

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 7, July 2017

Profiling of Amino Acids in five edible fruits of Kerala

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ABSTRACT: Amino acids are the building blocks for protein, and that reputation is well-deserved. Our body with tens of thousands of proteins are constructed from amino acids. The protein- amino acid relation is definitely critical in support of our health especially the health of our immune system. Amino acids are the direct participants in our nervous system, digestive system and detox system. Fruits are power-packed foods with full of valuable nutrients which have lots of health benefits. They give us plenty of vitamins, minerals, fibre, including folate, potassium and vitamins (A and C) and phytochemicals. A healthy intake of fruit and vegetables protect the body against major illnesses, such as heart disease and cancer. Fruits are the source of simple sugars, fiber, and vitamins, which are essential for optimizing our health and are low in calories and fat. They provide plenty of soluble dietary fiber which helps to ward off cholesterol and fats from the body and to help in smooth bowel movements as well as offer relief from constipation ailments. The study was aimed at monitoring the Amino acid profile of some selected edible fruits as well as investigating the nutritional status of these fruits in terms of available amino acids. The following 5 fruits were used for the present study- *Carica papaya*, *Mangifera indica*, *Musa sapientum*, *Punica granatum* and *Psidium guajava*. Among all the five selected fruits for their amino acid profiling, the fruit *Musa sapientum* emerged as the most potential one with higher concentration of all the non-essential amino acids. The highest concentration was shown by the amino acid proline (104.242mg/g), followed by glutamine (98.567mg/g) and glycine (93.478 mg/g) and the least one was found to be aspartate (29.054 mg/g). *Psidium guajava*, was proved to be the next candidate with potential profile of non-essential amino acids followed by *Mangifera indica*, *Carica papaya* and *Punica granatum*. All the samples were also analysed for their chemical score. From *Musa sapientum*, highest chemical score was demonstrated in proline (260605) and the lowest score was recorded in aspartate (72635). In case of *Psidium guajava* also, highest chemical score was demonstrated in proline (154545) and the lowest score was recorded in aspartate (43072.5). In almost all the samples, the results followed the same pattern.

KEYWORDS: Edible fruits, Amino acid profile, Proline, Aspartate, Glutamine.

I. INTRODUCTION

Food is made up of nutrients. Nutrition from food is necessary for human health and to support life. It helps our body cells to carry out its routine functions which include growth, development and reproduction and it also protect from diseases. Amino acids are precursors for the biosynthesis of nitrogenous compounds such as haem, purines, urea, pyrimidines, hormones, neurotransmitters, biological active peptides, and proteins (V. W. Rodwell; V.W. Rodwell and P. J. Kennelly) [1, 2]. Out of over 300 naturally occurring amino acids, 20 amino acids are utilized in biologic systems to form a strands of protein molecules (V. W. Rodwell, B. Alberts) [1, 3]. Nutrition scientists have shown that humans and other mammals lack the capability to synthesize around 10 of the 20 L- α -amino acids present in proteins in amounts adequate to support infant growth or to maintain wellbeing in adulthood. Consequently, diets for human and livestock must contain adequate quantities of these nutritionally essential amino acids, whereas the remaining

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nutritionally non-essential amino acids are readily biosynthesized from metabolic pathways involving amphibolic intermediates (Rodwell and P. J. Kennelly) [2]. The amino acid is an important aspect playing a pivotal role in human life for healthy growth and immune system. The amino-acid molecule consists of a carbon atom bonded to an amino group ($-\text{NH}_2$), a carboxyl group ($-\text{COOH}$), a hydrogen atom, and a fourth group that differs from one amino acid to another and often is referred to as the R group or the side chain. The R group, which can vary widely, is responsible for the differences in chemical properties. The composition of carbon, hydrogen, oxygen, and nitrogen, are arranged as strands of amino acids called proteins. They are serving as the basic structural molecules for the hormones, enzymes, nutrient carriers, antibodies and many other substances in the body and it make up nearly 17 percent of the total body weight. Proteins are easily available in many fruits. Fruits are full of vitamins, minerals, along with several organic compounds, it is now well to cure diseases and it serves an array of important functions in our body. Today fruits play a vital role in the diet of the humans. They are usually eaten raw, although some varieties can be cooked. Absorbing sufficient energy from fruits comes with absorbing sufficient protein. The aim of this study was to examine the amino acid profiling and chemical score of five selected edible fruits of Kerala.

