# Differences in the Amino Acid Composition of the Breast Muscle of Wild and Farmed Pheasants

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**Abstract**

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Numerous studies show the slaughter yield and also basic chemical composition of pheasant meat. The results reveal a higher biological value of the meat of pheasants which were fed naturally, in comparison to the meat of pheasants fed with commercial mixtures. In many countries, the pheasant is selected with the aim of producing high quality meat with very desirable nutritional values. There are only few publications on amino acid composition of pheasant meat. The knowledge of amino acid composition of pheasant meat can be used to determine its potential nutritional value. The amino acid compositions were compared of the meats of wild and farm pheasants. In the study, the following amino acids were determined: Asp, Thr, Ser, Glu, Pro, Gly, Ala, Val, Ile, Leu, Tyr, Phe, His, Lys, Arg. An improved amino acid profile was found in the breast muscle of pheasants kept at the farm in comparison with that of wild pheasants.

**Keywords**: meat production; pheasant; chemical composition; amino acids

Poultry production during the last 15 years has become the most intensively developing branch of farming (Genchev *et al*. 2008). The increased production of eggs and meat is associated with continuous attempts to diversify the product range. This is noticeable in big distributive networks offering some new products such as meat from quails, ostriches, and pheasants. Pheasant meat is consumed relatively rarely in comparison with poultry meat, pork, or beef (Chisholm *et al*. 2008). Many authors suggest that among all pheasant species living in the wild there is one that can be potentially used to produce meat of high quality (Marsico & Vonghia 1992; McGowan & Garson 1995). As reported by Straka and Malota (2005), a slightly different distribution of proteins in the pheasant influences the characteristic taste of the bird meat. Apart from high gustatory values the meat is also very soft and juicy (Dronca 2008). Numerous studies have showm the slaughter yield and also basic chemical composition of pheasant meat (Richter *et al*. 1992; Tucak *et al*. 2008). Sarica *et al*. (1999) investigated the effect of age of slaughtered birds on the carcass traits, Adamski and Kuźniacka (2006) in their study showed that there were no differences in the chemical composition and physical characteristics between most pheasant meat samples in view of sex. The results by Tucak *et al*. (2004) showed a higher biological value of the meat of pheasants which were fed naturally in comparison to the meat of pheasants fed with commercial mixtures. The studies conducted by Wang *et al*. (1993) reported the amino acid composition of the feathers of ill

brown eared pheasant. Nevertheless, there are relatively few publications relating to the issues of amino acid composition of pheasant meat. This topic was presented by Straková *et al.* (2006), who compared the amino acid composition of pheasant and chicken meats at the age of 42 days. Uherová *et al.* (1992) found that game contains higher levels of essential amino acids as compared with traditionally produced meat. Whereas Hofbauer *et al.* (2010) maintain that the material taken from wild birds is very valuable for dietary reasons, it was observed in our study which was conducted previously that, from the nutritional point of view amino acid composition of pheasant meat *Phasianus colchicus* var. *tenebrosus* is better in comparison with *Phasianus colchicus* (Brudnicki *et al.* 2010). In many countries, the pheasant is selected with the aim of producing high quality meat with very desirable nutritional values (Santos Schmidt *et al.* 2007). The knowledge of the amino acid composition of food is very important. It is useful for the determination of the potential nutritional value (Young & Pellett 1984).

The aim of this study was to compare the amino acid composition of the breast muscle of wild pheasants with that of farm pheasants.

## MATERIAL AND METHODS

Wild birds ($n$ = 50) were collected during a hunt in the hunting district of Bydgoszcz in Poland at the end of autumn and the beginning of winter in 2010. Immediately after the hunt, the age of the hunted birds was marked. The age was determined according to the method proposed by Gates (1966), by measuring the spur length. After the birds selection, 10 one year old birds with the body weight near to the average body weight of the population were taken to the laboratory for the research purposes. Another group of birds ($n$ = 50) were reared in aviaries on deep bedding in a pheasant farm with controlled light, temperature, and hygienic regimens observing the respective conditions of the rearing technology. Microclimatic parameters in the experimental enclosure were as follows: average air temperature ranged from 31°C to 21°C depending on age; average relative humidity was 65–75%; light regimen during the whole period of feeding was set to: 23 h of light and 1 h of dark. Birds were fed *ad libitum* according to the age using the feed from Provimi Company (Świecie, Poland) whose chemical composition is given in Table 1. In the last feeding period (from week 9), instead of approximately 20% of the mixture PI 422 a mixture of corn and wheat (in ratio 1:1) was introduced.

