Fractionation of Amino Acids and Fatty Acids of Fresh Local and Frozen Imported Chicken Meat

Fatin S. Hasanin[1], Omayma M.A.L. Maghraby[2] and Ahmed M. Mostafa[2]

[1]Food Control Dept., Fac. Vet. Med., Benha University. [2]Food Hygiene Dept., Animal Health research Institute, Dokki.

ABSTRACT

Sixty random samples of fresh local and frozen imported chicken meat (30 of each) were collected for fractionation of amino and fatty acids. The results showed that the fresh local chicken meat had the highest content of Histidine (3.27 %), Isoleucine (4.81%), Leucine (7.63%), Lysine (9.08%), Phenylalanine (4.32%), Methionine (2.56%), Threonine (3.91%), Tryptophan (0.35%), Glycine (4.75%) and Valine (4.74%). In the same time, the frozen imported chicken meat had the highest content of Alanine (5.76%), Arginine (6.28%), Aspartic acid (9.02%), Glutamic acid (16.24%), Serine (4.17%) and Tyrosine (3.43%). Total Mono-Unsaturated Fatty acids in the examined fresh local and frozen imported chicken meat samples were (1996 and 1749 mg/100 g fat), total poly-unsaturated fatty acids were (976and 910 mg/100 g fat), and total saturated fatty acids were (1657 and 1892 mg/100 g fat), respectively. Finally, the fresh local chicken meat had a higher nutritive value and lower shelf-life than the frozen imported chicken meat.

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

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1. INTRODUCTION

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 (Saad et al. 2013). Much of the value of a protein food is based on its amino acid content whereby the high nutritional value is related to a high presence of essential amino acids (Bender, 1992). Amino acids represent over 90% of the crude protein in the body of poultry (Hunton, 1995). In a comparison to red meat, chicken meat has a high nutritional value, low cholesterol and saturated fatty acids level which are the main reasons for arteriosclerosis, and heart diseases due to the deposition on the blood vessels (FAO, 1992). Amino acid and fatty acid composition have been known to have an effect on chicken meat taste and flavor that can be influenced by genotypes, rearing systems and feeds (Wattanachant, 2008). The amino acid profile is an important parameter because some amino acids cannot be synthesized by human and must be obtained from diet (Alina and Ovidiu, 2007). Amongst the fatty acids profile of meats, the high levels of unsaturated fatty acids are usually associated to poultry. Unsaturated fatty acids are regarded as beneficial to human health (Babji *et al.* 1980). Individual cuts of poultry meat differ in contents of fat. 'Marbling' typical of meat of large farm animals does not occur in poultry meat. An important feature of poultry meat from dietetic aspects is an increased content of fatty acids, particularly

linoleic acid, linolenic acid and arachidonic acid (Matušovičová, 1986). Arachnoic acid and Docosahexaenoic acid (DHA) are the only essential fatty acids. Arachinoic acid is necessary for growth, proper hydration and healthy hair. While, DHA is necessary for learning, intelligence and visual activity. Alterations in brain 22:6n-3 and other long chain fatty acids have been associated with changes in physiological function for example enzyme activity (Masterjohn, 2005).

Therefore, the aim of the present study was to compare the nutritional value of fresh local and frozen imported chicken meat, through their content of amino acids and fatty acids.

2. MATERIALS AND METHODS

2.1. Collection of samples:

Sixty random samples of fresh local and frozen imported chicken meat (30 of each) were collected from different shops, supermarkets and hypermarkets in different localities in Kalyobia governorate. All samples were kept in an ice box during transportation to the laboratory with minimum time of delay. Then, all breasts and thighs were separately dissected from each carcass, chopped together and analyzed as rapidly as possible for fractionation of amino and fatty acids.

2.2. Fractionation of amino acids:

The technique recommended by Mabbott (1990) for fractionation of amino acids was applied by Gas Liquid Chromatography (GLC).

2.3. Fractionation of fatty acids:

2.3.1. Extraction of fat from chicken meat:

One hundred grams of the sample were placed in a 500 ml closed stopper flask then, 300 ml of n-hexane was added, and the flask was shacked for 30 min. using horizontal shaker and left for 24 hours at room temperature. The homogenated mixture was filtered and the residue was re-extracted as mentioned above. The combined filtrates were evaporated under reduced pressure according to AOAC (2000).

2.3.2. Identification and determination of fatty acids:

Fatty acids were determined in chicken meat by Gas Chromatography technique (GC) according to Aura *et al.* (1995).

2.3.3. Isolation and extraction of fatty acids:

The fats under study were saponified with ethanolic potassium hydroxide (40%, w/v) for 24 hours at room temperature according to the method of AOCS (1993). The aqueous layer (containing potassium salt of fatty acids and free from unsaponifiable matter) was acidified with HCL (0.5N), then it was extracted three times with petroleum ether. The petroleum ether extract was washed several times with distilled water, and dried over anhydrous sodium sulphate.

