Fractionation of amino acids and fatty acids of frozen poultry meat

Saad, M.S.[a], Ibraheem, H.M.[a], Hassan, M.A.[a], and Hassan, F.Y.[b]
[a]Department of food control, Faculty of Veterinary Medicine, Benha University, [b]Moshtohor Agriculture School, Toukh, Qalubia

Abstract

Fifteen random samples of frozen chicken breast, duck breast and whole pigeon meat (5 of each) were collected from different supermarkets located in Qalubia governorate. Each chicken and duck breast sample weight was 300g and was transferred in an insulated ice box to the laboratory without undue delay. The collected samples were subjected to fractionation of amino and fatty acids. The results showed that chicken breast had the highest content of arginine (7.05%), leucine (12.23%), methionine (6.85%) and phenylalanine (4.79%). In the same time, duck breast had the highest content of cystein (2.41%), hydroxyproline (2.45%), lysine (6.10%), proline (10.28%), serine (5.46%), thyronine (7.02), and tyrosine (4.63%). Concerning pigeon meat it had the highest content of alanine (9.82%), Aspartic acid (10.17%), glutamic acid (13.95%), glycine (12.02%), tryptophan (9.13%), and valine (6.07%). Total unsaturated fatty acids in the examined chicken breast, duck breast, pigeon samples constituted 43.9%, 47.3% and 42.4%, respectively while, total saturated one was represented by 56.1%, 52.7% and 57.6%, respectively. The ratios between them were 0.78, 0.89 and 0.74, respectively. Finally, the examined samples of duck breast meat had lower shelf life than chicken breast and pigeon meat samples.

Key words: Amino acids, fatty acids, poultry meat.

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1. INTRODUCTION

Amino acid composition of poultry meat can play a significant role in determination of the nutritional value as well as identification of each specific poultry meat. The ratio of amino acids as arginine, histidine and lysine for the investigated species of poultry do not depend on age or weight of the animal [5]. Broiler fat contained more unsaturated than saturated fatty acids [7]. Presence of tryptophan (essential amino acid) increases the nutritional value of the product. Accordingly, pigeon meat had the higher percent of tryptophan (9.13%) than chicken breast and duck breast samples. In addition, the presence of hydroxyproline (non-essential amino acid) decreases the nutritive value of the product, so the duck breast had lower nutritional value than chicken breast and pigeon samples [9]. The presence of unsaturated fatty acids in the food articles increases their nutritive value and decrease the shelf life of the product. In addition, the high percent of saturated fatty acids of the product decrease the nutritional value and increase the shelf life of the product. Accordingly, the examined samples of duck meat had lower shelf life than chicken and pigeon meat samples [9]. Oxidative deterioration results in losing the quality of poultry meat due to development of rancid odor and taste. Moreover, the rancid flavor can develop rapidly during refrigerated storage of such frozen poultry meats, which are more susceptible to rancidity because of their high contents of unsaturated fatty acids [2]. On the other hand, the deterioration of fats or rancidity represents one of the most important technical problems in food industries. Rancidity may occur through hydrolysis of the ester linkage by lipase and

moisture 'hydrolytic rancidity' or through the auto-oxidation of unsaturated fatty acid glycerides by atmospheric oxygen 'oxidative rancidity' or through the enzymatic oxidation of unsaturated fatty acid glycerides 'lipooxidase rancidity' or through the enzymatic oxidation of certain saturated fatty [4]. The amino acid profile is an important parameter because some amino acids cannot be synthesized by human and must be obtained from diet [1].

The aim of the present study was to determine the nutritional value of poultry meat, through their content of amino acids and fatty acids.

2. MATERIALS AND METHODS

2.1. samples

A total of 15 random samples of frozen poultry breast meats represented by chicken, duck and pigeon (5 of each) were collected from different supermarkets in Qalubia governorate.

Each chicken and duck breast sample weight was 300 g and transferred in an insulated ice box to the laboratory. All the collected samples were subjected to study the fractionation of amino and fatty acids.

2.2. Evaluation of amino acids profile

The technique recommended by [6] was applied for identification of amino acids of the protein sample.

2.2. Evaluation of fatty acids profile

2.2.1. Extraction of fatty acids

The fats under study were saponified with ethanol potassium hydroxide (40%, w/v) for 24 hr at room temperature according to the method recommended by [3].

