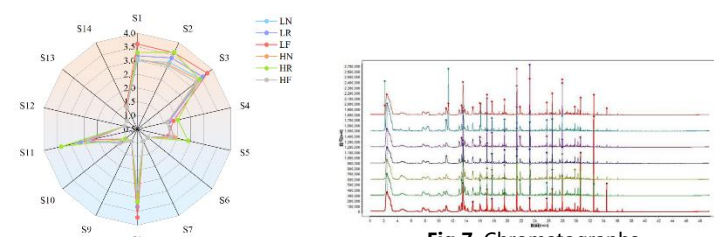


Fig.5. E-nose radar diagram

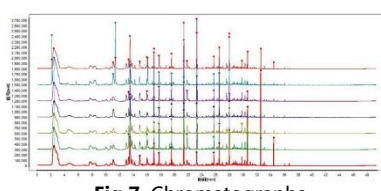


Fig.7. Chromatographs

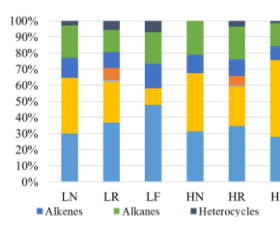


Fig.8. Stacking diagram of compounds

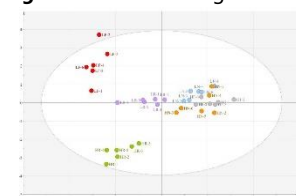


Fig.6. E-nose OPLS-DA analysis

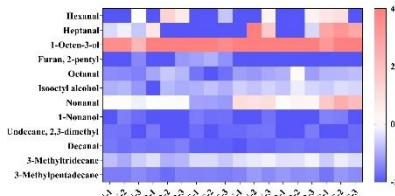


Fig.9. Heatmap of volatile compounds

- Heating and storage significantly influence the flavor performance.
- The levels of alcohols, aldehydes, and alkanes are higher than others.
- 1-octen-3-ol, octanal, and nonanal are the key volatile compounds.

Conclusion

The results indicate that heating temperatures and storage conditions significantly affect proximate composition contents. Heating at 95°C reduced collagen content. HR group has the highest sweet amino acids level. Room temperature storage can promote the transformation of SFA into MUFA. Frozen storage condition damaged the abalone muscle structure in histology. Higher heating temperatures can increase the hardness and chewiness but reduce the adhesiveness. E-nose analysis shows that there is a great difference between the flavor of the HR and LF groups. HS-SPME-GC-MS revealed that heating at 95°C increased the levels of aldehydes and esters compounds appear in room temperature storage condition. In summary, heating at 95°C and storing at room temperature are better processing conditions.