

Abstract

Comparative Assessment of Nutritional Composition in European Anchovy and European Sardine [†]

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Abstract

Introduction: Fish consumption in Portugal (53.61 kg/year) and Spain (40.68 kg/year) remains the highest in the European Union, highlighting the nutritional and economic relevance of small pelagic species. However, fish composition is highly dynamic and influenced by biological and environmental factors, including reproductive cycle, seasonality, and feeding patterns. European anchovy (*Engraulis encrasicolus*, EE) and European sardine (*Sardina pilchardus*, SP) exhibit complementary spawning periods, summer and winter breeders, respectively, making them ideal models to study seasonal nutritional variability. A systematic evaluation of their proximate composition is essential not only for quality control but also to support sustainable fisheries management and nutritional recommendations. **Objective:** This study aimed to comparatively assess the seasonal variation in proximate composition of EE and SP fillets in early autumn and early spring, identifying species-specific nutritional advantages linked to their reproductive cycles. **Methodology:** Twelve composite samples (six per season) were analysed, each comprising multiple specimens of the same species (EE or SP). Standard proximate analyses were performed to determine moisture, ash, protein, and lipid content, and energy values were calculated. Statistical comparisons were conducted using SPSS (Version 21) to evaluate seasonal and interspecific differences. **Results:** Sardines showed higher ash, lipid, and energy values, whereas anchovies exhibited higher protein overall. Marked seasonal differences ($p < 0.05$) were observed: sardine (SP)—autumn: higher lipid (10.00 g/100 g) and energy (176.22 kcal/100 g); spring: higher protein (21.69 g/100 g) and ash (1.96 g/100 g); and anchovy (EE)—spring: higher protein (23.18 g/100 g), lipid (2.44 g/100 g), and energy (117.68 kcal/100 g). Notably, in early spring, anchovies surpassed sardines in protein, lipid, and energy content, highlighting a seasonal inversion of nutritional value between species. **Conclusions:** Results demonstrate a clear seasonal complementarity in the nutritional value of anchovies and sardines, directly linked to their reproductive cycles. Sardine reaches its peak nutritional quality in autumn, while anchovy becomes nutritionally superior in spring. The alternating pattern suggests that seasonally targeted consumption and fisheries management strategies could optimise both nutritional intake and resource sustainability. These findings provide a strong basis for developing evidence-based recommendations



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for consumers, industry, and policymakers. Future research should expand this approach by incorporating fatty acid profiles, micronutrients (vitamin D, selenium), and contaminants (e.g., mercury), enabling a more comprehensive evaluation of nutritional quality and food safety.

Keywords: proximate analysis; *Engraulis encrasicolus*; *Sardina pilchardus*; small pelagic fish; seasonality

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