2.2.2 Extraction of fat

a) Identification and determination of fatty acids:

Fatty acids were determined in the samples by Gas Liquid Chromatography (GLC) according to the method described by [4].

b) Methylation of fatty acids:

The obtained fatty acids were converted to methyl ester as follow; the extracted fatty acids were dissolved in anhydrous diethyl ether (0.5-1.0ml) and methylated by drop wise addition of diazomethane solution [10] until the yellow color persisted. The mixture was then left at room temperature for 15 min. and the solvent was evaporated on a water bath maintained at 60^{o}C.

Finally, the methyl ester of fatty acids was dissolved in chloroform and aliquots of this solution were subjected to analysis by G.L.C.

c. Separation of fatty acid methyl esters:

The fatty acid methyl esters were analyzed by Hewlett Packard gas chromatography (5890 series) equipped with flame ionization detector. The chromatograph was fitted with FFAP (2.5m X 0.30µm film thickness and 0.32mm diameter). Capillary column coated with polyethylene glycol. The column oven temperature was programmed from 50^{o}C to 240^{o}C (7^{o}C/min.) and finally kept at 240^{o}C for 30 min.injector and detector temperature were 250 and 260^{o}C, respectively. Gases flow rates were33, 30, and 330 ml/min. for N_2, H_2 and air, respectively. The flow rate inside column was 2ml/min. Under these conditions, all peaks from C_8 to C_{20} homologous series were defined. Peak identification was performed by comparison of the relative retention time (RRT) for each peak with those of standard chromatograms. The peak was measured by triangulation and the relative proportions of the individual compound were therefore obtained by determination of the partial areas in relation to the total area.

3. RESULTS AND DISCUSSION

Chicken are good source of animal protein of high biologic value, which contains all the essential amino acids required for human nutrition. Amino acid composition of meat components as being a part of meat protein can play a significant role in meat identification.

Results presented in Table (1) revealed that chicken breast had the highest content of arginine (7.05), leucine(12.23), methionine(6.85) and phenylalanine(4.79) , lower results obtained by (6). In the same time, duck breast had the highest content of cystein(2.41) , hydroxyproline(2.45) , lysine(6.10) , praline(10.28) , serine(5.46) , thyronine(7.02) , and tyrosine(4.63) . Concerning pigeon meat, the highest content of alanine(9.82) ,Aspartic acid(10.17) ,glutamic acid (13.95),glycine (12.02),tryptophan (9.13) and valine(6.07) .

Presence of tryptophan (essential amino acid) increases the nutritional value of the product. Accordingly, pigeon meat had the higher percent of tryptophan (9.13%) than chicken breast and duck breast samples. In addition, the presence of hydroxyproline (non essential amino acid) decreases the nutritive value of the product, so the duck breast had lower nutritional value than chicken breast and pigeon samples (9). The differences of the amino acid contents may be attributed to the use of collagen rich muscles in the formulation as hydroxyproline amino acid, which is the major component of the protein collagen.

Table 1 Fractionation of amino acid contents (Mean ±) in the examined samples of different poultry meat samples.

Poultry meat / Amino acids	Chicken breast meat	Duck breast meat	Pigeon meat
Alanine	5.91	8.15	9.82
Arginine	7.05	3.74	3.39
Aspartic acid	4.66	5.86	10.17
Cystein	1.27	2.41	0.65
Glutamic acid	10.14	6.52	13.95
Glycine	9.56	7.74	12.02
Hydroxyproline	1.08	2.45	0.33
Leucine	12.23	11.92	7.71
lysine	5.69	6.10	3.14
Methionine	6.85	3.83	5.96
Phenylalanine	4.79	1.94	1.35
Proline	7.54	10.28	4.22
Serine	2.11	5.46	1.91
Thyronine	3.35	7.02	3.78
Tryptophan	7.42	2.89	9.13
Tyrosine	3.86	4.63	1.50
Valine	5.51	3.95	6.07

The amino acid profile is an important parameter because some amino acids cannot be synthesized by human and must be obtained from diet [1]. It is obvious from the results obtained in table (2) that total unsaturated fatty acids constituted 43.9%, higher results obtained by (6) however, total saturated one were represented by 56.1%, lower results obtained by (6) and the ratio between them was 0.78 in chicken breast meat. Moreover, total unsaturated fatty acids constituted 47.3%, however, total saturated one were represented by 52.7% and the ratio between them was 0.89 in duck breast meat.

