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Seasonal variation in the proxy-biochemical composition of the non-indigenous pearl oyster *Pinctada imbricata radiata* (Leach, 1814) from the Central West Aegean Sea, Greece

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ABSTRACT

The proximate biochemical composition of the flesh of the invasive pearl oyster *Pinctada imbricata radiata* (Leach, 1814) sampled (2019-2020) in CE Aegean Sea (Saronikos & Evoikos Gulf) ranged: 64.33% ± 3.04 for protein, 11.41% ± 1.43 for fat, 11.61% ± 3.87 for carbohydrate, 12.65% ± 2.97 for ash and 79.97% ± 3.56 for moisture. The results demonstrate the high nutritional value of the pearl oyster, supporting its suitability as potential seafood source for human consumption.

Keywords:pearl oyster, biochemical composition, Aegean Sea

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1. Introduction

The *Pinctada i. radiata* (Leach, 1814) (pearl oyster) is a benthic species that lives on sandy bottoms and coral reefs (Strack, 2008). It originates from the Indo-Pacific Ocean region and has been recorded in the Mediterranean as a non-endemic species since the 19th century (1874), immediately after the opening of the Suez Canal (Zenetos et al., 2005). Since then, the pearl oyster has spread and settled in areas of the Central-Eastern Mediterranean with a significant presence in Aegean Sea (Theodorou et al., 2019).

Several reports suggest that a seafood diet prevents chronic diseases such as heart disease (Harris & Von Schacky 2004). Bivalves are a source of high quality protein, vitamin, essential amino acid, mineral and low lipid in addition to beneficial ones such as polyunsaturated fatty acid PUFAs, which offer such benefits to the human body (Biandolino et al., 2020; Rittenschober et al., 2013; Anacleto et al., 2014). Protein deficiency worldwide will continue to increase sharply in the coming decades. For now, and in the near future, this deficiency can be partly overcome with effective use of protein-rich molluscs. Molluscs are the largest marine invertebrates and account for 12% of the world's total production. These include species such as gastropods, mussels, and oysters that are popular protein-rich foods and can be used by all cultures as an important part of their diet (Celik et al. 2014).

2. Material and Methods

To assess the nutritional value and seasonal variation of the chemical composition of pearl oyster flesh, 4 seasonal samplings were performed (Winter, Spring and Autumn 2019, as well as Summer 2020), in 2 areas: one high (Saronikos Gulf) and one low (Evoikos Gulf) productivity. Specifically, the sampling of the species took place in two coastal areas, in the Saronikos Gulf (sea area of Salamis, 37 59 '113' '/ 23 26' 059 ") and in the Northern Evoikos Gulf (north of Chalkida, 38 30 '783' '/ 23 32' 254 "). The locations of the sampling sites are presented in Figure 1. In the period February 2019 - July 2020, a total of 120 individuals of the species (30 individuals per sampling) were collected from the Saronikos Gulf in 4 samplings (11/2/2019, 1/4/2019, 21/10/2019, and 9/7/2020) and 120 individuals of the species (30 individuals per sampling) from the Evoikos Gulf in 4 sampling (12/2/2019, 2/4/2019, 22/10/2019 and 15/7/2020) (figure 1). The sampling was done by autonomous diving to a depth of 1-4 m and the collection by hand, while each sampling lasted 30 min (Moutopoulos et al., 2020).

The flesh from 30 pearl oysters from each study area was lyophilized and then homogenized to give 5 pooled samples in which protein was measured [Keldahl method (AOAC, 1997)], total fat by extraction (Vareltzis et al., 1997) and ash (from 0.1 g of sample at 550 ^{o}C for 24 hours). Water was measured from the flesh of all 30 oysters (one at a time) by weighing before and after lyophilization).The carbohydrate content (%dry weight) was calculated as:

Carbohydrate (%) =100 - [Lipid (%) + Protein(%) + Ash (%)+ Moisture(%)] (Alkuraieef et al., 2021).

From the results of the biochemical analysis of all samples in each sampling area, the mean value was obtained separately for each biochemical characteristic. The resulting values were used to create the graph in Figure 2.

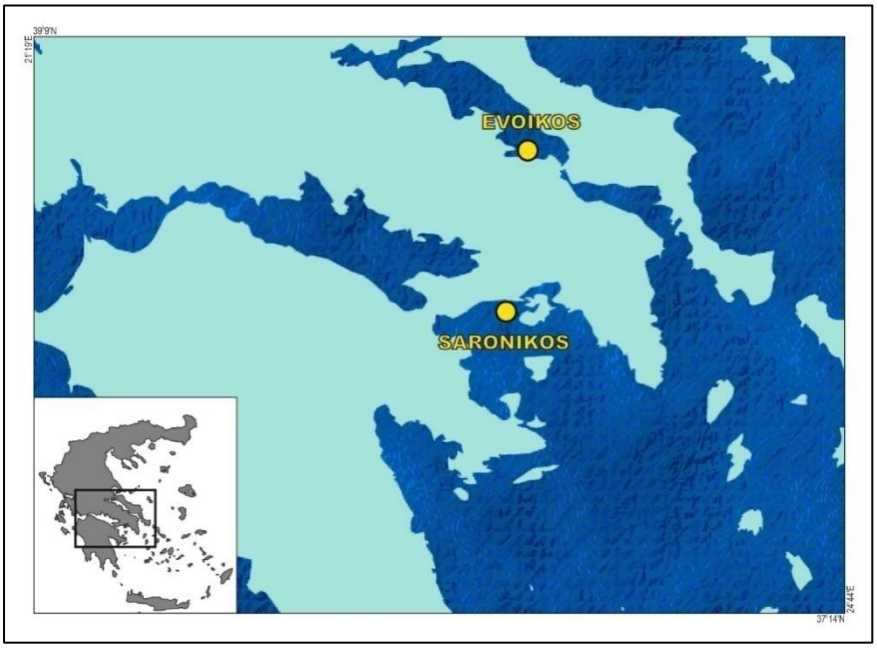

Figure 1. Map of study area. Sampling position Gulf of pearl oyster 37 59 '113' '/ 23 26' 059 " in the Saronikos Gulf and sampling position 38 30 '783' '/ 23 32' 254 " in the Evoikos Gulf.

