Meat quality of male and female Italian Padovana and Polverara slow-growing chicken breeds

Antonella Dalle Zotte, Giulia Tasoniero, Gabriele Baldan & Marco Cullere

To cite this article: Antonella Dalle Zotte, Giulia Tasoniero, Gabriele Baldan & Marco Cullere (2019): Meat quality of male and female Italian Padovana and Polverara slow-growing chicken breeds, Italian Journal of Animal Science, DOI: 10.1080/1828051X.2018.1530963

To link to this article: https://doi.org/10.1080/1828051X.2018.1530963

© 2019 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

Published online: 08 Jan 2019.

Submit your article to this journal

Article views: 62

View Crossmark data
Meat quality of male and female Italian Padovana and Polverara slow-growing chicken breeds

Antonella Dalle Zotte\textsuperscript{a}, Giulia Tasoniero\textsuperscript{a}, Gabriele Baldan\textsuperscript{b} and Marco Cullere\textsuperscript{a}

\textsuperscript{a}Dipartimento di Medicina Animale, Produzioni e Salute, Università degli Studi di Padova, Padova, Italy; \textsuperscript{b}Istituto agrario di Istruzione Superiore "Duca degli Abruzzi", Padova, Italy

ABSTRACT

The study characterised and compared proximate composition and fatty acid (FA) profile of breast and leg meat of chickens belonging to Padovana and Polverara Italian local breeds. Birds were slaughtered at 183 days of age and four experimental groups were formed: Padovana males (PAD M), Padovana females (PAD F), Polverara males (POL M) and Polverara females (POL F). Proximate composition was assessed on 10 breasts and 10 legs per group, whereas FA profile and cholesterol content were assessed on six samples per cut per group. Breast meat proximate composition resulted in similarity between the two genotypes and sexes. Genotype did not affect breast FA profile except for C18:1 \textit{n}-11, whereas females breast meat was richer in DHA (\textit{p} < .05) and thus in \textit{n-3} (\textit{p} < .05). Leg meat exhibited greater variability due to genotype and sex. Indeed, PAD chicken legs were richer in dry matter (\textit{p} < .01), lipids (\textit{p} < .01) and cholesterol (\textit{p} < .01) than POL. It emerged that leg meat from PAD breed was characterised by a more desirable FA profile due to its higher UFA:SFA (\textit{p} < .05) and lower \textit{n-6}/\textit{n-3} (\textit{p} < .05) ratios. Despite exhibiting a lower PUFA:SFA ratio than males (\textit{p} < .05), females exhibited a better \textit{n-6}/\textit{n-3} ratio (\textit{p} < .01). The two genotypes and the two sexes possess peculiar nutritional quality. The aim of this study was to create economic interest around these local productions to assure their survival.

HIGHLIGHTS

- Padovana and Polverara are two rustic slow-growing chicken breeds which are farmed in the Veneto region of Italy.
- The goal of the present study is contributing to the creation of economic interest around local productions from Padovana and Polverara chickens.
- Creating an economic interest around Padovana and Polverara breeds would contribute to the preservation of local tradition and rural culture.

Introduction

Padovana and Polverara are two rustic slow-growing chicken breeds extensively reared in the Veneto region (Italy), where they are of interest for scientists and evaluated as a traditional product (De Marchi et al. 2005; Tasoniero et al. 2018). The huge supply of standardised poultry meat products from highly performing chicken hybrids has led to a limited diffusion of local slow-growing breeds during the last decades. Nevertheless, the interest exhibited by the consumers for poultry products deriving from free-range or organic systems encouraged the use of local genotypes (De Marchi et al. 2005; Fanatico et al. 2007). A recent study of Tasoniero et al. (2018) indicated promising productive performances combined with good adaptability to the extensive rearing conditions and resistance for both Padovana and Polverara chicken breeds. This aspect has important economic consequences, as condemnation at the processing plant could be reduced and a better product offered to the consumers. As for meat, the literature highlighted the well-differentiated quality of Padovana and Polverara breast and leg meat in terms of physical traits Tasoniero et al. 2018. Differently, the studies conducted so far on the nutritional quality of Italian local chicken genotypes only focussed on Padovana breast meat that resulted in lean but rich in polyunsaturated fatty acids (De Marchi et al. 2005, 2012; Zanetti...
et al. 2010; Cassandro et al. 2015). Therefore, the present study focussed on an aspect not yet considered. Proximate composition and fatty acid profile of breast and leg meat of Padovana and Polverara chickens were characterised and compared; moreover, a possible sex effect was also evaluated as a source of variability for the considered traits. The ultimate goal of the present study is contributing to the creation of economic interest around these local productions, which could represent a valuable alternative to standardised poultry products and would permit the preservation of local tradition and rural culture.

