

## **AMINO ACIDS PROFILE OF THREE DIFFERENT EGYPTIAN GOAT BREEDS**

**Abdelhamed, W.A.<sup>1</sup> ; M.M. El-Danasoury<sup>1</sup> ; S.M. El-Hamamsy<sup>1</sup>  
and M.A. El-Sayed<sup>2</sup>**

1- Biochemistry Department, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt

2- Animal Genetic Resources Department, National Gene Bank, Agricultural Research Center, Giza, Egypt

**Key Words:** Baladi and Damascus breed, Egyptian goat breeds, Amino acid profile.

### **ABSTRACT**

Fifteen samples of three goat breeds; Baladi (n=5), Damascus (n=5), and Hybrid breed (Baladi-Damascus) (n=5) were used in the study. Amino Acid Analyzer ARACUS works according to the gold standard of post-column derivatization with ninhydrin reagent. The essential amino acids (EAA) Methionine, Lysine, Threonine, Leucine, Isoleucine, Valine, Phenylalanine, Tryptophan, Cysteine, Arginine, and Histidine were 14.1, 118.5, 99.2, 29.0, 11.6, 28.6, 130.0, 68.4, 29.8, 30.0 and 760 mmol/mol, with the total of 1319.2 mmol/mol, in Baladi goat breed, respectively. Also, in Damascus goat breed were 12.6, 114.5, 98.6, 32.1, 10.3, 39.1, 73.5, 72.0, 27.0, 28.0 and 820 mmol/mol, with the total of 1327.7, mmol/mol respectively. While, in Hybrid (Baladi and Damascus) goat breed recorded of 13.1, 112, 87.0, 34.0, 9.4, 45.0, 122.0, 72.0, 26.0, 28.0 and 915 mmol/mol respectively, with the total of 1463.5 mmol/mol. On other hand, the values of Non-Essential amino acids (Non-EAA) Alanine, Aspartate, Asparagine, Glutamine, Glutamate, Cysteine, Tyrosine, Serine, Proline, and Glycine were 194.0, 13.9, 89.0, 340.0, 27.4, 36.0, 118.0, 240.0, 18.2 and 1320 mmol/mol respectively, with a total of 2396.5 mmol/mol in Baladi goat breed. Also, the Non-Essential amino acids quantitative in Damascus goat breed recorded that 180.0, 14.2, 88.0, 312.6, 21.0, 25.0, 110, 210, 16.5, and 1200 mmol/mol with the total of 2093.8 mmol/mol respectively. Finally, in Hybrid (Baladi and Damascus) goat breed were 230.0, 14.8, 88.0, 325.0, 21.0, 27.0, 120, 200, 13.0 and 1055 mmol/mol respectively, with the total of 2177.3 mmol/mol.

The three goat breeds revealed wide of differences between individual essential amino acids profile.

### **INTRODUCTION**

Goat as a major livestock species distributed throughout the world, provide ample meat, milk and fiber especially for human consumption in developing countries of Asia and Africa (Aziz 2010 and Amills *et al.*, 2017). To date, domestic goats have evolved into many distinct breeds (e.g. dairy, meat, and fiber breeds), mostly as a result of artificial long-

term selection. This selection, in turn, could have left genetic footprints in the goat genome, reflecting a phenotypic evolution driven by various breeding goals or adaptation to local environments (**Guo et al., 2018**).

Protein are found in all living organisms, Protein also account for more than 50 percent of the dry weight of cells and are present in greater quantities than any other biomolecule. Protein have the advantage of maintaining the interactions that occurs within biological systems (**Whitford, 2005**). The main target of farm animal husbandry is the processing of proteins for human consumption, research methods to investigate proteins play a major role in the science of farm animals and meat (**D'Alessandro and Zolla, 2013**).

Goat meat also provides a high quality protein; skeletal muscle is a good source of all essential amino acids (**Moawad et al., 2013**). Amino acids are vital nutrients for growth and maintenance of health in humans (**Hejtmánková et al., 2012**). In addition, the amino acid profile is most important in terms of the indispensable amino acids (**Anaeto et al., 2010**).

Amino acids have enormous physiological importance, serving as building blocks for proteins and substrates for synthesis of low molecular-weight substances, Based on growth or nitrogen balance, Amino acids were traditionally classified as nutritionally essential or nonessential for animals (**Wu et al., 2014**).

