



Nutritional evaluation of the lipid fraction of feral wild boar (*Sus scrofa scrofa*) meat

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ABSTRACT

Consumer increasing demand for wild boar meat and scarceness of data on its lipid fraction justified this study. The *psaos major* muscle collected from 25 feral wild boars was used to quantify the total lipid, total cholesterol, fatty acid (FA) profile, and vitamin E homologues.

Intramuscular fat and total cholesterol contents averaged 4.64 g/100 g of meat and 56.9 mg/100 g of meat, respectively. No differences were found in FA composition between groups, except for 20:5n-3 that was higher in youngsters. All groups presented small concentrations of rumenic acid in meat (CLA; 0.24% of total FA). FA profile showed considerable resemblance with pork, while the vitamin E profile is marked by high concentrations of both alpha- (17.4 ± 3.3 µg/g meat) and gamma-tocopherols (2.6 ± 1.3 µg/g meat) and by the presence of other vitamin E homologues not previously reported in wild boar meat.

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1. Introduction

In Portugal, the wild boar (*Sus scrofa scrofa*) population has been growing since the 1980s, such increase was the consequence of several factors: 1) absence of natural predators; 2) rural depopulation, abandonment of traditional agricultural practices and agricultural lands; 3) expansion of the forest area and 4) spread of game managed areas (Lopes & Borges, 2004). These factors have promoted a widespread distribution of wild boar to an intimidating density, representing a threat not only to agricultural practices and cultures but also to the ecosystem (Herrero, García-Serrano, Couto, Ortuño, & García-González, 2006; Massei & Genov, 2004). The wild boar has an opportunist and omnivorous feeding behavior, which includes mainly vegetable material but also small game species, eggs and nestlings of ground-nesting birds (Laurent & Timothy, 2003). Cultivated crops represent an important dietary component of wild boar and the main crops taken include maize, potatoes, oats, sugar beet, wheat and grasses (Laurent & Timothy, 2003). Therefore, in the absence of natural predators, the wild boar hunting is an ecological need, in order to decrease the wild boar density and impact on small game species and decrease its economic impact on agriculture (Geisser, Reyer, & Krausman, 2004).

The wild boar populations have been particularly successful on Montado areas. The Portuguese Montado closely resembles the Spanish Dehesa, and both represent an ancient human-modified ecosystem based on evergreen oak woodland with a scattered tree cover (60–100 trees per ha), where Cork and Holm oaks (*Quercus suber* and *Quercus ilex rotundifolia*, respectively) are the predominant trees (Correia, 1993; Pinto-Correia, 2000; Pinto-Correia & Mascarenhas, 1999). Montado lands has been managed, since ancient times, as an agro-silvo-pastoral system, being traditionally exploited for cork, and its land used for crop farming, sheep and cattle farming and Iberian pig-raising, all at low stocking densities (Pinto-Correia & Mascarenhas, 1999). Recently, significant areas of Montado are being converted into rural tourism or hunting reserves for small or big game species (Pinto-Correia, 2000).

Game hunting is an economic activity on its one, but the commerce of big game meat, a surplus of the trophy hunting activity, is of economic importance and wild boar meat has gathered enthusiastic consumers among the Portuguese population. Despite consumer's interest for wild boar meat, the information concerning its nutritional quality, particularly of the lipid fraction, is scarce. The lipid fraction is of major importance to the characterization of meat nutritional quality (Wood et al., 2004). Therefore, the objective of this study was to evaluate the nutritional quality of the Montado's wild boar meat, determining the intramuscular fat, the fatty acid profile, cholesterol and vitamin E content.

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2. Materials and methods

2.1. Animals and meat samples

The wild boars used in this study were shot, in accordance with the provision of national laws on game and hunting (Official Journal of the Republic of Portugal, law 173/99, 21st of September, and 201/2005 24th of November).

This study includes wild boars from two adjacent big game hunting reserves (Vale Feitoso and Poupá), both located in Idanha-a-Nova, a southern council of the Beira Baixa province. Both hunting reserves share a common habitat, where Montado ecosystem dominates, sharing similar feeding options (where acorn is the predominant feeding option throughout the Autumn and Winter seasons), equivalent feeding supplementation (wheat, rye and maize grains, supplemented during the summer months) and equal hunting management. The two hunting reserves possess a global area of 11,900 ha, of which 8200 ha are used for big game hunting. The wild boar population number is difficult to estimate, since wild boars damage the herd fences allowing the escape and entrance of neighboring animals, which makes the population variable during the year, however the overall wild boar adult population has been estimated to fluctuate between 400 and 600 adult wild boars.