3. Results

Figure 2 shows the seasonal variation of the proxy-biochemical composition of pearl oyster flesh. The total variation of biochemical composition of the flesh of pearl oysters in CE Greece was protein 64.33% ± 3.04, fat 11.41% ± 1.43, carbohydrate 11.61% ± 3.87, ash 12.65% ± 2.97 and moisture 79.97% ± 3.56.

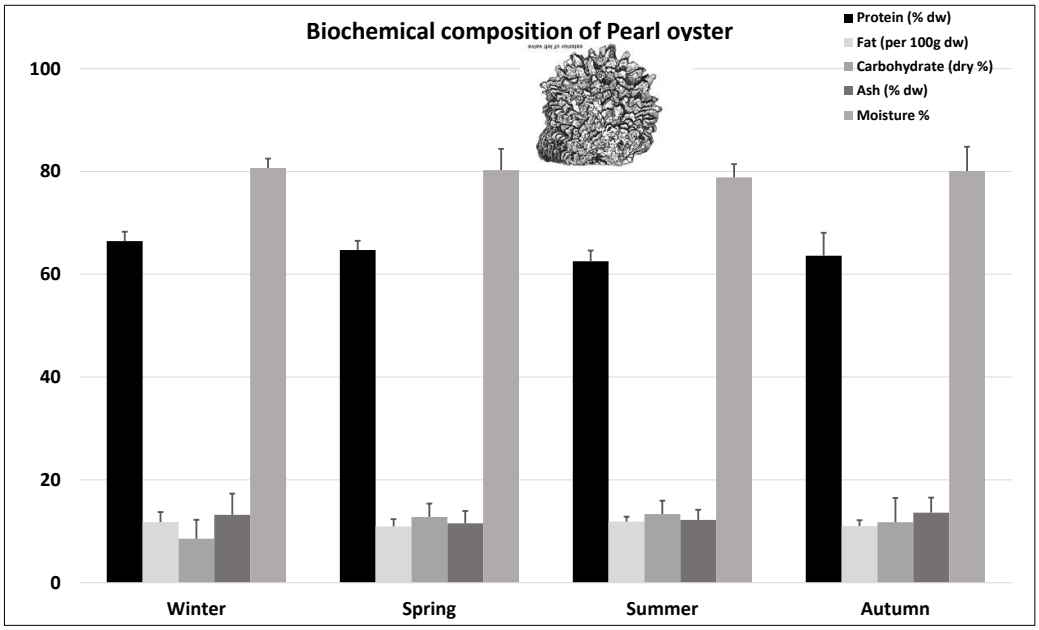

Figure 2. Graph from seasonal variation of the pearl oyster proxy-biochemical composition originated from CE Aegean Sea coast line.

Table 1. Comparison of the biochemical components of *Pinctada i. radiata* studied in the present work and 4 other bivalve molluscs of the eastern Mediterranean Sea and SW Black Sea.

No	Bivalve Species	Protein (%)	Fat (%)	Carbohydrate (%)	Ash (%)	Moisture (%)	Catch location	References
1	*Pinctada imbricata radiata*	64.33±3.04	11.41±1.43	11.61±3.87	12.65±2.97	79.97±3.56	CE Aegean Sea, Greece	Present study 2021
2	*Ostrea edulis*	48.11±3.04	8.01±0.65	29.16±4.62	13.92±1.89	82.25±2.66	Dardanelles & Marmara Sea, Turkey	Celik et al. 2014
3	*Mytilus gallopronviciallis*	54.03±2.82	10.52±1.22	22.84±4.33	12.61±2.54	82.45±1.70	Dardanelles & Marmara Sea, Turkey	Celik et al. 2014
4	*Ruditapes decussatus*	56.27±1.98	5.82±0.34	23.39±1.62	14.53±0.66	83.58±0.59	Dardanelles & Marmara Sea, Turkey	Celik et al. 2014
5	*Ruditapes philippinarium*	55.88±2.04	5.60±0.19	23.43±1.59	15.10±0.67	83.28±0.86	Dardanelles & Marmara Sea, Turkey	Celik et al. 2014

Table 1 compares the studied pearl oyster with 4 other species of bivalve molluscs and shows that the pearl oyster has a higher nutritional value since the composition of its flesh is rich mainly in protein and fat.

4. Discussion

Protein, fat, and carbohydrate are the basic building blocks of all living organisms. These molecules change in different organisms depending on their metabolism, give energy and synthesize basic products in them. Pearl oysters from CE Aegean Sea are rich in protein (64.33 ± 3.04%) and fat (11.41 ± 1.43%) with limited carbohydrates (11.61 ± 3.87%)comparing to that of the other native edible molluscs (flat oysters, Mediterranean mussels, clams) in the region. The pearl oyster protein content is maximum in the winter and minimum in the summer. The fat content is maximum during the winter and summer, while the ash shows the maximum values during the winter and autumn.

This superior nutritional profile, of the pearl oyster *Pinctada i. radiata*, is recommended for human consumption in E. Mediterranean.

Acknowledgements

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