Analysis of amino acids is a classic and well-documented common-use process. Since almost all amino acids do not have chromophore groups, several analytical techniques focusing on derivatization chemistry and the subsequent separation of these derivatives have been established by **Kato and Takatsu (2019)**. Amino acid composition is among the essential indices of meat product nutritional composition (**Lei et al., 2020**).

The aim of this study was to evaluate, investigate and characterize different relationships between of three Egyptian goat breeds (Baladi, Damascus and Hybrid breeds) using of amino acids profile.

## MATERIALS AND METHODS

### 1. Ethical assent

During the collection of blood samples from goats, attention was paid to minimizing pain to the animals and all collection of samples were done in compliance with the guidelines defined by the International Animal Ethics Committee and the prevailing local laws.

### 2. Blood samples collections

Fifteen samples of three goat breeds; Baladi (n=5), Damascus (n=5), and Hybrid breed (Baladi-Damascus) (n=5) were used in this study. The blood samples were collected from (Baladi, Damascus, and Hybrid) goat breeds in two tubes; Frist tube containing 0.5 ml from

EDTA (0.5 M) as an anticoagulant matter (blood plasma), and the second tube containing only fresh blood without material (blood serum).

### 3. Extract of Blood plasma and serum

Blood plasma and serum were extracted obtained by centrifugation at 14000 rpm for 10 minutes at 4 °C then the blood plasma and serum were transferred to new tubes and stored at -20 °C.

### 5. Amino acids quantitative assay

Quantitative estimation of amino acids in blood serum samples were analyzed for the three Egyptian local goat breeds (Baladi, Damascus, and Hybrid).

- Amino Acid Analyzer (ARACUS):

Amino Acid Analyzer ARACUS works according to the gold standard of post-column derivatization with ninhydrin (Macchi *et al.*, 2000), detection at 440 nm and 570 nm using maintenance-free LED photometers, Autosampler, Reactor temperature (20- 130 °C), Detection limit < 2 nmol/mL and Ready to use kits.

## RESULTS AND DISCUSSION

There are more than 700 amino acids in nature, but only 20 of them (alanine, arginine, asparagine, aspartate, cysteine, glutamate, glutamine, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, tyrosine, threonine, tryptophan, and valine) are building blocks for proteins in cells (Wu, 2013).

### 1. Quantitative determination of amino acids

This study was conducted for a group of amino acids on three breeds of Egyptian local breed's goat, which are Baladi, Damascus and Hybrid (Baladi and Damascus) goat breeds with the aim of distinguishing, identifying and characterizing these breeds from each other through their quantity or content of amino acids in them.

#### 2.1. Essential Amino Acids

##### a) Baladi goat breed

The essential amino acids in the Baladi goat breed were Methionine, Lysine, Threonine, Leucine, Isoleucine, Valine, Phenylalanine, Tryptophan, Cysteine, Arginine, and Histidine respectively. While Abbreviation this amino acids were Met, Lys, Thr, Leu, Ile, Val, Phe, Trp, Cys, Arg and His, respectively as shown in table (1) and figures (1 and 2). Essential amino acids quantitative 14.1, 118.5, 99.2, 29.0, 11.6, 28.6, 130.0, 68.4, 29.8, 30.0 and 760 mmol/mol were recorded respectively. Total essential amino acids (EAA) were 1319.2 mmol/mol and the largest amino acids quantitative was found at Histidine (His) (760 mmol/mol) and the smallest at Isoleucine (Ile) (11.6 mmol/mol). Moawad *et al.*, (2013) revealed that, among 17 amino acids identified in Baladi goat LD muscles protein, glutamic acid is present in the highest amounts. Also, Rafiq *et al.*, (2016) Investigation revealed

that leucine was the major amino acid in casein while lysine was second among all essential amino acids, Leucine plays a distinct role in protein metabolism and the translation initiation pathway of muscle protein synthesis.

