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Chemical and fatty acid composition of meat and liver of wild ducks (*Anas platyrhynchos*)

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Abstract

The chemical and fatty acid composition of the liver and the meat from breasts and legs of Spanish wild ducks have been studied. Significant differences ($p < 0.05$) in the chemical composition were observed among the different parts for dry matter, protein and fat. The major fatty acids in liver and in the meat of breast and leg were C-16:0 (18–22%), C-18:0 (12–22%), C-18:1 (17–34%), C-18:2 (13–23%) and C-20:4 (8–19%). Liver showed significantly ($p < 0.05$) higher C-16:0, C-17:0, C-18:0, C-20:4 and C-22:6 contents than the meat from breast and leg whereas the C-14:0, C-16:1, C-18:1, C-18:2 and C-18:3 contents were lower in liver. Significant differences were also observed between breast and leg meat. Breast showed higher C-18:0, C-20:4 and C-20:5 contents and a lower C-18:1 content than leg meat. We conclude that wild duck meat is a good source of polyunsaturated fatty acids, particularly those with 20 and 22 carbon atoms, as part of a varied diet.

1. Introduction

Some wild animals are hunted for food during hunting seasons. In Spain, this meat is consumed in autumn and winter. Different studies (Cambero, De La Hoz, Sanz & Ordóñez, 1991, Cobos, De La Hoz, Cambero & Ordóñez, 1995) have shown that meats from Spanish wild animals are of a good nutritional value due to their low fat contents and high levels of polyunsaturated fatty acids of the omega-3 and omega-6 families, compared with other meats. However, these studies are about the meat of rabbit and hares and, nowadays, the numbers of these animals are decreasing due to different diseases. So, it could be important to study the composition of other wild animal meats. Wild ducks (*Anas platyrhynchos*) are also hunted for food and there are no studies available on the chemical and fatty acid composition of this meat.

There are only data about the composition of domesticated ducks, mainly Muscovy ducks (*Cairina moschata*). The breast meat lipids of these ducks have a high level (30.5%) of polyunsaturated fatty acids (Salichon, Guy, Rousselot & Blum, 1994). Nevertheless, diet has a great influence on the duck fatty acid composition (El-Deek, Barahat, Attia & El-Sebeay, 1997) and there are many differences between the diets of domesticated ducks and wild ducks. So, the fatty acid compositions may be very different.

The objective of the present work was to study the chemical and fatty acid composition of the liver and the meat from breasts and legs of Spanish wild ducks.

2. Materials and methods

2.1. Animals

Five wild ducks (*A. platyrhynchos*), caught in Galicia (north-west of Spain), were analysed. Firstly, the feathers were removed and the meat from breast and legs was obtained by carefully dissecting flesh from skeleton. The liver was also obtained. The rest of the carcass and viscera were discarded.

2.2. Chemical analysis of meat

The meat and liver obtained from each duck were finely minced in a blender (Polytron PT 10-35). The

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final sample was composed of a homogenate of the meat or liver from each animal. AOAC (1995) methods were used for the dry matter, protein and ash determination. Lipids were extracted and purified from the former homogenate according to the method described by Hanson and Olley (1963). Total lipids were gravimetrically determined. The fatty acid methyl esters of lipids were obtained according to the method described by Utrilla, Juarez and Martínez, (1976) using KOH as catalyst and analysed with a Hewlett-Packard 5890 chromatograph equipped with a dual flame ionization detector. The capillary column (30 m, internal diameter 0.25 mm) was packed with OV-225 (0.1 μm) on fused silica. Analysis was performed using an initial isothermic period (150°C, 2 min); thereafter the temperature was increased to 210°C at an increasing rate of 4°C/min, and finally an isothermic period (210°C, 15 min) was established. For quantitative analyses, a Hewlett–Packard HP3394A integrator was used. The identification of different fatty acid methyl esters was made by comparison with authentic standards (Sigma).

2.3. Statistical methods

Statistical treatment was performed using the analysis of variance and the differences between means were analysed using the Student–Newman–Keuls test (SPSS version 6.1.3. for Windows, 1995).