**Materials and methods**

**Experimental groups**

This study was conducted in post-mortem and the *in vivo* measurements were applied within the regular farm management practices that did not require any stressful procedures. No ethical approval was therefore requested.

At 183 days of age, 20 Padovana and 20 Polverara chickens of both sexes were randomly selected from a broiler unit at the Agricultural Professional High School ‘Duca degli Abruzzi’ (Padova, Italy) and slaughtered in a commercial plant (average slaughter weights: 2473 ± 212g Padovana M; 1750 ± 165g Padovana F; 2378 ± 190g Polverara M; 1744 ± 176g Polverara F). From each bird, breast fillets and legs were excised and four experimental groups were formed: Padovana males (PAD M), Padovana females (PAD F), Polverara males (POL M) and Polverara females (POL F). All samples were transported to the Department of Animal Medicine, Production and Health (MAPS) laboratory the same day of slaughter. All the four experimental groups received the same standard crumbled organic vegetable diet (Table 1) for *ad libitum* consumption and considering the overall rearing period (0–183 d of age), the two breeds had similar FI that resulted in similar FCR (Tasoniero et al. 2018). All birds had free access to outdoor pens. Birds management, productive performances, slaughtering and further processing was previously described in Tasoniero et al. (2018), as well as pH and L\(^*\)a\(^*\)b\(^*\) colour measurements. For this study, a total of 40 left fillets (*Pectoralis major* and *Pectoralis minor* muscles) and 40 left legs (thigh and drumstick muscles) were chosen and used to assess meat proximate composition, cholesterol contents and fatty acid profile.

**Meat proximate composition**

Meat proximate composition was determined on 40 left breasts (*n* = 10 breasts/group) and 40 left legs without skin and bones (*n* = 10 legs/group). Samples were chopped, ground using a Retsch Grindomix GM 200 (10 s at 4000 rpm) and freeze-dried. Dry matter and ash were determined following the AOAC (1995) procedures, whereas protein contents were estimated by difference. Ether extraction was carried out combining the traditional Folch method (Folch et al., 1957) with that provided by Lee et al. (1996), together with the Accelerated Solvent Extraction (M-ASE). Briefly, the analysis was performed on 2.5 g of freeze-dried sample with Dionex ASE 350 (Thermo Fisher Scientific Inc., Waltham, MA) set to method 16, using a binary solvent mixture chloroform/methanol 1:2 (reagents by Sigma-Aldrich, St. Louis, MO). Subsequently, samples were shaken in a saline solution (0.5% NaCl in water) equal to one-fourth of their total extracted volume and allowed to stand for 1 h to obtain a biphasic separation. The lower phase was filtered with a filter paper (Whatman No. 1) provided with a layer of anhydrous sodium sulphate; the filter paper was then washed with 5 mL of chloroform. The solvent was removed by centrifugal evaporator Genevac EZ-2 (Genevac Ltd, Ipswich, UK) under a nitrogen stream at 50 °C. Then, the test tubes were put in a stove at 60 °C for 20 minutes and let to cool down at room temperature in a vacuum desiccator. Test tubes were weighed to gravimetrically determine ether extract content. Crude protein, ether extract and ash were expressed as a percentage on as is basis.