2.3.4. Methylation of fatty acids:

The obtained fatty acids were converted to methyl esters as follows:

The extracted fatty acids were dissolved in anhydrous diethyl ether (0.5-1.0ml) and methylated by drop wise addition of diazomethane solution (Vogel, 1975) until the yellow color persisted. The mixture was then left at room temperature for 15 minutes and the solvent was evaporated on a water bath maintained at 60°C. Finally, the methyl ester of fatty acids was dissolved in chloroform and aliquots of this solution were subjected to analysis by GC.

2.3.5. Separation of fatty acid methyl esters:

The fatty acids methyl esters were analyzed by Hewlett Packard gas chromatography (5890 series) equipped with flame ionization detector. The chromatograph was fitted with FFAP (2.5m × 0.30µm film thickness and 0.32mm diameter). Capillary column coated with polyethylene glycol. The column oven temperature was programmed from 50°C to 240°C (7°C /min.) and finally kept at 240°C for 30 minutes. Injector and detector temperature

were 250°C and 260°C, respectively. Gases flow rates were 33, 30 and 330 ml/min. for N2, H2 and air, respectively. The flow rate inside column was 2ml/min. Under these conditions, all peaks from C8 to C22 homologous series well defined. Peak identification was performed by comparison of the relative retention time (RTT) 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

Results presented in table (1) revealed that the fractionation of amino acids of fresh local chicken meat were Histidine (3.27 %), Isoleucine (4.81%), Leucine (7.63%), Lysine (9.08%), Phenylalanine (4.32%), Methionine (2.56%), Threonine (3.91%), Tryptophan (0.35%), Glycine (4.75%), Valine (4.74%), Alanine (5.60%), Arginine (6.12%), Aspartic acid (8.97%), Glutamic acid (15.88%), Serine (4.03 %) and Tyrosine (3.29%). In the same time, the fractionation of amino acids of frozen imported chicken meat were Alanine (5.76%), Arginine (6.28%), Aspartic acid (9.02%), Glutamic acid (16.24%), Serine (4.17%), Tyrosine (3.43%), Histidine (2.99%), Isoleucine (4.45%), Leucine (7.12%), Lysine (8.86%), Phenylalanine (4.07%), Methionine (2.30%), Threonine (3.64%), Tryptophan (0.29%), Glycine (4.69%) and Valine (4.59%). Table (2) revealed that the fractionation of fatty acids of the fresh local chicken meat were Palmitoleic (352 mg/100 g fat), Oleic (1644 mg/100 g fat), Total Mono-Unsaturated Fatty acids (1996 mg/100 g fat), Linoleic (639 mg/100 g fat),Linolenic (106 mg/100 g fat), Eicosadienoic acid (21 mg/100 g fat),Dihomo-γ-linolenic (30 mg/100 g fat), Arachidonic (126 mg/100 g fat), Eicosapentaenoic "EPA" (11 mg/100 g fat),Docosapentaenoic "DPA" (25 mg/100 g fat),Docosahexaenoic "DHA" (18 mg/100 g fat), Total Poly-Unsaturated Fatty acids (976 mg/100 g fat), Lauric acid (36 mg/100 g fat), Myristic (54 mg/100 g fat), Palmitic (1158 mg/100 g fat), Stearic (409 mg/100 g fat) and Total Saturated Fatty acids (1657 mg/100 g fat).

Table (1): Fractionation of amino acid composition (g/100 g protein) in the examined samples of fresh local and frozen imported chicken meat (n=30).

Amino acids	Fresh local chicken meat	Frozen imported chicken meat
Essential Amino Acids:		
Histidine	3.27	2.99
Isoleucine	4.81	4.45
Leucine	7.63	7.12
Lysine	9.08	8.86
Phenylalanine	4.32	4.07
Methionine	2.56	2.30
Threonine	3.91	3.64
Tryptophan	0.35	0.29
Valine	4.74	4.59
Non Essential Amino Acids:		
Alanine	5.60	5.76
Arginine	6.12	6.28
Aspartic acid	8.97	9.02
Glycine	4.75	4.69
Glutamic acid	15.88	16.24
Serine	4.03	4.17
Tyrosine	3.29	3.43

Table (2): Fractionation of fatty acids (FAs) composition (mg/100 g fat) in the examined samples of fresh local and frozen imported chicken meat (n=30).