3. Results

The chemical compositions of the liver and the meat from breasts and legs from wild ducks are shown in Table 1. Significant differences ($p < 0.05$) were observed among the different parts. Liver showed a higher dry matter and fat content than the meat from breast and leg whereas the protein content was lower in liver. Significant differences were also observed between breast and leg meat. Breast showed higher dry matter and protein content than leg meat. No significant differences were observed with respect to the ash content.

The fatty acid compositions of the liver and the meat from breasts and legs from wild ducks are shown in Table 2. Gas chromatography (GC) analysis of fatty acid methyl esters from the lipids of ducks revealed the presence of more than 20 fatty acids. Only the more abundant ones are shown in the table. The major fatty acids in liver and in the meat of breast and leg were C-16:0, C-18:0, C-18:1, C-18:2 and C-20:4. However, significant differences ($p < 0.05$) were observed among the different parts. Liver showed higher C-16:0, C-17:0, C-18:0, C-20:4 and C-22:6 contents than the meat from breast and leg whereas the C-14:0, C-16:1, C-18:1, C-18:2 and C-18:3 contents were lower in liver. Significant differences were also observed between breast and leg meat. Breast showed higher C-18:0, C-20:4 and C-20:5 contents and of lower C-18:1 content than leg meat.

Table 1
Chemical composition (% wet weight) [mean ± standard deviation (range)] of liver, breast and leg meat from wild ducks (n = 5)[a]

	Liver	Breast	Leg
Dry matter	27.18a ± 0.43 (26.47–27.66)	26.07b ± 0.30 (25.64–26.58)	25.10c ± 0.80 (23.90–26.32)
Protein	18.1a ± 1.03 (16.4–19.6)	20.8b ± 0.45 (20.23–21.45)	19.6c ± 0.54 (18.9–20.5)
Fat	5.47a ± 1.16 (4.24–7.61)	3.39b ± 0.38 (2.71–3.76)	3.84b ± 0.34 (3.24–4.00)
Ash	1.53a ± 0.19 (1.27–1.81)	1.27a ± 0.18 (1.06–1.57)	1.27a ± 0.15 (1.06–1.49)

[a] Means within a row without a common letter differ significatly ($p < 0.05$).

Table 2
Fatty acid composition (weight %) [mean ± standard deviation (range)] of liver, breast and leg meat from wild ducks ($n = 5$)[a]

	Liver	Breast	Leg
C-14:0	0.21a ± 0.07 (0.16–0.32)	0.39b ± 0.10 (0.27–0.50)	0.49b ± 0.14 (0.34–0.70)
C-16:0	22.5a ± 1.27 (21.0–24.3)	18.4b ± 1.26 (16.9–20.0)	18.7b ± 1.37 (16.8–20.4)
C-16:1	0.41a ± 0.16 (0.29–0.70)	1.41b ± 0.37 (0.94–1.87)	1.75b ± 0.48 (0.99–2.22)
C-17:0	0.41a ± 0.17 (0.16–0.57	0.28ab ± 0.06 (0.20–0.34)	0.22b ± 0.04 (0.17–0.26)
C-18:0	22.0a ± 1.36 (19.9–23.3)	16.1b ± 1.84 (13.8–18.6)	11.7c ± 2.53 (10.2–11.0)
C-18:1	16.70a ± 3.04 (13.9–20.9)	22.3a ± 4.70 (15.6–27.1)	33.8b ± 8.90 (23.0–43.3)
C-18:2ω6	12.8a ± 3.31 (8.52–15.7)	21.8b ± 4.88 (14.9–25.7)	22.8b ± 7.20 (13.5–29.4)
C-18:3ω3	0.39a ± 0.22 (0.10–0.62)	1.00b ± 0.30 (0.76–1.50)	0.88b ± 0.13 (0.77–1.08)
C-20:4ω6	19.5a ± 1.34 (18.4–21.6)	15.3b ± 1.64 (13.1–17.6)	7.51c ± 2.92 (5.35–12.6)
C-20:5ω3	0.63a ± 0.18 (0.42–0.87)	0.62a ± 0.19 (0.45–0.86)	0.18b ± 0.05 (0.13–0.26)
C-22:5ω3	0.98a ± 0.32 (0.59–1.49)	0.68a ± 0.14 (0.50–0.88)	0.66a ± 0.11 (0.54–0.83)
C-22:6ω3	3.59a ± 1.07 (1.98–4.94)	1.83b ± 0.53 (1.22–2.45)	1.31b ± 0.20 (1.07–1.57)
Total SFA[b]	45.1a ± 0.73 (44.7–46.4)	35.1b ± 1.41 (33.8–37.52)	31.1c ± 2.49 (28.4–34.9)
Total MUFA[c]	17.1a ± 0.32 (14.2–21.6)	23.7a ± 5.04 (16.5–28.9)	35.5b ± 9.19 (24.0–45.3)
Total PUFA[d]	37.8a ± 2.93 (33.9–40.9)	41.2a ± 4.37 (36.3–46.0)	33.4a ± 8.77 (22.5–41.2)