**Fatty acid profile determination**

After ether extraction, fatty acid methyl esters (FAMEs) were quantified on 24 breasts (*n* = 6/group) and 24 legs (*n* = 6/group). For each sample, 40 mg of fat were transmethylated by adding 1.5 mL of a 4% H\(_2\)SO\(_4\) methanolic solution (Sigma-Aldrich, St. Louis, MO); test tubes were then put in a stove at 60 °C, regularly

---

**Table 1.** Chemical composition (g/kg as-fed) of the diets fed to Padovana and Polverara chickens.

| Diets                     | Period 1 (0–28d) | Period 2 (29–71 d) | Period 3 (72–183 d) |
|---------------------------|------------------|--------------------|---------------------|
| Dry matter                | 898              | 882                | 906                 |
| Crude protein             | 196              | 194                | 174                 |
| Ether extract             | 37.3             | 18.4               | 30.9                |
| Crude fibre               | 27.4             | 14.9               | 29.5                |
| Ash                       | 49.7             | 74.4               | 60.5                |

Standard crumbled organic vegetable diets (Progeo, Reggio Emilia, Italy): maize flour, toasted soybean, meal, maize gluten meal, soybean oil, added vitamins and mineral, without animal products, antibiotics or coccidiostat.
vortexed and let in the stove overnight. The day after, 1 mL of MilliQ distilled water and 1.5 mL of N-Heptane (Riedel-de Haën AG, Seelze, Germany) were added, test tubes were vortexed and centrifuged for 10 min at 1000 rpm. Subsequently, 1 mL of the supernatant was transferred in glass vials and injected in a gas chromatograph (GC-2010 Plus, Shimadzu, Kyoto, Japan) equipped with Omegawax Supelco 250 column (30 m × 0.25 μm × 0.25 μm) and FID 2010 detector. Injector and detector temperature were 260°C; helium was used as carrier gas at a constant flow of 0.8 mL/min (linear speed of 22 cm/s). Peaks were identified based on commercially available FAMEs mixtures (37-Component FAME Mix, Supelco Inc., Bellefonte, PA) and the data obtained were expressed as a percentage (w/w) of total detected FAMEs.

**Cholesterol content**

From the same freeze-dried samples used to determine the fatty acid profile (breasts =6/group; legs =6/group), an aliquot of 500 mg was weighed and analysed according to Casiraghi et al. (1994). Samples were added with 1 mL of mobile phase solution (7% isopropyl alcohol in N-Hexane) and injected in HPLC system (LC-10 ADVP, System controller SCL 10VP; Shimadzu, Kyoto, Japan). The instrument was equipped with auto-injector SIL-10 ADVP, column mode Bondclone 10 μm Silica 300 × 3.9 mm (Phenomenex, Torrance, CA) and spectrophotometric detector LC 90 UV at (Perkin Elmer, Waltham, MA) at a 208 nm wavelength. Samples were injected at a volume of 20 μl at a speed of 0.7 mL/min. The data obtained were expressed as mg/100 g on as is basis.

**Statistical analysis**

Data were analysed using the SAS 9.1.3 statistical software package (Cary, NC, USA) for Windows (SAS, 2008). The studied variables were evaluated by a two-way ANOVA that considered breed (B) and sex (S) as fixed effects (PROC GLM). B × G interaction was also analysed. The experimental unit was represented by the single bird. The hypothesis of the linear model were graphically assessed on the residuals of the model. A Shapiro–Wilk test was performed to evaluate the normality of data. Post hoc pairwise contrasts were evaluated by Bonferroni adjustments: \( p < .05; \ p < .01, \ p < .001 \) and \( p < .0001 \) were assigned as significance levels.

**Table 2. Proximate composition (% on as is basis) of chicken breast meat (without skin).**

| Breed (B) | Sex (S) | Probability |
|----------|---------|-------------|
| PAD      | POL     | M           | F       | B   | S   | B × S   |
| Number of samples | 20 | 20 | 20 | 20 |
| Dry matter | 25.8 | 25.9 | 25.8 | 25.9 | 0.20 | 0.75 | 0.71 | 0.29 |
| Protein | 20.4 | 20.7 | 20.5 | 20.6 | 0.20 | 0.29 | 0.85 | 0.64 |
| Lipids | 4.02 | 3.89 | 3.94 | 3.97 | 0.08 | 0.24 | 0.78 | 0.05 |
| Ash | 1.37 | 1.33 | 1.33 | 1.37 | 0.06 | 0.61 | 0.69 | 0.87 |
| Number of samples | 12 | 12 | 12 | 12 |
| Cholesterol, mg/100 g | 40.8 | 39.4 | 40.7 | 39.6 | 1.50 | 0.50 | 0.61 | 0.13 |

PAD: Padovana; POL: Polverara; M: male; F: female.

