SEASONAL VARIATION OF LIPID CONTENT AND FATTY ACID COMPOSITION OF NOAH'S ARK (*ARCA NOAE*) FROM BIZERTE LAGOON (NORTHERN TUNISIA)

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Abstract

The aim of this work was to study the natural variations in lipid and fatty acid composition and their health-related lipid indices in the soft tissue of *Arca noae* seasonally sampled from Tunisian costs. The level of saturated fatty acid and unsaturated fatty acid showed significant variability during seasons. The polyunsaturated fatty acid, EPA (C20:5n-3) and DHA (C22:6n-3) were the most abundant (5.16-6.48 % and 8.12-11.50 %, respectively). Oleic acid (C18:1(n-9)) was the most abundant monounsaturated fatty acids (6.76-9.64%) and palmitic acid (C16:0) was the most abundant saturated acid (17.21-25.97 %). In comparison, with saturated fatty acids (SFA) and monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA) constituted the highest proportion in *A. noae*.

Keywords: Bivalves, North-Eastern Mediterranean, Lagoons

Introduction

Biochemical studies of bivalve tissue are of considerable interest to assess their nutritional value in terms of energy units. Lipids represent an important energy reserve because of their high caloric contents; they are mainly used in chronic stress conditions. Noah's Ark (*Arca noae*) is a commercially edible epifaunal bivalve mostly harvested and exploited in Croatia (Adriatic Sea). However, the commercial exploitation of this ark shell in Tunisia is not yet denoted and still limited to the unregulated catches. To the best of our knowledge, this is the first investigation on the lipid content and fatty acids profile of the Tunisian *A. noae.*

Materials and methods

Ten mature specimens of *Arca noae* (40 mm – 60 mm) were collected monthly from Bizerte lagoon at a depth of 3 meters by scuba diving between October 2013 and September 2014. Lipids were extracted according to the method of Folch [1]. Lipid extracts were trans-esterified according to the method of cecci [2]. The fatty acid methyl esters (FAMEs) were analyzed by capillary gas chromatography. The evolution of the reproductive activity of *Arca noae* was followed through Condition index (CI). Data was analyzed using STATISTICA 8 according to the One Way Analysis of Variance method (ANOVA).The method used to discriminate between the means was Kruskal Wallis and the differences between samples were deemed to be significant at $p < 0.05$.

Results and discussions

Lipid content ranged between 2.98 and 7.14 %. Lower values of CI, were registered in summer and autumn 2014, probably correspond to the spawning period. During this season, high lipid levels in *A. noae* were noted, this indicates that lipids can play a role in the maturation of gametes; they increase during summer in sexually ripe animals and decrease in autumn and winter. Fatty acid composition of the soft tissue of *Arca noae* is shown in Table 1. The palmitic C16:0, oleic C18:1 (n-9) and palmitoleic C16:1 (n-7) acids dominated among the saturated (SFAs) and monounsaturated fatty acids (MUFAs), respectively, while among the polyunsaturated fatty acids (PUFAs), docosahexaenoic acid (DHA, C22:6n-3) and eicosapentaenoic acid (EPA, C20:5n-3) prevailed. These findings were in agreement with those reported by Radic et al. 2014 [3]. SFA and MUFA variations were similar during this study but inverse to that of PUFA. Results in Table 1 clearly showed that *A. noae* soft tissue were rich in (n-3) than (n-6) PUFA, nutritionally essential for growth and condition. The low values of AI (Index of Atherogenicity) and the very low TI (Index of Thrombogenicity) reveal a very interesting nutritional quality of this bivalve (Table 1). The fatty acid composition of *Arca noae* corresponds in general to a healthy marine mollusks pattern characterized by a high degree of unsaturation, being similar to those of other adult marine bivalves [3].

Tab. 1. Seasonal variation of Fatty acid composition (% of total fatty acids) in the soft tissue of A. noae. Results are given as mean ± SD (n=6).