[a] Means within a row without a common letter differ significantly ($p < 0.05$).
[b] SFA, saturated fatty acids.
[c] MUFA, monounsaturated fatty acids.
[d] PUFA, polyunsaturated fatty acids.

4. Discussion

The chemical composition of meat from wild ducks was in general agreement with that reported by Salichon, Guy et al. (1994) and Setiawan, Babile, Auvergne, Belveze and Latil (1994) in Muscovy duck breasts. These results are also similar to those observed in leg meat and loin meat from Spanish wild rabbits and hares (Cobos et al., 1995). However, the fat content of liver was lower than Muscovy ducks where the ducks are force-fed until lipid content reached 59% of total liver (Auvergne, Remingnon, Babile & Baudonnet-Lenfant, 1995).

It has been reported that organ meats, including the liver, have lower monounsaturated fatty acid (MUFA) and higher polyunsaturated fatty acids (PUFA) percentages than skeletal muscle tissue (Rhee, 1992). Although the duck liver also showed a lower MUFA content than breast and leg meat, the PUFA content was not significantly different. Nevertheless, the liver showed higher C-20:4 and C-22:6 contents than the meat from breast and leg. In agreement with this, Enser et al. (1998) observed that liver is a good source of C20 and C22 PUFA.

In general, lipids from ruminant livers appear to contain more C-18:0 and less C-16:0 than from ruminant muscle. However, we found the highest content of both fatty acids in liver.

The differences observed between duck breast and leg in C-18:0, C-18:1 and C-20:4 have been also reported in other meats such as chicken (Rhee, 1992) and spent hens (Ajuyah, Hardin, Cheung & Sim, 1992).

The fatty acid composition of liver and meat of domesticated ducks are different from our results in wild ducks. In this sense, Salichon, Guy et al. (1994) observed that C-18:1 is the main fatty acid in livers of domesticated ducks [mule ducks (Muscovy × common ducks) and Muscovy ducks] with more than 51% of total fatty acids. C-18:1 content in wild ducks never exceeded 20%. Salichon, Baeza and Leclercq (1997) found that the main fatty acids of Muscovy duck breast were C-18:1, C-16:0, C-18:0 and C-20:4. These results are similar to those observed with wild ducks, although the C-18:2 was also of very important fatty acid in wild ducks. These differences may be explained because the diet has a great influence on the duck meat fatty acid composition (El-Deek et al., 1997). The diet of domesticated ducks is mainly based in grains, while wild ducks are omnivorous animals eating a great variety of aquatic plants, grains and, even, aquatic animals.

Likes other game meats (Cobos et al., 1995), breast and leg meats of wild ducks show high contents of C20 and C22 PUFA. This may be because these fatty acids could have an exogenous origin, mainly from aquatic animals and plants (Mishra, Temelli & Ooraikul, 1993) and, therefore, the high concentration of these compounds could be due to a dietary effect. However, since the fatty acids C-20:4, C-20:5, C-22:5 and C-22:6 could have a phospholipidic origin (Cobos et al., 1995) and the duck meat has a high content of phospholipids (Salichon, Baeza et al., 1997), this may explain the higher concentration of these fatty acids in the meat of the ducks.

Finally, in view of the nutritional importance to man of ω-3 and ω-6 PUFA, particularly those with 20 and 22 carbon atoms (Department of Health, 1994; Department of Health and Social Security, 1984), wild duck meat shows good nutritional potential due to its high levels of these fatty acids in comparison with other meats.

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