**Results and discussion**

**Proximate composition**

As it can be evinced from Table 2, neither breed nor sex influenced breast meat proximate composition. To this respect, our findings are partially inconsistent with the mean values observed for Padovana chicken breast meat in other previous studies. In fact, on one hand, our PAD chickens exhibited similar dry matter contents as those previously observed by De Marchi et al. (2005) and Zanetti et al. (2010). On the other hand, higher levels of lipid and ash, as well as lower amounts of protein were noticed in the present study when compared to the cited articles. In addition, differently from De Marchi et al. (2005), sexual dimorphism involving the breast proximate composition was not observed here. These discrepancies among studies in terms of breast meat proximate composition might be explained by the lack of standardisation in the productive performances and meat quality traits of these animals. In fact, up until now, the selection for these slow-growing breeds aimed at the conservation of morphological traits and to assure their survival. As for the Polverara chicken, the present research is the first one in assessing the nutritional quality attributes of its meat according to the authors’ knowledge. Anyway, the similar breast proximate composition exhibited by the two genotypes, particularly in terms of cholesterol and lipid contents, seems to suggest that PAD and POL possess similar histological traits, whereas, previously, different muscle fibre size and density were detected between Padovana and another slow-growing genotype (Verdiglione and Cassandra, 2013).

Unlike breast, PAD leg meat exhibited higher dry matter (\( p < .01 \)), higher lipid (\( p < .01 \)) and higher cholesterol (\( p < .01 \)) contents compared to POL chickens (Table 3). On the other hand, the leg meat of POL chickens was characterised by a greater percentage of ash (\( p < .05 \)). Leg meat proximate composition did not exhibit sexual dimorphism, except for a higher ash level found in males’ legs (\( p < .05 \)). Unfortunately, no
previous studies were conducted on the leg meat proximate composition of these rustic purebreds; therefore, our findings are not comparable with previous literature on the same genotype. Nevertheless, leaner meat and lower cholesterol amounts detected in POL legs than PAD ones could be explained by a greater locomotory activity distinguishing these birds from the Padovana counterparts. As they are very active birds, they might have burnt more energy and thus have partly used the muscles lipid reserve. Indeed, Polverara chickens are known for their wild nature: they perch on trees when possible and they are used to roam in the vineyards and along the countryside hedges (http://www.arpa.veneto.it/upload_teolo/agrometeo/fix/1pdf.pdf). In addition, a greater locomotory activity might have led to more oxidative muscle fibres but with greater fibres size in POL leg muscles, thereby reducing the sarcolemma surface.

### Table 3. Proximate composition (% on as is basis) of chicken leg meat (without skin).

| Breed (B) | Sex (S) | Probability |
|----------|--------|-------------|
|          | PAD    | POL         | M | F | SE | B | S | B × S |
| Number of samples | 20 | 20 | 20 | 20 | | | | |
| Dry matter | 25.8<sup>a</sup> | 24.9<sup>b</sup> | 25.4 | 25.3 | 0.10 | <0.01 | 0.69 | 0.96 |
| Protein | 17.9 | 18.0 | 18.0 | 18.0 | 0.10 | 0.42 | 0.69 | 0.04 |
| Lipids | 6.63<sup>a</sup> | 5.46<sup>b</sup> | 5.98 | 6.11 | 0.16 | <0.01 | 0.58 | 0.36 |
| Ash | 1.23<sup>b</sup> | 1.40<sup>a</sup> | 1.39<sup>*</sup> | 1.24<sup>b</sup> | 0.05 | 0.02 | 0.04 | 0.22 |
| Number of samples | 12 | 12 | 12 | 12 | | | | |
| Cholesterol, mg/100 g | 71.3<sup>a</sup> | 66.5<sup>b</sup> | 69.9 | 67.8 | 1.00 | <0.01 | 0.15 | 0.11 |

PAD: Padovana; POL: Polverara; M: male; F: female.
<sup>a,b</sup>Means within the same row followed by different lowercase superscript letters differ p ≤ .05.
<sup>A,B</sup>Means within the same row followed by different uppercase superscript letters differ p ≤ .01, p ≤ .0001.
*% on as is basis means that the % is not expressed on the dry matter but on the FRESH leg meat (including water).