#### **b) Damascus goat breed**

Fractionation of the essential amino acids of Met, Lys, Thr, Leu, Ile, Val, Phe, Trp, Cys, Arg and His, quantitative in Damascus goat breed were 12.6, 114.5, 98.6, 32.1, 10.3, 39.1, 73.5, 72.0, 27.0, 28.0 and 820 mmol/mol, respectively. Total essential amino acids (EAA) were 1327.7 mmol/mol and the largest amino acids quantitative was found at Histidine (His) (820 mmol/mol) and the smallest at Isoleucine (Ile) (10.3 mmol/mol), this result as shown in table (1) and Figures (1 and 2). **Hejtmánková et al., (2012)** stated the total essential amino acids made approximately 40% of the total amino acids in the goat and sheep. While, **Anaeto et al., (2010)** reported that the usual limiting amino acids in various diets in various areas of the world are lysine, total sulphur amino acids, threonine, and tryptophan and these are present in meat.

#### **c) Hybrid (Baladi and Demusces) goat breed**

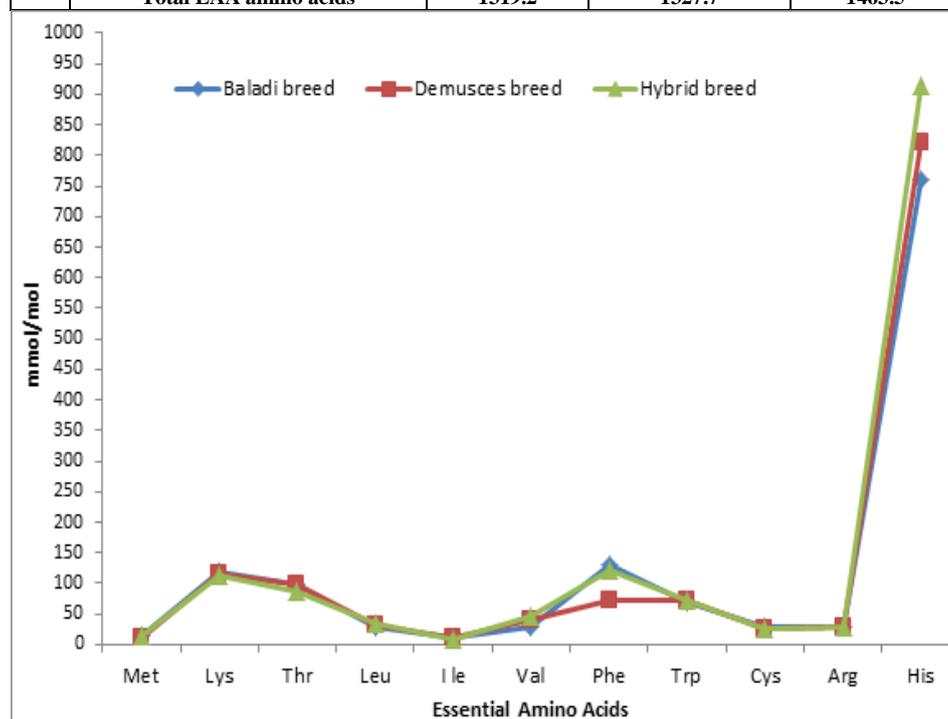
The essential amino acids of Met, Lys, Thr, Leu, Ile, Val, Phe, Trp, Cys, Arg, and His, quantitative in Hybrid (Baladi and Damascus) goat breed recorded that 13.1, 112, 87.0, 34.0, 9.4, 45.0, 122.0, 72.0, 26.0, 28.0 and 915 mmol/mol respectively, Total essential amino acids (EAA) were 1463.5 mmol/mol and the largest essential amino acids quantitative was found at Histidine (His) (915 mmol/mol) and the smallest at Isoleucine (Ile) (9.4 mmol/mol), this results as shown in table (1) and Figures (1 and 2). **Ferreira, (2004)** abstracted that the essential amino acids composition of the components differed from the whole empty body concentration. Therefore, the average essential amino acids composition (EAA/100 g crude protein) for goats was as follows: 5.65 arginine; 2.69 histidine; 2.94 isoleucine; 7.86 leucine; 6.83 lysine; 1.83 methionine; 3.04 phenylalanine; 5.55 threonine; 4.86 valine, this composition can serve as the ideal EAA requirements for growth in meat and milk goats.