At the age of 10 months, 10 pheasant were randomly selected for chemical analyses of breast muscle. Uneviscerated carcasses were delivered to the laboratory, similarly as in the case of wild pheasants. All birds were of male sex. The estimation of the amino acids content in the sample was made using an automatic amino acid analyser AAA 400 (INGOS, Prague, Czech Republic) and the methodology described by Moore and Stein (1963). The analysis was performed according to the method proposed by INGOS (Prague, Czech

Table 1. Chemical composition of feeding mixtures administered to farmed pheasant

| Nutrient content in 1 kg of mixtures | | PI 420<br>0–3 weeks | PI 421<br>4–8 weeks | PI 422<br>9–40 weeks |
|---|---|---|---|---|
| ME | min. (kcal) | 2800 | 2765 | 2750 |
| Protein | (%) | 26.00 | 22.50 | 18.00 |
| Crude fiber | min.–max. (%) | 5.00 | 5.80 | 6.00 |
| Crude ash | min.–max. (%) | 6.2–8.2 | 5.2–7.2 | 4.7–6.7 |
| Crude fats | min. (%) | 3.6–5.6 | 3.3–5.3 | 2.5–4.5 |
| Ca | min. (%) | 1.10 | 0.85 | 0.75 |
| P | min. (%) | 0.55 | 0.45 | 0.40 |
| Na | min. (%) | 0.16 | 0.13 | 0.13 |
| Lysine | min. (%) | 1.55 | 1.25 | 0.92 |
| Methionine | min. (%) | 0.58 | 0.42 | 0.35 |
| Methionine + Cystein | min. (%) | 1.00 | 0.81 | 0.69 |
| Tryptophan | min. (%) | 0.29 | 0.25 | 0.19 |

Republic). Before the analysis, the samples were subjected to acid hydrolysis (6M HCl, 24 h, 110°C). In the study, the following amino acids were deteminated: aspartic acid (Asp), threonine (Thr), serine (Ser), glutamic acid (Glu), proline (Pro), glycine (Gly), alanine (Ala), valine (Val), isoleucine (Ile), leucine (Leu), tyrosine (Tyr), phenylalanine (Phe), histidine (His), lysine (Lys), and arginine (Arg). The resulting values of amino acids were re-calculated to 100% dry matter for the purpose of comparison. All data in the study were analysed statistically using the Statistica 7.0. The results are expressed as means. The data were analysed using normality Shapiro-Wilk test and Fisher test verifying the homogeneity of variances. The differences between the independent groups were assessed by *t*-Student and Cochran-Cox tests. The level of statistical significance was at $P \leq 0.05$.

## RESULTS AND DISCUSSION

The comparison was made of the amino acid composition of breast muscle between wild pheasants and farm pheasants of comparable ages.

The contents of amino acids in the breast muscle of wild pheasants ranged from 24.72 g/kg (Ser) to 87.58 g/kg (Glu), whereas in that of farm pheasants from 27.66 g/kg (Tyr) to 140.48 g/kg (Glu) (Table 2). As obvious from Table 2, the levels of most amino acids in the pheasant breast muscles were higher in the group of farm birds.

In this study, it was found that the meat of the farm pheasants, in comparison to that of the wild pheasants, was characterised by higher levels of 12 from the total of 15 amino acids analysed. The differences were statistically significant ($P \leq 0.05$). In the case of isoleucine and phenylalanine, the differences in the levels of these amino acids were not statistically significant. However the content of tyrosine was statistically significantly ($P \leq 0.05$) higher in the breast muscle of the wild pheasants. The sum of the analysed amino acids in the breast muscle of the wild pheasants amounted to 638.82 g/kg containing 249.26 g/kg of essential amino acids, whereas in the case of the pheasants kept in aviary it was 804.70 g/kg containing 258.79 g/kg essential amino acids.