### Table 4. Fatty acid profile of breast meat (% on total Fatty acids methyl esters).

| Breed (B) | Sex (S) | Probability |
|----------|--------|-------------|
|          | PAD    | POL         | M | F | SE | B | S | B × S |
| Number of samples | 12 | 12 | 12 | 12 | | | | |
| Total SFA | 39.3 | 39.7 | 40.3 | 38.7 | 0.56 | 0.65 | 0.06 | 0.80 |
| C 10:0 | 0.14 | 0.13 | 0.08 | 0.19 | 0.04 | 0.90 | 0.04 | 0.33 |
| C 12:0 | 0.08 | 0.02 | 0.10 | 0.00 | 0.06 | 0.47 | 0.24 | 0.47 |
| C 14:0 | 0.42 | 0.39 | 0.47 | 0.34 | 0.04 | 0.61 | 0.04 | 0.99 |
| C 15:0 | 0.07 | 0.08 | 0.75 | 0.54 | 0.10 | 0.40 | 0.15 | 0.54 |
| C 16:0 | 24.9 | 24.9 | 25.3 | 24.5 | 0.30 | 0.98 | 0.11 | 0.69 |
| C 17:0 | 0.08 | 0.06 | 0.05 | 0.10 | 0.02 | 0.48 | 0.15 | 0.28 |
| C 18:0 | 12.6 | 13.2 | 13.2 | 12.6 | 0.3 | 0.16 | 0.20 | 0.85 |
| C 20:0 | 0.13 | 0.14 | 0.12 | 0.15 | 0.003 | 0.91 | 0.45 | 0.12 |
| C 22:0 | 0.05 | 0.13 | 0.09 | 0.09 | 0.03 | 0.13 | 0.85 | 0.35 |
| C 24:0 | 0.18 | 0.12 | 0.17 | 0.13 | 0.04 | 0.29 | 0.47 | 0.42 |
| Total MUFA | 25.6 | 24.3 | 24.6 | 25.4 | 0.66 | 0.17 | 0.39 | 0.92 |
| C 14:1 n–9 | 0.04 | 0.00 | 0.04 | 0.00 | 0.03 | 0.33 | 0.33 | 0.33 |
| C 16:1 n–9 | 1.09 | 1.00 | 1.12 | 0.97 | 0.10 | 0.54 | 0.34 | 0.77 |
| C 17:1 n–10 | 0.04 | 0.01 | 0.01 | 0.04 | 0.01 | 0.31 | 0.31 | 0.03 |
| C 18:1 n–9 | 21.5 | 20.7 | 20.7 | 21.5 | 0.60 | 0.35 | 0.31 | 0.88 |
| C 18:1 n–11 | 2.94<sup>a</sup> | 2.57<sup>b</sup> | 2.72 | 2.80 | 0.10 | 0.01 | 0.56 | 0.59 |
| C 22:1 n–9 | 0.01 | 0.02 | 0.00 | 0.04 | 0.02 | 0.70 | 0.19 | 0.70 |
| Total PUFA | 33.8 | 34.9 | 34.0 | 34.7 | 0.60 | 0.19 | 0.39 | 0.70 |
| C 18:2 n–6 | 15.2 | 15.8 | 16.0 | 15.0 | 0.50 | 0.37 | 0.17 | 0.61 |
| C 18:3 n–3 | 0.35 | 0.38 | 0.33 | 0.40 | 0.05 | 0.68 | 0.35 | 0.36 |
| C 18:3 n–6 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.33 | 0.33 | 0.33 |
| C 20:2 n–6 | 0.30 | 0.32 | 0.36 | 0.27 | 0.03 | 0.68 | 0.07 | 0.43 |
| C 20:3 n–3 | 0.06 | 0.07 | 0.07 | 0.06 | 0.03 | 0.73 | 0.96 | 0.49 |
| C 20:3 n–6 | 0.77 | 0.85 | 0.78 | 0.84 | 0.04 | 0.20 | 0.34 | 0.45 |
| C 20:4 n–6 | 15.3 | 15.9 | 14.8 | 16.4 | 0.60 | 0.50 | 0.08 | 0.52 |
| C 20:5 n–3 | 0.24 | 0.20 | 0.23 | 0.21 | 0.08 | 0.73 | 0.86 | 0.54 |
| C 22:5 n–3 | 1.62 | 1.44 | 1.35<sup>b</sup> | 1.71<sup>*</sup> | 0.10 | 0.23 | 0.02 | 0.59 |
| UFA:SFA | 1.52 | 1.50 | 1.46 | 1.55 | 0.04 | 0.75 | 0.08 | 0.84 |
| PUFA:SFA | 0.86 | 0.88 | 0.85 | 0.90 | 0.02 | 0.51 | 0.11 | 0.70 |
| n–6 | 31.6 | 32.9 | 32.0 | 32.4 | 0.60 | 0.12 | 0.58 | 0.76 |
| n–3 | 2.26 | 2.09 | 2.04<sup>b</sup> | 2.31<sup>*</sup> | 0.09 | 0.19 | 0.04 | 0.38 |
| n–6/n–3 | 14.3 | 16.0 | 16.1 | 14.2 | 0.70 | 0.08 | 0.05 | 0.46 |

