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Portuguese consumers' attitudes and perceptions of bivalve molluscs

Patrícia Anacleto [a,b,*], Sara Barrento [c], Maria Leonor Nunes [a,d], Rui Rosa [b], António Marques [a,d]

[a] Division of Aquaculture and Upgrading (DivAV), Portuguese Institute for the Sea and Atmosphere (IPMA, I.P.), Avenida de Brasília, 1449-006 Lisbon, Portugal
[b] Guia Marine Laboratory, Center of Oceanography, Faculty of Sciences, University of Lisbon (FCUL), Campo Grande, 1749-016 Lisbon, Portugal
[c] Centre for Sustainable Aquaculture Research, Department of Biosciences, College of Science, Swansea University, Singleton Park, Swansea SA2 8PP, UK
[d] Interdisciplinary Centre of Marine and Environmental Research (CIIMAR), University of Porto, Rua das Bragas, 289, 4050-123 Porto, Portugal

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ABSTRACT

Bivalves have been promoted as healthy food in many countries. Yet, little information is available about bivalve consumers' purchasing behaviour and attitudes. The aim of this study was to investigate the marketing and quality aspects of several bivalve species with economical value in Portugal and to examine the relationship between each respondent's demographic and socio-economic status with bivalve consumption attitudes and preferences. A randomly selected sample of 1778 people answered a web-based questionnaire. The majority of respondents claimed to consume clams (pullet carpet shell clam and Japanese carpet shell clam) and usually prefer bivalves from national production. Smell, size and cleaned shells were considered as the most important criteria when choosing live bivalves. Most consumers buy clams in supermarkets and revealed good knowledge about the risks associated with its consumption. Trust in the selling establishment and product's label information was the main perceived quality criteria associated to bivalve purchasing. Nonetheless, consumers' attitudes and preferences differed considerably according to their demographic and socio-economic characteristics. The current findings provide a useful tool for producers and stakeholders involved in the trade chain of bivalves to understand the consumption profile and the most important quality criteria involved in bivalve purchase. Additionally, it is an important tool to predict the risks of bivalve consumption as well as to understand the different scenarios of contamination occurring in harvesting areas by national competent authorities.

1. Introduction

Global bivalve production from aquaculture has consistently increased over the years from 7.1 million mt in 1995 to 14.2 million mt in 2010, and the consumer demand is expected to further increase in the future (FAO, 2012). In Portugal, molluscs represent the most important farmed seafood group, representing 48% of total aquaculture production, mainly composed by clams (61%), oysters (25%) and mussels (8%; INE/DGPA, 2010), thus, playing an important role in sustainable seafood production. Portugal has the highest annual seafood per capita consumption in the European Union (54.2 kg/capita in 2009), with bivalves having a special place in consumers preferences (2.5 kg/capita in 2009; INE/DGPA, 2010). The current availability of bivalves in Portugal is insufficient to cope with consumers demand, thus requiring the import of several species (e.g. mussels, oysters). Bivalve prices vary greatly according to season (usually higher in summer), region (higher prices inland), species and consumer demand. Generally, retail prices in early summer (corresponding to a peak of consumption) are: mussels (small: 2.50 €/kg and big: 4.00 €/kg), oysters (4.00 €/kg), Japanese carpet shell clam (7.00 €/kg), pullet carpet shell clam (12.00 €/kg) and grooved carpet shell clam (14.00 €/kg).

Bivalve meat have been recommended in several dietary regimes for their high protein content, low calorific values, low fat/cholesterol profile and lower proportions of saturated fat, the presence of good lipids, significant amounts of omega-3-fatty acids, dietary essential amino acids, vitamin B_{12} and several important minerals such as iron, zinc and copper (Dong, 2001; Krzynowek, Krzynowek, D'Entremont, & Murphy, 1989). Within bivalves, clams are the most important species consumed in Portugal, particularly pullet carpet shell clam (*Venerupis pullastra*) and Japanese carpet shell clam (*Ruditapes philippinarum*), representing 56% of all bivalves (INE/DGPA, 2010). Bivalves species are

* Corresponding author. Portuguese Institute for the Sea and Atmosphere (IPMA, I.P.), Avenida de Brasília, 1449–006 Lisbon, Portugal. Tel.: +351 213 027 025; fax: +351 21 3015948.
E-mail address: panacleto@ipma.pt (A. Marques).