Fatty acids	Fresh local chicken meat	Frozen imported chicken meat
Lauric acid (C12:0)	36	42
Myristic (C14:0)	54	66
Palmitic (C16:0)	1158	1270
Stearic (C18:0)	409	514
Total Saturated F.As	1657	1892
Palmitoleic (C16:1)	352	331
Oleic (C18:1)	1644	1418
Total Mono-Unsaturated F.As	1996	1749
Linoleic (C18:2)	639	622
Linolenic (C18:3)	106	93
Eicosadienoic acid (C20:2)	21	16
Dihomo-γ-linolenic (C20:3)	30	23
Arachidonic (C20:4)	126	112
Eicosapentaenoic “EPA” (C20:5)	11	10
Docosapentaenoic “DPA” (C22:5)	25	21
Docosahexaenoic “DHA” (C22:6)	18	13
Total Poly-Unsaturated F.As	976	910

In the same time, the fractionation of fatty acids of frozen imported chicken meat were Lauric acid (42 mg/100 g fat), Myristic (66 mg/100 g fat), Palmitic (1270 mg/100 g fat), Stearic (514 mg/100 g fat), Total saturated fatty acids (1892 mg/100 g fat), Palmitoleic (331 mg/100 g fat), Oleic (1418 mg/100 g fat), Total Mono-Unsaturated Fatty acids (1749 mg/100 g fat), Linoleic (622 mg/100 g fat), Linolenic (93 mg/100 g fat), Eicosadienoic acid (16 mg/100 g fat), Dihomo-γ-linolenic (23 mg/100 g fat), Arachidonic (112 mg/100 g fat), Eicosapentaenoic “EPA” (10 mg/100 g fat), Docosapentaenoic “DPA” (21 mg/100 g fat), Docosahexaenoic “DHA” (13 mg/100 g fat) and Total Poly-Unsaturated Fatty acids (910 mg/100 g fat).

4. DISSCUSION

It is evident from the results recorded in table (1) that the fractionation of amino acid in the examined samples were nearly similar to those obtained by Paul and Southgate (1978) who indicated that the amino acids content (g/ 100 g protein) of the chicken meat was Lysine (8.96), Threonine(4.16), Valine (4.80), Methionine (2.40), Isoleucine (4.64), Leucine (7.52), Phenylalanine (4.48), Histidine (3.04), Arginine (6.24), Aspartic acid (9.12), Serine (4.00), Glutamic acid (16.48), Glycine (4.82), Tyrosine(3.52) and Alanine (5.76). Lower results were obtained by Mavromichalis *et al.* (2000) who recorded that the amino acids composition of chicken meat (g/100 g protein) were Leucine (6.14), Lysine (6.23), Tyrosine (1.95), Valine (3.75), Arginine (4.98), Alanine (4.34), Aspartic acid (6.80), Glutamic acid (11.25), Glycine (3.13), and Serine (2.92). Results presented in table (1) revealed that the examined samples of fresh local chicken meat had the highest content of Histidine, Isoleucine, Leucine, Lysine, Phenylalanine, Methionine, Threonine, Tryptophan, Glycine, and Valine, and had the lowest content of Alanine, Arginine, Aspartic acid, Glutamic acid, Serine, and Tyrosine than the examined samples of frozen imported chicken meat. According to the above mentioned results, the fresh local chicken samples had the highest content of essential

amino acids and lowest content of non-essential amino acids than frozen imported chicken samples. So, the fresh local chicken samples had higher percent nutritive value than frozen imported chicken samples.

Nine of the amino acids present in proteins are essential (or semi-essential) because the human body cannot synthesize them from other compounds, and therefore must take them up from food. Therefore, the requirement for dietary protein consists of two components; (a) a requirement for the nutritionally essential amino acids, and (b) the need to meet the requirement for non-specific nitrogen in order to supply the nitrogen necessary for synthesis of the nutritionally not essential amino acids and other physiologically important nitrogen containing compounds (nucleic acids, creatine, porphyrins) (Pellett and Young, 1990). The results of total saturated fatty acid, total monounsaturated fatty acid and total polyunsaturated fatty acid obtained in table (2) were lower than those recorded by Suriani et al. (2014). Table (2) revealed that the examined samples of fresh local chicken meat had the highest content of Palmitoleic, Oleic, Total Mono-Unsaturated Fatty acids, Linoleic, Linolenic, Eicosadienoic acid, Dihomo-γ-linolenic, Arachidonic, Eicosa-pentaenoic "EPA", Docosapentaenoic "DPA", Docosahexaenoic "DHA" and total poly-unsaturated fatty acids and had the lowest content of Lauric acid, Myristic, Palmitic, Stearic and total saturated fatty acids than the frozen imported chicken meat. According to the above mentioned result, the fresh local chicken samples had the highest content of Total Poly-Unsaturated Fatty acids and Total Mono-Unsaturated Fatty acids and lowest content of Total Saturated Fatty acids than frozen imported chicken samples. This means that the fresh local chicken samples had higher nutritive value than frozen imported chicken samples.

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