SFA: Saturated Fatty Acids; UFA: Unsaturated Fatty Acids; MUFA: Monounsaturated Fatty Acids; PUFA: Polyunsaturated Fatty Acids; PAD: Padovana; POL: Polverara; M: male; F: female.
<sup>a,b</sup>Means within the same row followed by different lowercase superscript letters differ p ≤ .05.
and thus the cholesterol content, as cholesterol is mainly contained in cells membranes (Serra et al. 2017). The legs of Polverara breed and those of males were also characterised by a higher ash percentage. A possible explanation of such finding is reported in the companion paper (Tasoniero et al. 2018) where extremely high \( a^*/C_3 \) colour values for Iliotibialis lateralis muscles belonging to Polverara males were found, reasonably related to a superior myoglobin and possibly haem iron contents. To confirm this hypothesis, further research on the mineral composition of the Polverara meat, including the iron content, would be necessary.

### Fatty acid profiles

The different fatty acid proportions found in the present experiment can be attributable to genotype and sex, which could impact lipid metabolism and fatty acid deposition in the edible tissues (Dal Bosco et al. 2012). The fatty acid profile of breast meat is reported in Table 4. It can be evinced that the breast meat of the two breeds had similar SFA, MUFA and PUFA total amounts and composition, as well as similar, derived healthiness indexes (UFA:SFA, PUFA:SFA and \( n-6/n-3 \) ratios). The only exception was represented by a higher vaccenic acid content detected in PAD breast fillets \( (p < .05) \). No differences were detected between males and females in terms of total SFA and MUFA contents and profiles, with the only exceptions regarding \( C\) 10:0 and \( C\) 14:0 FA for which females were the richest and the poorest, respectively \( (p < .05) \). Despite having similar total PUFA percentages, the female breast meat was richer in \( C\) 22:6 \( n-3 \) (DHA; \( p < .05 \)) and thus in \( n-3 \) \( (p < .05) \). Since breast meat lipids profile was globally homogeneous between the two genotypes and the two sexes, leg fatty acids composition exhibited a greater variability, which is probably due to a higher intramuscular fat content of leg muscles than the pectoral one. Leg meat fatty acid profile is depicted in Table 5. No differences were detected between PAD and POL breeds in terms of total SFA