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preferably consumed live/raw (e.g. oysters) or lightly cooked (e.g. clams and mussels). This culinary tradition makes consumers more exigent about bivalve quality, but also increases the risk for human health as bivalves can concentrate pathogenic micro-organisms, such as bacteria, human viruses, toxins from harmful algal blooms, and chemical contaminants from the water column since they have a filter-feeding activity (Lee, Lovatelli, & Ababouch, 2008; Rippey, 1994). On the other hand, the harvesting of bivalve molluscs usually occurs in inshore estuaries subjected to strong anthropogenic pressures which are constantly changing due to climatic variability causing impacts such as increase of biological contaminants in the marine environment (e.g., toxins produced by harmful algal blooms (HABs)) and increase of populations of pathogenic microorganisms (e.g., *Vibrio* spp. frequently detected when seawater temperature increases) (Marques, Nunes, Moore, & Strom, 2010). These factors will affect water quality and consequently the quality and risks of consumption of bivalves' species. With a view to protect public health and to provide safe products of high quality to consumers, several regulations have been imposed by the European Commission on shellfish production and trade chain in member states (Lee et al., 2008). These European regulations (EC Regulations 854/2004, EC, 2004; 1441/2007, EC, 2007) establish limits for indicator microorganisms (less than 300 faecal coliforms or less than 230 *Escherichia coli* per 100 g of flesh and inter-valve liquid) and pathogens (absence of *Salmonella* spp. in 25 g of flesh) for a production area of bivalves suitable for direct human consumption (EU class A). However, no limits have been established for other microorganisms such as *Vibrio* spp. (EC, 2001). Other problems were reported in the last years by the Portuguese authorities: several tonnes per month of bivalves unfit for human consumption or harvested in illegal areas to be traded without any sanitary control such as depuration process (Público, 2012). Shellfish-illnesses caused by food contaminated with potentially pathogenic bacteria still occur (4.2% in 2011, RASFF, 2012). Despite these problems, the demand for live bivalves in Portugal is high and, therefore, it is fundamental to comprehend consumers' behaviour to predict the risks of bivalve consumption and adapt the legislation according to the findings.

Consumer surveys are an excellent tool to assess this type of information, since they are a crucial building block in a modern information-based society (Groves et al., 2004). Much research has been devoted to seafood markets and consumption in several European countries, namely fish in Belgium (Verbeke & Vackier, 2005), fish in Denmark (Rortveit & Olsen, 2007), shellfish in Greece (Batzios et al., 2004; Batzios, Angelidis, Moutopoulos, Anastasiadou, & Chrisopolitou, 2003), oysters and mussels (Charles & Paquotte, 1998), seafood in France (Girard, Mariojouls, Paquotte, & Wisner-Bourgeois, 1998), fish in Norway (Rortveit & Olsen, 2009; Trondsen, Braaten, Lund, & Eggen, 2004), seafood in Spain (Manrique & Jensen, 2001) and in Portugal (Cardoso, Lourenço, Costa, Gonçalves, & Nunes, 2013). Several theories and conceptual frameworks can be used to determine consumer's behaviour (e.g. Berg, 2003) The studies focused in shellfish have employed sociological approaches, as they have shown that consumers' behaviour and attitudes vary considerably according to their demographic and socio-economic characteristics. Particularly, French buyers of oysters and mussels have shown different choices according to the location of supermarkets. Yet, there is no such knowledge about bivalve market in Portugal. Multiple studies have indicated no difference in responses between mail-in surveys and web-based surveys (Fleming & Bowden, 2009). In 2012, statistics of Portugal Contemporary Database (PORDATA, 2013) reported that the number of Internet assessment in Portugal was high (62.4% of the whole population), which supports the utilization of web-based surveys to understand consumer behaviour.

Table 1
Demographic characteristics of survey respondents (n = 1778) and Portuguese population with internet access (PORDATA, 2013).

Demographic categories	This study (percent)	Portuguese population (percent)
Age (years)		
<25	20.3	15.3
25–34	26.4	30.3
35–44	21.8	29.1
45–54	19.0	9.2
55–65	11.5	9.6
>65	1.0	6.5
Gender		
Women	62.5	59.7
Men	37.5	40.3
Education level		
Basic	17.0	18.9
High	83.0	81.1
Household people		
1	13.0	n.a.
≥2	87.0	n.a.
Household income		
≤800 €	5.4	n.a.
801–1500 €	17.2	n.a.
1501–3000 €	42.9	n.a.
>3000 €	29.0	n.a.
No answer	5.5	n.a.
Regional distribution		
Coastal	88.9	85.6
Inland	11.1	14.4

n.a., not available.

The present study aim to investigate the consumers' preferences and attitudes towards several bivalve species with economical value in Portugal (e.g. pullet carpet shell clam *V. pullastra*, Japanese carpet shell clam *R. philippinarum*, mussels *Mytilus* sp., oysters *Crassostrea* sp. and scallops *Pecten* sp.), according to consumers demographic and socio-economic conditions. In other words, is bivalve consumers behaviour affected by age, gender, education level, household income and number of household people? Such information is extremely important to enable the assessment of risks associated with the consumption of bivalves by health and maritime authorities and also by industry stakeholders.

2. Materials and methods

An online survey was implemented to investigate the main preferences and quality standards of Portuguese consumers of bivalve shellfish using the software Limesurvey. A short introduction of the study as well as a time frame to complete the study (10 min) was given. With a link provided in the e-mail, the questionnaire could be filled out on-line. The survey was randomly disseminated to more than 5000 people by email, but also disseminated at national press and institutional websites. The survey was made available between April and June 2012. The questionnaire included several general questions covering different aspects, such as bivalve species consumed, frequency of consumption, amount per meal, reasons for not consuming bivalves, and quality criteria for choosing specimens (e.g. origin, shell appearance, package preferences). Special attention was given to clams (e.g. *V. pullastra* and *R. philippinarum)* due to their importance in Portugal such as seasonality, mode of consumption, places to eat, knowledge of risks, consumption of broken or closed shells after cooking, as well as points of purchase, mode of purchase and criteria of choice (smell, shell appearance, size, price, package, expiry date, species origin, presence of depuration certificate and trust in the selling establishment).

A representative survey (n = 1778) was obtained with age, gender, education level, number of household people, social class