Polyamines content in meat of feathered game

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Information about polyamines content in food is of great interest for many researches and dieticians. The reason for increasing interest is due to polyamines specific biological role, including participation in tumour growth. In the study the content of polyamines (spermine and spermidine) in the breast and thigh muscles of selected feathered game, killed in a way typical for used farming method, was observed. For purposes of this study the carcasses of mallards (Anas platyrhynchos) bred out on the pond and shot by hunters and carcasses of pheasants (Phasianus colchicus) from farm, killed by pithing, were used. The carcasses of both kinds of feathered game were stored at 0 and 7°C for 21 days. At regularly weekly intervals (1., 7., 14., 21. day after killing) samples of breast and thigh muscles (m=0.5 g) were taken. Polyamines (spermine and spermidine) were separated and quantified by reverse phase liquid chromatography. Obviously higher spermidine concentrations were observed in muscles of pheasant (maximal reached concentrations were 2.58 mg/kg and 2.60 mg/kg for breast and thigh muscle, respectively) compared to muscles of wild ducks (maximal reached concentrations were 0.22 mg/kg and 0.29 mg/kg for breast and thigh muscles, respectively). Spermine concentration assessed in pheasants muscle was higher than those in mallards muscle too. In the case of pheasants muscle, the differences between breast and thigh muscle were observed (maximal reached concentrations were 59.40 mg/kg and 39.14 mg/kg for breast and thigh muscle, respectively). Spermine concentrations in muscle of wild duck were lower and the difference between breast and thigh muscle was not so apparent (maximal reached concentrations were 50.26 mg/kg and 47.31 mg/kg for breast and thigh muscle, respectively).

Presented study brings new and helpful information about polyamines concentration in meat of feathered game.

Keywords: pheasant; mallard; spermine; spermidine; storage.

Introduction

Dietary polyamines spermine (SPM), spermidine (SPD) and putrescine (PUT) were separated from their traditional classification within biogenic amines during the 1990s due to their specific biological roles and biosynthesis pathways (Dadakova et al., 2011; 2012; Kozova 2009). Putrescine, though structurally a diamine, is also classified as a polyamine, being the precursor of both physiological polyamines (PUT→SPD→SPM) (Dadakova et al., 2011). Mentioned polyamines participate in numerous human physiological processes, including cell proliferation, and tumour growth; wound healing, maturation and regeneration of intestinal mucosa (Krausova et al., 2008; Peulen et al., 2004; Deloyer et al., 2005; Weiss et al., 2004). Information on the content of the polyamines in oods and
beverages would be thus of great interest for assessing their dietary intake (Krausova et al., 2008; Dadakova et al., 2011).

The works focused on the concentrations of polyamines in food showed, that higher SPM compared to SPD contents, are usual in foods of animal origin (mainly in muscle), while the opposite is observed in foods of plant origin. (Kalac, 2006; Kalac & Krausova, 2005; Dadakova et al., 2011). The content of polyamines has been just studied in meat of chicken (Kozova et al., 2009), sheep and lambs (Dadakova et al., 2011), rabbit (Dadakova et al., 2012), duck (Dadakova et al., 2012) and also in pork and beef meat (Krausova et al., 2006; 2008).

Surprisingly, limited data on polyamine contents is available for meat from game (venison). The objective of this study was to gain new information about the content of polyamines (SPM, SPD) in the meat of feathered game (*Phasianus colchicus* and *Anas platyrhynchos*).

**Materials and methods**

**Sampling**
The content of polyamines (SPD, SPM) was assessed in the meat of selected feathered game, killed in a way typical for used farming method. Carcasses of 35 pithed common pheasants (*Phasianus colchicus*) from farm and 35 carcasses of wild ducks (*Anas platyrhynchos*) bred out on the pond and shot by hunters were used for purposes of the study. Five carcasses of each kind of feathered game were used for determination of initial polyamine (SPD, SPM) concentrations. The rest of carcasses (in feather, untreated) were stored at 0 and 7°C (15 carcasses of each kind of feathered game for each storage temperature). In the regular weekly intervals (7., 14. and 21. day of storage) the muscle samples (breast and thigh) were taken always from five carcasses of selected feathered game.

**Polyamines determination**
Concentrations of polyamines (SPM, SPD) were determined in each sample collected from the breast and thigh muscles. To ensure the representativeness of samples the collected muscles were pureed. From this homogenised material the amount of 0.5 g was consequently withdrawn for polyamines determination. One-step extraction using trichloracetic acid followed by clean-up step using 0.45 µm syringe filter was employed for sample preparation. Biogenic amines were subsequently separated by reverse phase liquid chromatography using C<sub>18</sub> (2.1 mm × 50 mm, 1.9 µm; Thermo Scientific, San Jose, CA, USA) column and detected by tandem mass spectrometry using a heated electro spray-ionization in positive ion mode. Thermo Scientific UHPLC Accela 1250 system was connected to a Thermo Scientific TSQ Quantum Access MAX Triple Quadrupole Instrument (Thermo, San Jose, CA, USA).