The comparison of the two research groups in the experiment was made on the ground of both the diet and method of killing. The farm pheasants, as opposed to the wild-living birds, are provided adequate nutrition throughout the year (Straková *et al.* 2006), whereas the wild pheasants must satiate the changing demands for nutrients in diverse conditions that change during the seasons. There are only few data on the amino acid composition of pheasant breast muscle. Such information on the differences in amino acid composition between the muscles of pheasants and those of broiler chickens were published by Straková *et al.* (2006). The results presented in the above-mentioned work are in accord with the results obtained during the own research and demonstrate that amino acid levels in the pheasant breast muscle are highly favourable, the meat being of a high nutritional value.

Table 2. Amino acid composition of breast muscle from wild ($n$ = 10) and farm ($n$ = 10) pheasants (results are related to 100% dry matter)

| Amino acid | Wild pheasant | Farm pheasant |
|---|---|---|
| Asp | 66.47 ± 4.64[a] | 81.83 ± 1.98[b] |
| Thr | 33.68 ± 2.53[a] | 44.72 ± 0.51[b] |
| Ser | 24.72 ± 2.00[a] | 37.59 ± 0.52[b] |
| Glu | 87.58 ± 6.44[a] | 140.48 ± 0.58[b] |
| Pro | 29.77 ± 2.55[a] | 35.30 ± 0.25[b] |
| Gly | 28.18 ± 1.06[a] | 38.13 ± 0.44[b] |
| Ala | 40.19 ± 2.71[a] | 50.93 ± 0.31[b] |
| Val | 33.95 ± 1.70[a] | 40.83 ± 0.64[b] |
| Ile | 33.82 ± 2.52 | 34.52 ± 0.35 |
| Leu | 58.07 ± 3.38 | 55.69 ± 0.59 |
| Tyr | 33.73 ± 2.07[a] | 27.66 ± 0.47[b] |
| Phe | 29.77 ± 2.33 | 32.34 ± 1.06 |
| His | 40.69 ± 2.46[a] | 52.41 ± 1.84[b] |
| Lys | 59.92 ± 4.51[a] | 67.76 ± 0.35[b] |
| Arg | 38.29 ± 3.07[a] | 64.55 ± 0.19[b] |

Data are means ± standard deviation; [a,b]different superscripts indicate significant ($P \leq 0.05$) differences between species within muscle

Proteins are the key components in meat from both the nutritional and technological points of view (Steinhauser *et al.* 2000). Many amino acids are of paramount importance in forming the taste of meat, some of them are the predominant flavour components in food, whereas other amino acids are responsible for the intensification of the taste (Colombo 1975; Fujimura & Kadowaki 2006).

The significantly higher content of glutamic acid in the breast muscle of farm pheasants in

comparison with that of wild animals has a great importance when it comes to the taste of meat. Moreover, arginine, whose level is higher in farm pheasants, is a precursor of nitric oxide in the body and is involved in immunological processes. In addition, according to Kirimura and Shimizu (1969), arginine has a bitter and slightly sweet taste, serine is sweet and sour with umami, glutamic acid is sour and umami, alanine is sweet with a hint of umami. The meat of wild pheasants is characterised by a higher content of tyrosine. For consumers, this fact is not without significance because tyrosine is a precursor of neurotransmitters such as adrenaline, noradrenaline, and dopamine, which perform important functions in the brain and tissues. Worth to note is also the recorded lower level of proline in the muscle of wild pheasants. Proline is an amino acid occurring usually in fibrous tissues and can be nitrosated. The results show that the sum of the analysed amino acids in the breast muscle is higher in farm pheasants in comparison with wild pheasants. The meat of pheasants kept in aviary conditions was characterised by a better quality in terms of the amino acids content, which was obviously influenced by controlled feeding conditions. Wild pheasants are unable to obtain a balanced diet, they feed on what is currently available depending on the season, hence the values of the respective parameters were lower. The results of the studies show that the pheasant can be a source of high quality meat for the modern consumer which can successfully compete with poultry meat, pork, or beef. The knowledge of amino acid composition of pheasant meat can be used to determine its potential nutritional value and also conduce to identifying and modifying the composition of feed for farmed birds depending on the current demands.

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