The three goat breeds revealed wide variations of differences between individual essential amino acids profile. Methionine, Lysine, Threonine, Isoleucine, Phenylalanine, Cysteine and Arginine amino acids (14.1, 118.5, 99.2, 11.6, 130.0, 29.2 and 30.0 mmol/mol) with essential amino acids highest in Baladi breed. While, Leucine, Valine, Tryptophan and Histidine amino acids (29.0, 28.6, 68.4 and 760 mmol/mol) with essential amino acids lowest in Baladi breed. On the other hand Methionine and Phenylalanine amino acids (12.6 and 73.0 mmol/mol) with essential amino acids lowest in Damascus breed. Furthermore, Leucine, Valine and Histidine amino acids (34.0, 45.0 and 915

mmol/mol) with essential amino acids were highest in the Hybrid breed. While, Lysine, Threonine, Isoleucine and Cysteine amino acids (112, 87.0, 9.4 and 26.0 mmol/mol) with essential amino acids lowest in Hybrid breed, Tryptophan and Arginine amino acids (72.0 and 28.0 mmol/mol) with essential amino acids highest in Damascus and Hybrid breeds as shown in table (1) and figure (1).

**Table (1): Essential Amino Acids (EAA) in three goat breeds.**

| No | Amino Acids<br>mmol/mol      | Abbreviation | Baladi breed  | Demusces breed | Hybrid breed  |
|----|------------------------------|--------------|---------------|----------------|---------------|
| 1  | Methionine                   | Met          | 14.1          | 12.6           | 13.1          |
| 2  | Lysine                       | Lys          | 118.5         | 114.5          | 112           |
| 3  | Threonine                    | Thr          | 99.2          | 98.6           | 87.0          |
| 4  | Leucine                      | Leu          | 29.0          | 32.1           | 34.0          |
| 5  | Isoleucine                   | Ile          | 11.6          | 10.3           | 9.4           |
| 6  | Valine                       | Val          | 28.6          | 39.1           | 45.0          |
| 7  | Phenylalanine                | Phe          | 130.0         | 73.5           | 122.0         |
| 8  | Tryptophan                   | Trp          | 68.4          | 72.0           | 72.0          |
| 9  | Cysteine                     | Cys          | 29.8          | 27.0           | 26.0          |
| 10 | Arginine                     | Arg          | 30.0          | 28.0           | 28.0          |
| 11 | Histidine                    | His          | 760           | 820            | 915           |
|    | <b>Total EAA amino acids</b> |              | <b>1319.2</b> | <b>1327.7</b>  | <b>1463.5</b> |



**Figure (1):** Essential amino acids in three goat breeds.

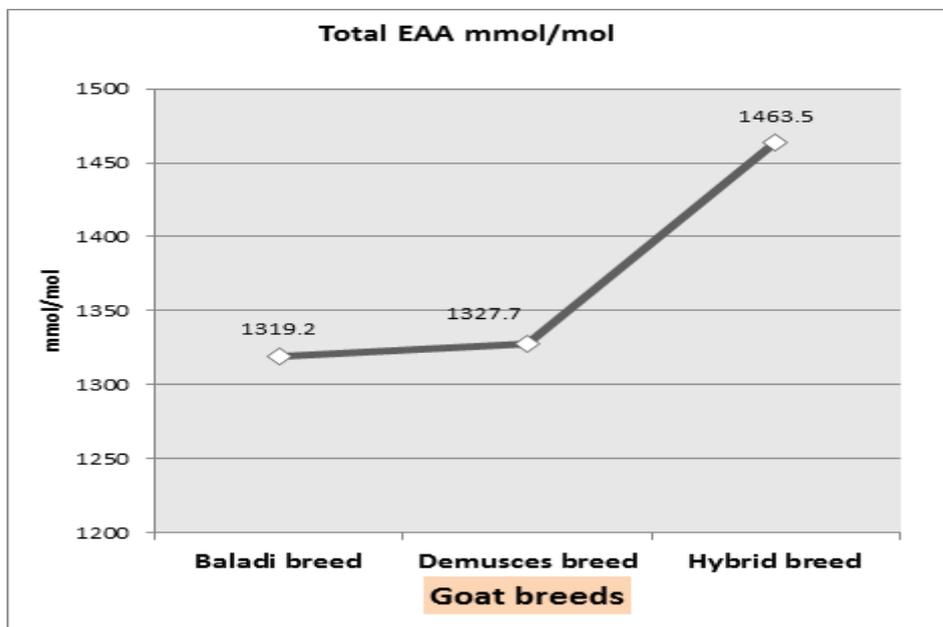


Figure (2): Total Essential amino acid in three goat breeds.