#### Table 5. Fatty acid profile of leg meat (% total Fatty acids methyl esters).

| Breed (B) | Sex (S) | Probability |
|----------|---------|-------------|
|          |         | B | S | B × S |
| Number of samples | 12 | 12 | 12 | 12 |
| Total SFA | 34.3 | 34.9 | 34.5 | 34.6 |
| C 10:0 | 0.11 | 0.10 | 0.09 | 0.11 |
| C 12:0 | 0.00 | 0.00 | 0.00 | 0.00 |
| C 14:0 | 0.48 | 0.47 | 0.47 | 0.48 |
| C 15:0 | 0.10 | 0.08 | 0.09 | 0.09 |
| C 16:0 | 19.2 | 18.4 | 18.0 | 19.6 |
| C 18:0 | 13.9 | 15.3 | 15.3 | 13.9 |
| C 20:0 | 0.13 | 0.13 | 0.14 | 0.12 |
| C 22:0 | 0.11 | 0.07 | 0.09 | 0.09 |
| C 24:0 | 0.14 | 0.19 | 0.19 | 0.14 |
| Total MUFA | 23.4 | 23.5 | 23.6 | 25.2 |
| Total PUFA | 37.5 | 38.5 | 38.7 | 37.2 |
| C 18:2 \( n-6 \) | 22.9 | B | 24.6 | A |
| C 18:3 \( n-3 \) | 0.59 | 0.54 | 0.55 | 0.58 |
| C 18:3 \( n-6 \) | 0.10 | 0.09 | 0.11 | 0.08 |
| C 20:2 | 0.19 | 0.25 | 0.18 | 0.25 |
| C 20:3 | 0.05 | 0.05 | 0.05 | 0.06 |
| C 20:4 | 11.7 | 11.2 | 11.2 | 11.7 |
| C 20:5 | 0.19 | 0.20 | 0.20 | 0.20 |
| C 22:6 \( n-3 \) | 1.4 | 1.7 | 1.8 | 1.8 |
| C 22:6 \( n-6 \) | 35.3 | 36.6 | 36.9 | 35.0 |
| n-6 | 35.3 | 36.6 | 36.9 | 35.0 |
| n-3 | 2.24 | 1.94 | 1.89 | 2.29 |
| n-6/n-3 | 1.61 | 20.7 | 21.3 | 15.6 |

**SFA:** Saturated Fatty Acids; **UFA:** Unsaturated Fatty Acids; **MUFA:** Monounsaturated Fatty Acids; **PUFA:** Polyunsaturated Fatty Acids; **PAD:** Padovana; **POL:** Polverara; **M:** male; **F:** female.

\( a,b \) Means within the same row followed by different lowercase superscript letters differ \( p \leq .05 \);