I	Autumn 13	Winter 14	Spring 14	Summer 14	Autumn 14
C14:0	4.94±0.54	4.39±1.20	5.63±0.81	7.62±1.01	5.68±1.33
C15:0	1.03±1.03	0.66±0.42	0.63±0.35	0.86±0.08	0.45±0.40
C16:0	22.14±4.70	17.21±4.23	20.64±4.65	25.97±1.45	21.06±2.13
C18:0	6.35±0.16	4.87±0.88	5.10±0.19	5.68±0.05	6.36±1.07
C20:0	0.65±0.89	0.69±0.72	0.09±0.05	0.10±0.02	0.16±0.05
C22:0	0.26±0.04	0.38±0.19	0.70±0.36	0.63±0.30	0.63±0.57
C24:0	0.61±0.49	0.67±0.17	0.62±0.49	0.36±0.10	0.25±0.19
Σ SFA	**36.00±1.51**	**31.58±2.93**	**33.45±3.53**	**40.80±2.27**	**34.62±2.05**
C14:1	0.97±0.92	0.73±0.53	0.89±0.21	0.41±0.21	0.63±0.60
C15:1	0.77±0.48	0.70±0.11	0.54±0.17	0.64±0.12	0.50±0.30
C16:1n-7	7.20±0.19	6.11±1.89	5.61±1.57	7.51±1.63	6.74±1.65
C18:1n-9/n-7	7.99±4.42	6.76±1.34	7.81±1.30	9.64±0.21	8.09±1.77
C20:1n-9	4.58±0.94	4.49±1.69	2.32±0.12	3.22±0.70	5.20±0.85
C20:1n-7	2.92±2.58	3.15±1.96	3.15±2.16	1.76±0.81	1.47±0.63
C22:1n	0.35±0.36	0.32±0.26	0.21±0.09	0.13±0.06	0.17±0.11
C24:1n-9	0.27±0.12	0.38±0.14	0.47±0.36	0.21±0.09	0.18±
Σ MUFA	**25.08±1.22**	**25.48±2.88**	**21.04±0.46**	**24.00±3.10**	**23.01±2.45**
C16:2	2.19±0.49	1.93±0.68	1.56±0.24	1.74±0.19	1.72±0.16
C16:3	0.62±0.24	0.63±0.16	1.01±0.54	0.66±0.18	1.17±0.94
C16:4	0.33±0.04	0.65±0.57	1.28±0.86	0.95±0.27	1.14±0.65
C18:2n-6	2.96±1.17	2.64±0.81	3.06±0.53	3.00±0.18	2.20±1.73
C18:3n-6	0.33±0.14	0.34±0.10	0.51±0.42	0.86±0.27	2.22±3.54
C18:3n-3	2.31±0.54	2.47±0.93	3.18±0.68	2.87±0.62	1.60±0.34
C18:4n-3	3.41±4.33	3.93±2.89	1.45±0.78	1.03±0.77	1.23±1.13
C20:2n-6	0.83±0.48	0.61±0.14	0.77±0.28	0.56±0.27	0.42±0.18
C20:3n-6	0.15±0.04	0.10±0.01	0.06±0.01	0.05±0.01	0.11±0.02
C20:4n-6	2.88±0.37	2.68±0.77	2.50±0.51	1.84±0.48	4.34±1.10
C20:3n-3	0.52±0.52	0.49±0.49	0.14±0.00	0.09±0.04	0.07±0.02
C20:4n-3	0.32±0.07	0.25±0.04	0.26±0.02	0.25±0.09	0.25±0.03
C20:5n-3	6.46±0.23	5.48±1.39	6.48±1.24	5.16±0.95	5.78±0.76
C22:2i/2j	3.39±0.58	3.56±1.33	4.28±0.70	2.85±0.67	5.75±2.27
C21:5	0.81±0.05	0.82±0.26	1.68±0.77	1.00±0.05	1.25±0.21
C22:5n-6	1.29±0.34	1.34±0.44	3.23±1.49	2.03±0.36	2.20±1.01
C22:5n-3	1.49±0.40	1.39±0.28	2.48±0.81	1.67±0.20	1.89±0.46
C22:6n-3	8.51±2.61	8.12±2.75	11.50±0.81	8.50±0.75	9.86±1.66
Σ PUFA	**38.90±0.29**	**43.64±0.22**	**45.50±3.91**	**35.18±1.28**	**43.29±4.91**
Σ UFA	**63.99±1.51**	**69.13±3.11**	**66.54±3.53**	**59.19±2.27**	**66.30±3.18**
Σ n-3	**23.05±1.94**	**25.68±1.13**	**25.51±0.61**	**19.61±0.58**	**20.71±2.99**
Σ n-6	**8.47±0.82**	**9.16±0.71**	**10.15±1.34**	**8.35±0.37**	**11.52±2.46**
ω3/ω6	**2.74±0.47**	**2.85±0.31**	**2.63±0.21**	**2.38±0.08**	**1.87±0.45**
DHA/EPA	**1.32±0.36**	**1.53±0.20**	**1.69±0.74**	**1.72±0.46**	**1.72±0.35**
AI	**0.87±0.05**	**0.72±0.14**	**0.87±0.10**	**1.20±0.15**	**0.91±0.12**
TI	**0.39±0.06**	**0.30±0.04**	**0.34±0.05**	**0.51±0.027**	**0.41±0.05**

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