## 2.2. Non-essential amino acids

### a) Baladi goat breed

The Non-Essential amino acids in the Baladi goat breed were Alanine, Aspartate, Asparagine, Glutamine, Glutamate, Cysteine, Tyrosine, Serine, Proline and Glycine respectively. While Abbreviation these amino acids were Ala, Asp, Aspx, Glu, Glux, Cys, Tyr, Ser, Pro and Gly, respectively. Non-Essential amino acids quantitative were 194.0, 13.9, 89.0, 340.0, 27.4, 36.0, 118.0, 240.0, 18.2 and 1320 mmol/mol, respectively. Total Non-Essential amino acids (Non-EAA) were 2396.5 mmol/mol and the largest Non-Essential amino acids quantitative was found at Glycine (Gly) (1320 mmol/mol) and the smallest at Aspartate (Asp) (13.9 mmol/mol) (Table 2 and figures 3 and 4). **Sabahelkheir et al., (2012)** reported that the glutamic acid was the major non-essential amino acid in five species human, camel, cow, goat and sheep milk are characterized by low content of Arginine and high content of leucine, isoleucine and valine except milk of goat has a low content in isoleucine.

### b) Damascus goat breed

The Non-Essential amino acids of Ala, Asp, Aspx, Glu, Glux, Cys, Tyr, Ser, Pro and Gly quantitative in Damascus goat breed recorded that 180.0, 14.2, 88.0, 312.6, 21.0, 25.0, 110, 210, 16.5 and 1200 mmol/mol, respectively. Total Non-Essential amino acids (Non-EAA) were 2093.8

found at Glycine (Gly) (1200 mmol/mol) and the smallest at Aspartate (Asp) (14.2 mmol/mol), the results as shown in table (2) and figures (3 and 4). **Landi et al., (2016)** reported that glutamic acid was by far the most abundant among the free amino acids (about 40.90, 34.66, and 45.76% in water buffalo), the alanine content was also quite abundant in the three different samples. Among the free amino acids, glycine, arginine, and asparagine were highly present, in descending order ( $\geq 2$  mg for 100 g).

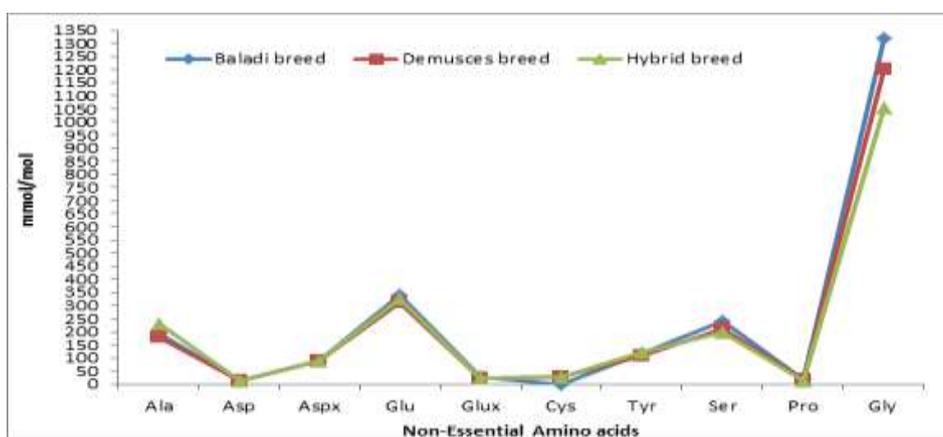
**c) Hybrid (Baladi and Demusces) goat breed**