Total unsaturated fatty acids constituted 42.4%, however, total saturated one were represented by 57.6%, and the ratio between them was 0.74 in pigeon meat. Accurately, the oxidative rancidity of fats results in destruction of essential fatty acids and development of pungent offensive off-flavor and rancid odor (8). Presence of tryptophan (essential amino acid) increases the nutritional value of the product. Accordingly, pigeon meat had the higher percent of tryptophan

(9.13%) than chicken breast and duck breast samples. Also, the presence of hydroxyproline (non essential amino acid) decreases the nutritive value of the product, so the duck breast had lower nutritional value than chicken breast and pigeon samples (9).

Table 2 Fractionation of fatty acid contents (mean) in the examined samples of different poultry meat samples.

Poultry meat / Fatty acids	Chicken breast meat	Duck breast meat	Pigeon meat
C 8:0	6.4	4.7	5.1
C10:0	3.9	1.9	5.6
C12:0	4.1	3.4	2.9
C14:0	4.7	5.6	3.4
C16:0	26.2	24.3	25.6
C18:0	6.0	7.6	6.7
C18:1	9.6	11.8	9.9
C18:2	3.1	3.5	2.7
C20:0	4.8	5.2	3.8
C20:1	7.7	6.1	7.4
C20:4	1.0	1.7	-
C20:5	4.2	4.3	3.9
C22:1	1.8	2.0	2.6
C22:5	-	1.1	-
C22:6	16.5	16.8	15.9
TU	43.9	47.3	42.4
TS	56.1	52.7	57.6
TU/TS	0.78	0.89	0.74

TU: Total unsaturated fatty acid.
TS: Total saturated fatty acids.

On the other hand, the deterioration of fats or rancidity represents one of the most important technical problems in food industries. Rancidity may occur through hydrolysis of the ester linkage by lipase and moisture 'hydrolytic rancidity', through the auto-oxidation of unsaturated fatty acid glycerides by atmospheric oxygen 'oxidative rancidity', through the enzymatic oxidation of unsaturated fatty acid glycerides 'lipooxidase rancidity' or through the enzymatic oxidation of certain saturated fatty acid glycerides 'ketonic rancidity' (4).

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تجزئة الأحماض الأمينية والأحماض الدهنية في لحوم الدواجن المجمدة

سعد محمود سعد[1]، همت مصطفي إبراهيم[1]، محمد أحمد حسن[1]، فاطمة الزهراء حسن يوسف[2]

[1]قسم المراقبة الصحية على اللحوم، كلية الطب البيطري– جامعة بنها، [2]مدرسة مشتهر الثانوية الزراعية.

الملخص العربى

أجريت الدراسة لمعرفة القيمة الغذائية ومدى جودة لحوم الدواجن المجمدة من عينات صدور الدجاج والبط والحمام الكامل حيث تم جمع عدد 15 عينة من لحوم الدواجن المختلفة المجمدة (5 من صدور الدجاج و5 من صدور البط و5 من الحمام الكامل) كان وزن كل من صدور الدجاج والبط حوالي 300 جم. و هذه العينات من محلات السوبر ماركت المختلفة بمحافظة القليوبية وتم دراسة كمية و نوع كل من الأحماض الأمينية وكذلك الدهنية لمعرفة القيمة الغذائية لكل منتج على حدة.و أظهرت دراسة كمية و نوع الأحماض الأمينية أن الحمام المجمد أكثر قيمة غذائية من صدور الدجاج و صدور البط المجمدين وذلك لاحتوائها على أعلى نسبة من التريبتوفان (9.13مقارنة بصدور الدجاج 7.42وصدور البط 2.89) و احتوائها على نسبة ضئيلة جدا من الهيدروكسى برولين(0.33مقارنة بصدور الدجاج 1.08و صدور البط 2.45).و كذلك دراسة كمية و نوع الأحماض الدهنية الموجودة بها أوضحت أن الحمام المجمد أكثر قيمة غذائية و ذلك لاحتوائه على أعلى نسبة من الأحماض الدهنية المشبعة(57.6) بخلاف صدور الدجاج المجمدة و صدور البط المجمد(56.1و 52.7 على التوالى) .

وقد خلصت الرسالة إلى أن الحمام المجمد أعلى فى القيمة الغذائية من صدور كل من الدجا ج والبط المجمدين.

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