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PATTERN OF THE AMINO ACIDS INFLUENCED ON NITROGEN METABOLISM OF EDIBLE BAMBOO SPROUTS

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權五溶 : 食用竹筍의 窒素代謝에 미치는 아미노酸의 部位에 關하여

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ABSTRACT

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It had been scarcely reported by any worker that the essential amino acids to be indispensable in our daily life contained in edible bamboo sprouts and that they had various pattern of free amino acids. For this reason, especially two species of Korean bamboo sprouts collected from the suburb of Chunju, in April, 1963 were used for researching the essential amino acids and free amino acids appeared on paper chromatography. The most suitable part for our edibles was investigated as a part of bio-chemical studies on Korean bamboo sprouts. The free amino acids contained in two species were found as 5-15 kinds and there were a few of difference according to its growing parts. Many kinds of free amino acids were found in the end parts more than the tip parts and mid parts of bamboo sprouts. Besides, the essential amino acids in each species were found to 3-9 kinds. From the characteristics and the experiments marked above, it was suggested to the author that many kinds of free amino acids in the end part accelerated the formation of nitrogen compounds more than the other parts.

INTRODUCTION

Although it is natural that bamboo sprouts have a great significance as phyto-protein sources thanks to the achievements of biochemistry, it is not reported for us about the free amino acids including in edible bamboo sprouts. Currently it should be ignored the problem of edible bamboo sprouts at each countryside which it is edible in many countries of East-South Asia.

The amino acids took in our stomach have no need of complex digestion in the digestive organ of human body, because various complex proteins analyze into amino acids several protease and compound into a living substance of human in it.

Essential amino acids were reported as 10 kinds by Robert et al⁽⁶⁾ in 1955 and amino acids were determined as approximately 24 kinds. In these studies on the qualitative assay with paper chromatography, the end parts of bamboo sprouts appeared more kinds of amino acids than the other parts, i.e. the mid parts and tip parts. By this result, the kinds of essential amino acids included in each parts according as its growth.

Some researches, therefore, have been determined the kinds of amino acid of the tip parts, and the end parts of bamboo sprouts, along with the kinds of essential amino acids included in each parts.

MATERIALS AND METHODS

The two species of Korean bamboo sprouts included *Phyllostachys nigra* Monor var. *Hensis* Stapf, *Phyllostachys reticulata* Koch were collected from the suburb of Chunju, in 1963. Being divided this

bamboo sprouts into three parts (the tip part, mid part and end part), they were used for research the essential amino acids, together with free amino acids to appear on paper chromatography.

The preparation of sample for paper chromatography was manipulated after the following methods; the amino acids for material were extracted by the common method of Moore & Stein, and the Ion Exchange resin was used before concentration. They are an extracted method and developed method of amino acids in various processes which are carried out this experiments.

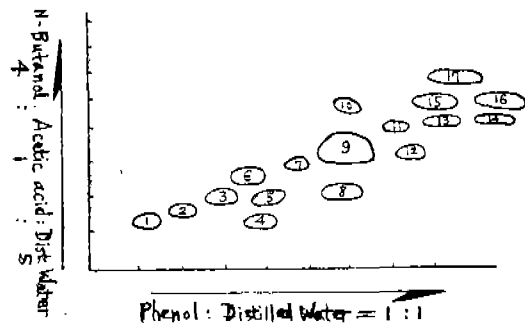
First, a 3g of dry material powder was taken as a sample and was extracted 3 times to 80% ethanol. Therefore sample was added with 40ml. ethanol for 12 hours. Dreg after the first extraction was added with 30ml. ethanol for 12 hours and dreg after the second extraction was added with 20ml. ethanol for 12 hours, and the dregs were excluded every time by centrifugation (5000/times/min.) for 5 minutes. The extracted solution was mixed well with three times of chloroform, and the mixture was put aside after the separating layer was clear, and then the upper layer was used for Ion Exchange. The liquid filtered from this column was concentrated at lower pressure and 40°C after the sample solution became 1.5ml.

Secondarily, the development was proceeded two dimensions with Toyo paper 50 (25cm 33cm), in the constant temperature chamber of 18°-20° C, and the sample spotting on this paper was taken 0.006ml. as a standard of assayed amino acids. The solvent used was water-saturated phenol (1:1) for one dimension, and butanol acetic acid solution (Butanol: Acetic acid: Distilled water) for two dimensions. Being finished the development, the paper was dried at 30°-40°C and sprayed with 0.2% ninhydrin solution. The Rf. value of the spot which appeared at 80°-90°C was compared with of each standard amino acid and the Rf. value found with several reports are added to these results.