**Statistical analysis**
Evaluation of the results was performed by assessing of polyamines changes in muscle samples (breast and thigh) and also by comparing polyamines content in each kind of selected feathered game meat. The significance of differences in the polyamines content between individual sampling dates, between breast and thigh muscle samples of each kind of feathered game was evaluated by the Kruskal-Wallis test in the statistical analysis package UNISTAT 5.6. *P* value less than 0.05 was considered as statistically significant.

**Results**
Spermidine concentration in breast and thigh muscles of common pheasant and wild duck are shown in the Table 1.

Table 1 Spermidine concentration (mg/kg) in breast and thigh muscles of feathered game (common pheasant and wild duck) stored at 0 and 7°C.

<table>
<thead>
<tr>
<th>Storage day</th>
<th>0°C</th>
<th>7°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Wild duck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM</td>
<td>0.09±0.02</td>
<td>0.16±0.03</td>
</tr>
<tr>
<td>TM</td>
<td>0.13±0.02</td>
<td>0.17±0.04</td>
</tr>
<tr>
<td>Pheasant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM</td>
<td>2.11±0.61</td>
<td>2.43±0.95</td>
</tr>
<tr>
<td>TM</td>
<td>1.87±0.68</td>
<td>2.32±0.80</td>
</tr>
</tbody>
</table>

BM-breast muscle; TM-thigh muscle

As can be seen from the results shown in the Table 1, higher spermidine concentrations were observed in muscles of pheasant compared to muscles of wild ducks. Statistical significant differences (p<0.01) were found in both storage temperatures for all taking sample terms. The differences in the spermidine content in breast muscle compared to thigh muscle were observed mainly in wild ducks meat. Statistically significant difference between breast and thigh muscle of wild ducks stored at 0°C was found in the following sample taking terms 1, 3 (p<0.05) and 4 (p<0.01) and in the 1st sample taking term (p<0.05) in the meat of wild ducks stored at 7°C. In the case of pheasant meat, there were found any statistical differences between spermidine concentrations in the breast and thigh muscle.

Spermine concentration in breast and thigh muscles of common pheasant and wild duck are shown in the Table 2.

Table 2 Spermine concentration (mg/kg) in breast and thigh muscles of feathered game (common pheasant and wild duck) stored at 0 and 7°C.

<table>
<thead>
<tr>
<th>Storage day</th>
<th>0°C</th>
<th>7°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Wild duck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM</td>
<td>37.48±1.90</td>
<td>45.12±3.80</td>
</tr>
<tr>
<td>TM</td>
<td>33.93±0.92</td>
<td>43.80±4.21</td>
</tr>
<tr>
<td>Pheasant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM</td>
<td>59.40±5.09</td>
<td>55.44±4.10</td>
</tr>
<tr>
<td>TM</td>
<td>39.14±3.51</td>
<td>33.84±3.90</td>
</tr>
</tbody>
</table>

BM-breast muscle; TM-thigh muscle

Higher spermine concentrations were generally observed in pheasant breast muscle compared to wild duck breast muscle. Statistically differences were found in all sample taking days (1st, 2nd, 3rd p<0.01 and 4th p<0.05) for carcasses stored at 0°C and also for those stored at 7°C (sample taking day 1st, 3rd, 4th p<0.01 and 2nd p<0.05). In the thigh muscle were generally higher spermine concentrations found in the wild ducks meat. Statistically significant differences were found in all sample taking days (1st, 3rd, 4th p<0.01 and 2nd p<0.05 for carcasses stored at 0°C; and p<0.01 for carcasses stored at 7°C in all sample taking days). Obviously higher spermine concentration was observed in the breast muscle of both feathered game carcasses. Most apparent differences between breast and thigh muscle were observed in the pheasants meat; statistically significant differences (p<0.01) were found in both storage temperature in all taking sample terms. In the case of wild ducks meat, the statistically significant difference (p<0.01) between spermine concentration in the breast muscle compared to thigh muscle was found in the 1st taking sample day (for both storage temperatures).
Conclusion

As can be seen from our results, obviously higher spermidine concentrations were observed in muscles of pheasant compared to muscles of wild ducks. In the wild ducks meat there were found differences in spermidine concentrations in breast and thigh muscles. In the case of pheasant carcasses differences in spermidine concentrations between breast and thigh muscle were negligible. Spermine concentration assessed in pheasants muscle was higher than those in mallards muscle too. In the case of pheasant’s meat, the differences between breast and thigh muscle were observed. Spermine concentrations in muscle of wild duck were lower and the difference between breast and thigh muscle was not so apparent.

The amount of information about content of biologically active polyamines in the game meat is generally very lacking. Presented study brings new and helpful information about polyamines concentration in meat of feathered game.

References