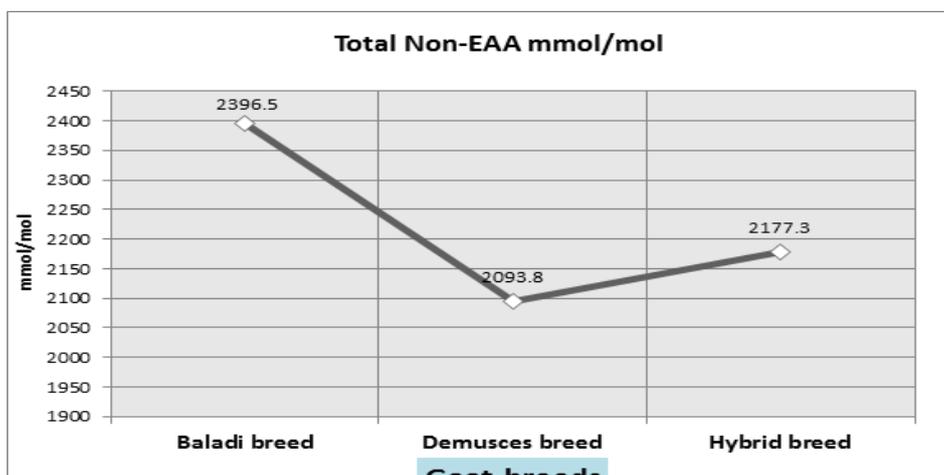
Non-Essential amino acids of Ala, Asp, Aspx, Glu, Glux, Cys, Tyr, Ser, Pro and Gly quantitative in Hybrid (Baladi and Damascus) goat breed were 230.0, 14.8, 88.0, 325.0, 21.0, 27.0, 120, 200, 13.0 and 1055 mmol/mol, respectively. Total Non-Essential amino acids (Non-EAA) were 2177.3 mol/mol, and the largest Non-Essential amino acids quantitative was found at Glycine (Gly) (1055 mmol/mol) and the smallest at Proline (Pro) (13.0 mmol/mol) as shown in table (2) and Figures (3 and 4). **Salem et al., (2009)** showed that glutamic and leucine are the major amino acid in whole casein, while methionine and glycine are the minor amino acids. **Rafiq et al., (2016)** obtained that the non-essential amino acids, the glutamic acid content was highest in both casein and whey proteins, However the buffalo (367 mg/g) and goat (359 mg/g) whey proteins have maximum glutamic acid concentration as compared to casein, The goat casein (144 mg/g) and camel whey proteins (129 mg/g) represented good content of proline. Amino acids obtained are distributed evenly to the types of essential and non-essential amino acids. Ongole crossbreed beef content a better amino acids profile than others, the beef appears to have higher contents of leucine, lysine and arginine of the essential category (**Susanto et al., 2019**).

The variations of differences between individual Non-essential amino acids profile in the three goat breeds. Asparagine, Glutamine, Glutamate, Cysteine, Serine, Proline and Glycine amino acids (89.0, 340.0, 27.4, 36.0, 240.0, 18.2 and 1320 mmol/mol) with Non-essential amino acids highest in Baladi breed. While Aspartate amino acid (13.9 mmol/mol) with Non-essential amino acids lowest in Baladi breed. Furthermore Alanine, Glutamine, Cysteine and Tyrosine amino acids (180, 312.6, 25.0, and 110 mmol/mol) with Non-essential amino acids lowest in Damascus breed. On the other hand, Alanine, Aspartate and Tyrosine amino acids (230.0, 14.8 and 120 mmol/mol) with Non-essential amino acids highest in the Hybrid breed. While, Serine, Proline and Glycine amino acids (200, 13.0 and 1055 mmol/mol) with Non-essential amino acids lowest in the Hybrid breed. Also, Asparagine and

**Table (2): Non-Essential Amino Acids in three goat breeds.**

| No                        | Amino Acids<br>mmol/mol | Abbreviation | Baladi breed | Damascus<br>breed | Hybrid breed |
|---------------------------|-------------------------|--------------|--------------|-------------------|--------------|
| 1                         | Alanine                 | Ala          | 194.0        | 180.0             | 230.0        |
| 2                         | Aspartate               | Asp          | 13.9         | 14.2              | 14.8         |
| 3                         | Asparagine              | Aspx         | 89.0         | 88.0              | 88.0         |
| 4                         | Glutamine               | Glu          | 340.0        | 312.6             | 325.0        |
| 5                         | Glutamate               | Glux         | 27.4         | 21.0              | 21.0         |
| 6                         | Cysteine                | Cys          | 36.0         | 25.0              | 27.0         |
| 7                         | Tyrosine                | Tyr          | 118.0        | 110               | 120          |
| 8                         | Serine                  | Ser          | 240.0        | 210               | 200          |
| 9                         | Proline                 | Pro          | 18.2         | 16.5              | 13.0         |
| 10                        | Glycine                 | Gly          | 1320         | 1200              | 1055         |
| Total Non-EAA amino acids |                         |              | 2396.5       | 2093.8            | 2177.3       |