EXPERIMENTAL RESULTS

The free amino acids detected in two species of Korean bamboo sprouts had been determined as 17 kinds in totality, but in addition to it's growing process, most of them were a few difference of amino acids among each parts.

Fig. 1. Qualitative assay of amino acids contained in edible bamboo sprouts.



- | | | |
|-------------------|------------------------|---------------|
| 1. Aspartic acid | 2. Glutamic acid | 3. Serine |
| 4. Asparagine | 5. Argine | 6. Glycine |
| 7. Theorine | 8. Glutamine | 9. Alanine |
| 10. Tyrosine | 11. β-Alanine | 12. Histidine |
| 13. Tryptophane | 14. Methionine | 15. Valine |
| 16. Phcnylalanine | 17. Leucine-Isoleucine | |

Table 1. Amino acids contained in bamboo sprouts of *Phyllostachys nigra* Monor var. *Henois* Honda. (* Essential amino acids)

Amino acids	Materials	End part	Mid part	Tip part
Aspartic acid			+	
Glutamic acid			+	+
Serine		+	+	+
Glycine		+	+	+
Arginine*		+	+	+
Asparagine		+	+	+
Threonine*		+	+	
Glutamine		+		
Alanine		+	+	
Tyrosine*		+	+	+
β-Alanine		+	+	
Histidine*		+		
Tryptophane*		+	+	
Methionine*		+	+	
Valine*		+		+
Phenylalanine*		+		+
Leucine-Isoleucine*		+		
Total		15	12	8

The essential amino acids contained in edible bamboo sprouts of *Phyllostachys nigra* Monor var. *Henois* Honda were Arginine, Threonine, Tyrosine, Histidine, Tryptophane, Methionine, Valine, Phenylalanine, and Leucine-Isoleucine. On the other hand, Aspartic acid, Glutamic acid, Serine, Glycine, Asparagine, Glutamine, Alanine, β -Alanine were contained as the free amino acids of *Phyllostachys nigra* Monor var. *Henois* Honda.

By a partial survey of edible bamboo sprouts, 9 kinds of essential amino acid were found in the end part of them, otherwise 5 kinds of essential amino acid were found in the mid part, and there were found 3 kinds of it in the tip part. While the free amino acids of edible bamboo sprouts detected as 15 kinds in the end part, 12 kinds in the mid part, and 8 kinds in the tip part as shown on Table I.

Table 2. Amino acids contained in Bamboo sprouts of *Phyllostachys reticulata* Koch. (* Essential amino acids)

Materials	End part	Mid part	Tip part
Amino acids			
Aspartic acid			
Glutamic acids		+	+
Serine	+	+	+
Glycine	+	+	+
Arginine*	+	+	+
Asparagine	+	+	
Threonine*	+	+	
Glutamine	+		
Alanine	+	+	
Tyrosine*	+	+	+
β -Alanine	+		
Histidine*			
Tryptophane*	+	+	
Methionine*	+	+	
Valine*	+		
Phenylalanine*	+		
Leucine-Isoleucine*	+		
Total	14	10	5

Table 3. Amino acids appeared according to the growing processes Bamboo sprouts (*Phyllostachys nigra* Monor var. *Henois* Stapf) (* essential amino acids)

Materials	10cm	20cm	30cm
Amino acids			
Aspartic acid		+	
Glutamic acid	+	+	
Serine	+	+	+
Glycine	+	+	+
Arginine*	+	+	+
Asparagine	+	+	+
Threonine*			+
Glutamine			+
Alanine		+	+
Tyrosine*	+	+	+
β -alanine		+	+
Histidine*			+
Tryptophane*		+	+
Methionine*	+	+	+
Valine*	+		+
Phenylalanine*			+
Leucine-Isoleucine*			
Total	8	11	14

The essential amino acids contained in *Phyllostachys reticulata* Koch of edible bamboo sprouts were assayed 8 kinds of Arginine, Threonine, Tyrosine, Tryptophane, Methionine, Valine, Phenylalanine, and Leucine-Isoleucine except for Histidine. In a partial assay of edible bamboo sprouts, the essential amino acids contained in bamboo sprouts of *Phyllostachys reticulata* Koch were also detected as 8 kinds in the end part, 5 kinds in the mid part, and 3 kinds in the tip part. At the free amino acids were as well assayed as 14 kinds in the end part, 10 kinds in the mid part, and 5 kinds in the tip part as marked Table II.