II. MATERIALS AND METHODS

The study was aimed at monitoring the Amino acid profile of some selected edible fruits as well as investigating the nutritional status of these fruits in terms of available amino acids. The following 5 fruits were used for the present study - *Carica papaya*, *Mangifera indica*, *Musa sapientum*, *Punica granatum* and *Psidium guajava*.

Quantification of amino acids- Amino acids of the selected fruits were determined using the method of Moore and Stein [4].

Estimation of chemical score- Chemical score (amino acid) was computed for each essential amino acid by the following formula:

$$\frac{\text{Milligram of amino acid in 1g of test sample}}{\text{Milligram of amino acid in reference pattern}} \times 100$$

III. EXPERIMENTAL RESULTS AND DISCUSSION

The amino acid profile of the five selected fruits was given in Table 1. Among all the five selected fruits for their amino acid profiling, the fruit *Musa sapientum* emerged as the most potential one with higher concentration of all the non-essential amino acids. The highest concentration was shown by the amino acid proline (104.242mg/g), followed by glutamine (98.567mg/g) and glycine (93.478 mg/g) and the least one was found to be aspartate (29.054 mg/g). These values are sufficient to match the recommended dietary allowances.

Psidium guajava, was proved to be the next candidate with potential profile of non-essential amino acids. The highest concentration of this fruit was given by proline (61.818mg/g), followed by glutamine (58.452 mg/g), then glycine (55.434 mg/g) and the least one, aspartate (17.229 mg/g). In the case of *Mangifera indica*, the amino acid proline showed highest value (52.121 mg/g), followed by glutamine (49.283 mg/g), glycine (46.739 mg/g) and the least one was again aspartate (14.527 mg/g). *Carica papaya* had given the values as proline, 37.575 mg/g; glutamine, 35.530 mg/g; glycine, 33.695 mg/g and was at the next position with an appreciable amount of non-essential amino acids as listed in the table 1. It was noted that *Punica granatum* showed the least concentration of amino acids (proline, 14.545 mg/g; glutamine, 13.753 mg/g; glycine, 13.043mg/g; the lowest one, aspartate, 4.054 mg/g) when compared with others. It has been reported in a study of the free amino acids in the ripe fruit of four different cultivars of *V. Vinifera*, notable differences in the concentrations of Proline and other members of the Glutamine family of amino acids (Gln, Glu, and Arg) (Anna P. Stines *et al.*, Lafon-Lafourcade and Guimberteau, ; Kliever, Ough and Stashak) [5, 6, 7, 8]. The amino acid proline is a non-essential amino acid improves skin texture and aids collagen formation and it helps to support healthy skin and recovery from soft tissue damage. It is also important in the maintenance of muscles, joints and tendons. It was reported in a study that glutamate was the most abundant non-essential amino acid in both Brebra

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seed and Soybean seed (Berhanu Andualem and Amare Gessesse , 2014) [9]. It was also reported by Paul Chidoka Chikezie *et al.*, [10], that the concentrations of the various amino acids in the cassava peels ranged from 0.54 to 6.54 g/100 g protein, but those of yam peels were ranged between 0.37 and 6.25 g/100 g protein. They contained comparatively high concentrations of leucine and glutamate. But in case of essential amino acids; isoleucine and valine were most abundant in all their samples. The amount of isoleucine in *Musa sapientum* was found to be 79.814 mg/g, and that of valine 65.900mg/g. In case of *Psidium guajava* the values were; isoleucine, 47.331mg/g and valine, 39.080mg/g. *Mangifera indica*, *Carica papaya* and *Punica granatum* showed almost similar profile of amino acids. Among all the selected fruits, *Musa sapientum* was showing highest values of essential amino acids. The result indicated that non-essential amino acids are higher in concentration compared to essential amino acids.

M. A. Fowomola, [11] found that the mango seed is very rich in glutamate amino acid. Glutamate is also produced in the body and binds with other amino acids to form a structural protein (Filer & Stegink) [12]. In the metabolism of sugars and fats glutamate or glutamic acid play an important role, and it helps for the transportation of potassium into the spinal fluid and across blood-brain barrier. It is most easily used as an energy source and it helps to accelerate early recovery from fatigue during exercise. Rennie *et al.*, [13] has suggested glutamine supplementation as a strategy to promote muscle growth. All the samples were also analysed for its chemical score to find out the limiting amino acid (Table 2). From *Musa sapientum*, highest chemical score was demonstrated in proline (260605) and the lowest score was recorded in aspartate (72635). In case of *Psidium guajava* also, highest chemical score was demonstrated in proline(154545) and the lowest score was recorded in aspartate(43072.5). In almost all the samples, the results followed the same pattern.