**Figure (3):** Non-Essential amino acids in three goat breeds.



## CONCLUSION

In conclusion, Amino acids profile obtained are distributed evenly to the types of essential and Non-essential amino acids. The total essential amino acids highest was 1463.5, mmol/mol with hybrid goat breeds. While, lowest was 1319.2, mmol/mol in the Baladi goat breed. Furthermore, the total Non-essential amino acids highest was 2396.5, mmol/mol with Baladi goat breeds. While, lowest was 2093.8, mmol/mol in the Damascus goat breed. This investigation recorded variations of differences between individual essential and Non-essential amino acids profile in the three goat breeds. Conventional goat meat breeds are part of the cultures of many countries, and many of them must be better studied and characterized as a way to preserve and protect them. Finally, we must think and take advantage of the new developments in amino acids, biochemistry, and nutrition to conserve animal production worldwide.

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### الاحماض الامينية لثلاثة سلالات مختلفة من الماعز المصرية

وليد عبد الحميد عبدالفتاح<sup>1</sup>، محمد مبروك الدناصوري<sup>1</sup>،

سام محمد امين الحمامصي<sup>1</sup>، محمد احمد السيد<sup>2</sup>

1- قسم الكيمياء الحيوية الزراعية- كلية الزراعة - جامعة الأزهر - القاهرة مصر

2- قسم الموارد الوراثية الحيوانية-البنك القومي للحينات-مركز البحوث الزراعية-الجيزة مصر

في هذه الدراسة تم استخدام خمسة عشر عينة من ثلاث سلالات من الماعز ؛ الماعز البلدي (5 عينات) ، الدمشقي (5 عينات) والسلالة الهجينة (بلدي دمشقي) (5 عينات). تم تحليل الاحماض الامينية بجهاز الARACUS باستخدام طريقة -gold standard of post-column derivatization بواسطة كاشف الننهيدرين. الأحماض الأمينية الأساسية (EAA) ميثيونين ، ليسين ، ثريونين ، لوسين ، أيزوليوسين ، فالين ، فينيل ألانين ، تريبتوفان ، سيسيتين ، أرجينين ، وهستيدين كانت بتركيز 14.1 ، 118.5 ، 99.2 ، 29.0 ، 11.6 ، 28.6 ، 130.0 ، 68.4 ، 29.8 ، 30.0 و 760 مليمول / مول على التوالي بتركيز إجمالي بلغ 1319.2 مليمول / مول في سلالة الماعز البلدي. كذلك في سلالة الماعز الدمشقي بلغ تركيز الاحماض الامينية الاساسية 12.6 و 114.5 و 98.6 و 32.1 و 10.3 و 39.1 و 73.5 و 72.0 و 27.0 و 28.0 و 820 مليمول / مول على التوالي بإجمالي 1327.7 مليمول / مول. بينما سجلت سلالة الماعز الهجين (البلدي والدمشقي) 13.1 و 112 و 87.0 و 34.0 و 9.4 و 45.0 و 122.0 و 72.0 و 26.0 و 28.0 و 915 ملمول / مول على التوالي

بإجمالي 1463.5 ملمول / مول. من ناحية أخرى ، الأحماض الأمينية غير الأساسية الألائين ،  
الأسبارتات ، الأسباراجين ، الجلوتامين ، الجلوتامات ، السيستين ، التيروسين ، السيرين ،  
البرولين ، والجليسين كانت بتركيز 194.0 ، 13.9 ، 89.0 ، 340.0 ، 27.4 ، 36.0 ،  
118.0 ، 240.0 ، 18.2 و 1320 مليمول / مول على التوالي ، بإجمالي 2396.5  
مليمول/مول في سلالة الماعز البلدي. كما سجلت الأحماض الأمينية غير الأساسية في سلالة  
ماعز الدمشقي 180.0 و 14.2 و 88.0 و 312.6 و 21.0 و 25.0 و 110 و 210 و  
16.5 و 1200 مليمول / مول بإجمالي 2093.8 مليمول / مول على التوالي. أخيراً في  
سلالات الماعز الهجين (البلدي والدمشقي) كانت بتركيز 230.0 و 14.8 و 88.0 و 325.0  
و 21.0 و 27.0 و 120 و 200 و 13.0 و 1055 مليمول / مول على التوالي بإجمالي  
2177.3 مليمول / مول. كشفت سلالات الماعز الثلاثة عن مجموعة واسعة من الاختلافات  
بين الأحماض الأمينية الأساسية الفردية.