\( A,B \) Means within the same row followed by different uppercase superscript letters differ \( p < .01 \).
amounts, even though POL legs were richer in C 18:0 \( (p < .05) \). As for monounsaturated fatty acids, PAD chickens’ legs were richer in total MUFA \( (p < .05) \) and in C 16:1 \( n-9 \) \( (p < .05) \) compared to their counterparts. Probably, greater palmitoleic acid and thus MUFA proportions in PAD leg meat might be explained by a superior D9-desaturase activity \( \text{Sirri et al. 2010}. \) Despite no differences were noticed between PAD and POL in terms of leg meat total PUFA amounts, it emerged that PAD leg meat was richer in C 20:3 \( n-6 \) \( (p < .05) \) but also in n-3 fatty acids \( (p < .05) \) and especially in C 22:6 \( n-3 \) \( (p < .01) \). On the other hand, POL leg meat exhibited a greater level of C 18:2 \( n-6 \) \( (p < .01) \). To this respect, a different trend was expected, as Polverara genotype was reported to exhibit higher locomotory and grazing activities and thus a greater pasture intake than the Padovana counterparts \( \text{Tasoniero et al. 2018}. \) These findings seem to suggest that PAD chickens probably possess a superior ability in n-6 fatty acids elongation as well as a higher efficiency in incorporating C 22:6 \( n-3 \) in their edible tissues than POL, which would, however, require further investigation. In addition, it might be that the grass biomass ingested by POL represented, on a dry matter basis, only a small percentage of the total feed intake, thereby having an only little effect on meat lipid composition \( \text{Ponte et al. 2008}. \) As a result, PAD leg meat possessed more desirable lipids healthiness indexes UFA:SFA \( (p < .05) \) and \( n-6/n-3 \) ratio \( (p < .05) \) than a POL. Despite males and females, leg meat was characterised by similar amounts of total SFA, C16:0 was more abundant in female legs \( (p < .01) \) whereas C18:0 was more abundant in male leg meat \( (p < .05) \). Total MUFA content was higher in females than in males \( (p < .05) \); however, monounsaturated fatty acids composition did not differ between the two sexes. Males possessed a higher total PUFA \( (p < .05) \) and a higher PUFA:SFA ratio \( (p < .05) \), but also a greater n-6 amount \( (p < .05) \). On the contrary, female leg meat exhibited significantly higher C 22:6 \( n-3 \) (DHA; \( p < .01 \)) and lower C 18:2 \( n-6 \) \( (p < .01) \) contents, that made its polyunsaturated fatty acid profile more desirable for a greater percentage of n-3 \( (p < .01) \) and a lower n-6/n-3 ratio \( (p < .01) \). From the analysis of interaction, it emerged that the leg meat of PAD females had a higher C 20:3 \( n-6 \) percentage compared to POL females with males of both genotypes being intermediate \( \text{PAD F: 0.52; POL F: 0.31; PAD M: 0.37; POL M: 0.43; } p < .01 \). More interestingly, POL M and PAD F were characterised by the lowest C 20:5 \( n-3 \) and POL M by the lowest \( n-3 \) fatty acids levels, that resulted in the least favourable \( n-6/n-3 \) ratio \( \text{POL M: 26.2; PAD M: 16.4; PAD F: 16.0; POL F: 15.2; } p < .05 \) (data not shown in Table). It can be evinced that females are more efficient in incorporating \( n-3 \) fatty acids in their muscles and in using them as a favourite substrate in the desaturation and elongation pathway to produce DHA \( \text{Cook 1991; } \text{Lands 1992}. \)
chicken breed, a commercial line, and their cross. Ital J Anim Sci. 14:304–309.
Cook HW, Byers DM, Palmer FB, Spence MW, Rakoff H, Duval SM, Emken EA. 1991. Alternate pathways in the desaturation and chain elongation of linolenic acid, 18:3(n-3), in cultured glioma cells. J Lipid Res. 32:1265–1273.
Dal Bosco A, Mugnai C, Ruggeri S, Mattioli S, Castellini C. 2012. Fatty acid composition of meat and estimated indices of lipid metabolism in different poultry genotypes reared under organic system. Poult Sci. 91:2039–2045.
De Marchi M, Cassandro M, Lunardi E, Baldan G, Siegel PB. 2005. Carcass characteristics and qualitative meat traits of the Padovana breed of chicken. Int J Poul. Sci. 4:233–238.
De Marchi M, Rovanto R, Penasa M, Cassandro M. 2012. At-line prediction of fatty acid profile in chicken breast using near infrared reflectance spectroscopy. Meat Sci. 90(3):653–657.
Fanatico AC, Pillai PB, Emmert JL, Owens CM. 2007. Meat quality of slow- and fast-growing chicken genotypes fed low-nutrient or standard diets and raised indoors or with outdoor access. Poult Sci. 86:2245–2255.
Folch J, Lees M, Sloane-Stanley H. 1957. A simple method for the isolation and purification of total lipids from animal tissue. J Biol Chem. 226:497–509.
Lands WEM. 1992. Biochemistry and physiology of n-3 fatty acids. FASEB J. 6(8):2530–2536.
Lee CM, Trevino B, Chaiyawat M. 1996. A simple and rapid solvent extraction method for determining total lipids in fish tissue. J AOAC Int. 79(2):487–492.
Ponte PIP, Alves SP, Bessa RJB, Ferreira LM, Gama LT, Brás JL, Fontes CM, Prates JA. 2008. Influence of pasture intake on the fatty acid composition, and cholesterol, tocopherols, and tocotrienols content in meat from free-range broilers. Poult Sci. 87:80–88.
Serra A, Conte G, Giannessi E, Casarosa L, Lenzi C, Baglini A, Ciucci F, Cappucci A, Mele M. 2017. Histological characteristics, fatty acid composition of lipid fractions, and cholesterol content of Semimembranosus and Triceps brachii muscles in Maremmana and Limousine bovine breeds. Front Vet Sci. 4:89.
Sirri F, Castellini C, Roncarati A, Franchini A, Meluzzi A. 2010. Effect of feeding and genotype on the lipid profile of organic chicken meat. Eur J Lipid Sci Technol. 112:994–1002.
Statistical Analysis Software for Windows 2008. Statistics version 9.1.3 ed. Cary, NC, USA: SAS Institute.
Tasoniero G, Cullere M, Baldan G, Dalle Zotte A. 2018. Productive performances and carcase quality of male and female Italian Padovana and Polverara slow-growing chicken breeds. Ital J Anim Sci. 17(2):530–539.
Verdiglione R, Cassandro M. 2013. Characterization of muscle fiber type in the pectoralis major muscle of slow-growing local and commercial chicken strains. Poult Sci. 92:2433–2437.
Zanetti E, De Marchi M, Dalvit C, Molette C, Remignon H, Cassandro M. 2010. Carcass characteristics and qualitative meat traits of three Italian local chicken breeds. Br Poult Sci. 51:629–634.