Table 1- Amino acid profile of five selected edible fruits

Amino Acids(mg/g)	<i>Carica papaya</i>	<i>Mangifera indica</i>	<i>Musa sapientum</i>	<i>Psidium guajava</i>	<i>Punica granatum</i>
Arginine	14.903	20.673	41.346	24.519	5.769
Histidine	14.957	20.747	41.495	24.607	5.790
Isoleucine	28.770	39.907	79.814	47.331	11.136
Leucine	19.344	26.833	53.666	31.825	7.488
Lysine	16.124	22.366	44.733	26.527	6.241
Methionine	11.753	16.303	32.606	19.336	4.549
Phenylalanine	22.545	31.272	62.545	37.090	8.727
Threonine	15.836	21.966	43.933	26.053	6.130
Tryptophan	15.856	21.994	43.989	26.086	6.138
Valine	23.754	32.950	65.900	39.080	9.195
Proline	37.575	52.121	104.242	61.818	14.545
Serine	30.097	41.747	83.495	49.514	11.650
Tyrosine	25.672	35.610	71.221	42.236	9.937

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Alanine	18.590	25.787	51.574	30.584	7.196
Aspartate	10.472	14.527	29.054	17.229	4.054
Cysteine	23.177	32.149	64.299	38.130	8.971
Glutamine	35.530	49.283	98.567	58.452	13.753
Glycine	33.695	46.739	93.478	55.434	13.043

Table 2- Chemical Score of five selected edible fruits

Amino Acids	<i>Carica papaya</i>	<i>Mangifera indica</i>	<i>Musa sapientum</i>	<i>Psidium guajava</i>	<i>Punica granatum</i>
Arginine	37257.5	51682.5	103365	61297.5	14422.5
Histidine	37392.5	51867.5	103737.5	61517.5	14475
Isoleucine	71925	99767.5	199535	118327.5	27840
Leucine	48360	67082.5	134165	79562.5	18720
Lysine	40310	55915	111832.5	66317.5	15602.5
Methionine	29382.5	40757.5	81515	48340	11372.5
Phenylalanine	56362.5	78180	156362.5	92725	21817.5
Threonine	39590	54915	109832.5	65132.5	15325
Tryptophan	39640	54985	109972.5	65215	15345
Valine	59385	82375	164750	97700	22987.5
Proline	93937.5	130302.5	260605	154545	36362.5
Serine	75242.5	104367.5	208737.5	123785	29125
Tyrosine	64180	89025	178052.5	105590	24842.5
Alanine	46475	64467.5	128935	76460	17990
Aspartate	26180	36317.5	72635	43072.5	10135
Cysteine	57942.5	80372.5	160747.5	95325	22427.5
Glutamine	88825	123207.5	246417.5	146130	34382.5
Glycine	84237.5	116847.5	233695	138585	32607.5

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IV. CONCLUSION

Fruits are essential to a healthy body. Losing fat and gaining muscle often means that the food we eat is based upon what macronutrient ratio is best for our goal. Because we are so focused on how much carbohydrate, fat, and protein we are getting in each meal, we often forget that micronutrients are also an essential part of a healthy body and a great physique. Micronutrients are essential vitamins and minerals that our body doesn't make; they need to come from diet. Although a body doesn't need much of them, they are necessary for a body's systems to function optimally. The amino acid content of fruit and fruit-derived foods is studied intensely because of the contribution to nutritional value, aroma, taste and health-promoting effects and their possible use as markers of origin and authenticity. Among all the five selected fruits for their amino acid profiling, the fruit *Musa sapientum* emerged as the most potential one with higher concentration of all the non-essential amino acids. The highest concentration was shown by the amino acid proline, followed by glutamine and glycine and the least one was found to be aspartate. *Psidium guajava*, was proved to be the next candidate with potential profile of non-essential amino acids followed by *Mangifera indica*, *Carica papaya* and *Punica granatum*. Among all the selected fruits, *Musa sapientum* was showing highest values of essential amino acids. All the samples were also analysed for its chemical score. From *Musa sapientum*, highest chemical score was demonstrated in proline and the lowest score was recorded in aspartate. In case of *Psidium guajava* also, highest chemical score was demonstrated in proline and the lowest score was recorded in aspartate. In almost all the samples, the results followed the same pattern.

Results showed that, these fruits can be recommended to be included in our daily diet. Future studies are to be made to replenish our ancestral knowledge about these fruits that will be helpful for the betterment of upcoming generations. It is important to fill our plate with nutrient-dense fruits instead of hoping the multivitamin will take care of any holes in human nutrition.

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