The wild boar meat used in this study was collected from 25 wild boars (6 adult males, 10 adult females and 9 youngsters, averaging 51, 43 and 17 kg of carcass weight, respectively) shot during two battues in February of 2006 (performed one week apart from each other). The carcass weight previously presented does not correspond to overall carcass weight, since it excludes a variable portion of carcass, removed due to hunting damages. The wild boars were shot during the morning period, and the sanitary inspection was performed, by the veterinary inspector, outdoors throughout the afternoon, with an external temperature of 6 °C. The *psaos major* muscle was collected soon after the sanitary inspection and transported in refrigeration (<5 °C) to the laboratory and kept in refrigeration until processing (an overall period of 18 h from time of sampling). Meat samples were trimmed of connective, adipose tissue and blood coagulum before blending in a food processor, vacuum packed and frozen at –70 °C until analysis. Half of this stored frozen meat was lyophilised (–60 °C and 2.0 h Pa) until constant weight using a lyophilisator Edwards Modulyo (Edwards High Vacuum International, West Sussex, UK), maintained desiccated at room temperature, and analyzed within one month.

2.2. Analytical methods

Total meat lipids were extracted from the lyophilised meat samples (0.25 g) and measured gravimetrically, as previously described (Alfaia et al., 2006). Lipid extracts were dissolved in 1 ml of dry toluene, then fatty acid methyl esters were prepared by base-catalyzed transesterification with sodium methoxide for 2 h at 30 °C. Fatty acid methyl esters were analyzed using a HP6890A chromatograph (Hewlett-Packard, Avondale, PA, USA), equipped with a flame-ionization detector and a fused-silica capillary column (CP-Sil 88; 100 m × 0.25 mm i.d. × 0.20 mm film thickness; Chrompack, Varian Inc., Walnut Creek, CA, USA). The column temperature of 100 °C was held for 15 min, increased to 150 °C at a rate of 10 °C/min and held for 5 min, then increased to 158 °C at 1 °C/min and held for 30 min, and finally increased to 200 °C at a rate of 1 °C/min and maintained for 65 min. Helium was used as carrier gas, and the injector and detector temperatures were 250 and 280 °C, respectively. Identification was accomplished by comparison of sample peak retention times with those of FAME standard mixtures (Sigma, St. Louis, MO, USA).

The identity of CLA isomers found in GC analysis was confirmed using a high performance liquid chromatography system (Agilent 1100 Series, Agilent Technologies Inc., Palo Alto, CA, USA), equipped

with 100 µl injection loop and diode array detector (DAD) operated at 233 nm, using as solid phase a triple silver-ion columns in series according to the procedure described previously by Alfaia et al. (2006).

The simultaneous determination of total cholesterol, tocopherols and tocotrienols was performed as previously described (Prates, Quaresma, Bessa, Fontes, & Alfaia, 2006).

2.3. Statistical analysis

Data were analyzed using GLM procedure of SAS (SAS Institute, Inc., Cary, NC) considering the sex/maturity group as single effect. Contrasts were constructed to evaluate the effect of sex (Male versus Female) and maturity (Adults versus Youngsters).

3. Results and discussion

3.1. Cholesterol

The wild boar *psaos major* muscle total cholesterol contents, presented in Table 1, did not differ between groups, averaging 56.9 mg/100 g of meat, with values ranging between 48.1 and 63.8 mg/100 g of meat. These values are in accordance to values of cholesterol content for pork (45.3–62.2 mg/100 g of meat) reviewed by (Chizzolini, Zanardi, Dorigoni, & Ghidini, 1999), but considerably above cholesterol contents determined in wild boar longissimus dorsi and semimembranosus muscles (Skewes, Morales, Mendoza, Smulders, & Paulsen, 2009), which has solely quantified the free cholesterol.

3.2. Intramuscular fat

Intramuscular fat content in wild boar *psaos major* muscle, depicted in Table 1, averaged 46.4 g/kg of meat, although the values ranged between 19 and 76 g/kg. The wide amplitude of IMF values in wild boar meat, was expectable considering the wild boar feral condition, but will reflect in variable sensorial qualities.

3.3. Vitamin E homologues

Vitamin E homologues and their contents for wild boar *psaos major* muscle are depicted on Table 1. The α-tocopherol is the major Vitamin E homologue in wild boar *psaos major* muscle, representing 71% of total vitamin E homologues. The α-tocopherol content in wild boar *psaos major* muscle was influenced by the maturity stage ($P = 0.023$), with adult animals displaying a higher content than youngsters. The

Table 1
Intramuscular lipids, cholesterol and vitamin E homologues in wild boar *psaos major* muscle according to sex and maturity.

	Adults		Youngster (n = 7)	RSD	Contrasts	
	Males (n = 6)	Females (n = 10)			A vs. Y	M vs. F
Lipids ^a	4.75	4.55	4.68	16.71	0.964	0.824
Total cholesterol ^b	58.7	55.6	57.1	0.041	0.808	0.936
Tocopherols ^c						
α	19.2	18.1	15.5	3.08	0.023	0.479
β	0.05	0.02	0.02	0.030	0.239	0.028
γ	1.75	1.61	1.14	0.582	0.038	0.639
δ	0.12	0.01	0.04	0.048	0.264	0.0003
Tocotrienols ^c						
α	0.00	0.52	0.69	0.836	0.234	0.242
γ	0.42	1.07	0.77	1.131	0.952	0.277
δ	0.03	0.07	0.04	0.122	0.817	0.504

M–F: Male–Female; A–Y: Adult–Youngster.

RSD – residual standard deviation.

^a g/100 g meat.

^b mg/100 g.

^c µg/g of meat.

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