When the two species of edible bamboo sprouts were surveyed according to the growing processes of each bamboo sprouts, there were a few difference between the two species. In the first material (*Phyllostachys nigra* Monor var. *Henois* Honda), the bamboo sprouts having the height of one meter had contained 14 kinds of free amino acid and 8 kinds of essential amino acid. On the contrary, the bamboo sprouts having the height of 30cm had been contained 11 kinds of free amino acid and 4 kinds of essential amino acid. Otherwise, bamboo sprouts having the height of 10cm were identified as 8 kinds of free amino acid and 4 kinds of essential amino acid by paper chromatography.

Table 4. Amino acids appeared according to the growing processes Bamboo sprouts (*Phyllostachys reticulata* Koch)
(* essential amino acids)

Amino acids	Materials	10cm	20cm	30cm
Aspartic acid				
Glutamic acid				
Serine				
Glycine		+	+	+
Arginine*		+	+	+
Asparagine				+
Threonine*				
Glutamine		+	+	+
Alanine			+	+
Tyrosine*		+	+	+
β -Alanin			+	+
Histidine*				
Tryptophane*				+
Methionine*		+	+	+
Valine*				
Phenylalanine*		+	+	+
Leucine-Isoleucine*				
Total		6	8	10

urization of amino acids. As to the function of essential amino acids in our human body, Alanine, Serine, Phenylalanine are appeared the sweat taste in bamboo sprouts, there are a acidulous Aspartic acid and a tasteless Leucine-Isoleucine. According to the report by Terada et al,⁽⁶⁾ he reported that a little of Tryptophane increased the appetite of human body, in case of much Tryptophane it arised the opposite function there, Phenylalanine was substitute for Vitamin C, and β -Alanine containing in bamboo sprouts controlled the acceleration of spinal reflex along with the contraction of Trachea.

Besides this statement, Methionine controlled the function of the allimentary canal, Arginine repressed the function of soluble blood, Aspartic acid excluded the toxics of nicotine in various organ of human body.

In the above experiments, the amino acids contained in edible bamboo sprouts were found as 5-15 kinds according to it's growing part; the end part of bamboo sprouts had contained more kinds of amino acids than the other parts, and the amino acids contained in the mid part appeared more kinds than the tip part.

It was many difference in the kinds of amino acid containing in the edible bamboo sprouts by the mature age of them; the edible bamboo sprouts having the height of one meter were most suitable for edibles in the countryside of our country.

The essential amino acids controlled the physiological function of human body were assayed as 3-9 kinds on the paper with chromatogram; there were also various differences in the case of assay on amino acids according to it's growth of bamboo sprouts.

The end part compared with the other parts were likely to accelerate the metabolism of amino acids in bamboo sprouts; because it had been contained more kinds of amino acids than the other parts.

Synthesizing the above statements, it is assumed that the value of nutrition is contained in the edible bamboo sprouts of Korea as the other foods which are closely related to our daily life.

In the second material, the edible bamboo sprouts having the height of one meter had contained 13 kinds of free amino acid and 8 kinds of essential amino acid. Those having the height of 30cm had contained 10 kinds of free amino acid and 4 kinds of essential amino acid. Finally those having the height of 10cm were determined as 6 kinds of free amino acid and 4 kinds of essential amino acid by standard of assayed amino acid. The free amino acids appeared en bamboo sprouts commonly seemed to be Serine, Glycine, Arginine, Tyrosine, Methionine, and Tryptophane.

DISCUSSION AND CONCLUSION

It had been clarified that the free amino acids including various essential amino acids had been contained in edible bamboo sprouts which were distributed over many regions of Korea. It seemed to the author that various amino acids determined the taste of each bamboo sprouts with some config-

摘 要

農村에서 食用으로 使用하는 두種의 竹筍에 대하여 含有하는 아미노酸을 生長部位에 따라 定性分析하였다. 大體로 한 種類가 含有하는 아미노酸은 5種 乃至 15種이었으며 竹筍의 生長過程에 따라 含有된 아미노酸의 種類는 各各 相違하였다.

食用 竹筍에 含有된 必需 아미노酸의 種類는 4種에서 9種임을 定性分析 할 수 있었다. 食用竹筍에 있어서도 다른 植物性 食品과 같이 營養價値가 있음을 알아 내었다. 先端部 보다 基部에 아미노산의 種類가 많이 分析된 것은 基部에서 부터 窒素代謝가 促進되어 간다는 것을 推測케 하였다.

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