

**DETERMINATION OF SOME NUTRITIONAL COMPONENTS
AND SENSORY CRITERIA OF IGNAME YAM
IN BAC GIANG PROVINCE (*Dioscorea esculenta*)**

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Abstract. Igname yams are agricultural products with high economic and nutritional value. Igname yam plants are grown a lot in our country, especially in Bac Giang province. The aim of this study was to the determination of nutritional components and sensory of igname yam in Bac Giang province. Research results have identified water content in igname yam is $69.3 \pm 0.2\%$, total lipid content is $4.2 \pm 0.1\%$, total glucide content is $20.5 \pm 0.1\%$, total protein content was $2.6 \pm 0.1\%$, vitamin B₁ was $28.5 \pm 0.1\text{mg}\%$ and vitamin B₂ was $12.3 \pm 0.1\text{mg}\%$. Besides, the content of minerals, such as Ca, Mg, Mn, P, K, Na, Zn, Cu, S, and Fe, fluctuates in the range of 1.4 to 34mg%. By the HPLC method, 17 amino acids have been identified in igname yam. Among those, there were 9 non-substituting amino acids, including histidine, arginine, threonine, valine, methionine, lysine, isoleucine, leucine, and phenylalanine. The igname yam meat has an ivory white color, a characteristic aroma, a fatty taste, a spongy and friable structure. These are important scientific bases for selecting igname yam for processing food products.

Keywords: amino acid, igname yam, nutritional components, sensory criteria.

1. Introduction

Igname yam is a tuber rich in nutritional values such as glucids, proteins, lipids, vitamins, and minerals [1-3]. Igname yam trees are grown a lot in Vietnam, including Bac Giang province. Bac Giang province has favorable natural conditions for igname yam tree development, in which igname yam Bac Giang varieties account for a large proportion of the province's agriculture structure. In Bac Giang province in particular and our country in general, the harvesting of Igname yam is a tuber is mainly based on sensory evaluation. Relying on sensory evaluation to determine the time of harvest still lacks a scientific basis [2, 4]. Meanwhile, up to this time in the country as well as in the

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world, there are very few published scientific studies on the nutritional composition and sensory parameters of this agricultural product [4, 5]. Besides, studies on the nutritional components and sensory of igname yam in Bac Giang province, in Vietnam have received little attention and research. Therefore, together with the agronomic criteria, it is very important to analyze and determine the nutritional components and sensory of igname yam in Bac Giang province to determine and verify the optimal harvest time. The aim of this study was to the determination of nutritional components and sensory of igname yam in Bac Giang province. These are important scientific bases for selecting igname yam for processing food products. Therefore, the identification of nutritional components and sensory criteria of igname yams postharvest is very necessary, and of high scientific and practical significance.

2. Content

2.1. Material and methods

2.1.1. Materials

The igname yam plant of Bac Giang province has the scientific name *Dioscorea esculenta*, this is a type of tuber with thin skin, white flesh, fatty and fleshy taste, characteristic aroma, loose and friable structure. The igname yam are harvested at a technical age, at this stage the igname yam is ivory brown, the skin is thin, and the flesh is white. The raw materials used are igname yam purchased at 3 VietGap-standard igname yam farms in Bac Giang province. Igname yam must be intact, free from pests, and diseases, and ensure food safety, igname yam from the peel are brown, and the flesh is white. Igname yams are stored in perforated styrofoam boxes and transported to the laboratory, stored in a refrigerator at a temperature of 4 to 6°C to conduct experiments.



Figure 1. Igname yam in Bac Giang province

2.1.2. Methods

- Method for sampling

Igname yams in Bac Giang province were sampled according to Vietnamese standards TCVN 9017:2011 [6].

- Method for preliminary sample processing

For each experiment of 10kg of samples, equivalent to 20-22 fresh igname yam, igname yam is peeled, washed, cut into small pieces, and pureed. The experiment was repeated 3 times.

- Method for determination of chemical composition

The water content of igname yam is determined according to Vietnamese standards (TCVN 5366: 1991) [7], protein contents were determined according to Vietnamese national standards (TCVN 8133-1, 2009) [8], glucid contents were determined according to Vietnamese national standards (TCVN 4594, 1998) [9] and lipid contents were determined according to Vietnamese national standards (TCVN 4592, 1988) [10].

The contents of vitamin B₁ and B₂ in igname yam were determined by the method of polarizing the pulse spectrum [11]. The mineral content of igname yam is determined according to Vietnam's national standard TCVN 1537: 2007 [12].

- Method for determination of amino acid content

Amino acid contents in the flesh of igname yam were determined by the HPLC method by using Detector PAD 2996, fluorescence 2475, and the Water model automatic pump of Water company (USA). The chromatographic column was Symmetry RP18 amino acid (150 mm × 4.6 mm × 3.5 μm) and Symmetry Shield RP18 column (150mm × 4.6mm × 5μm) by Water. The mobile phase was a buffer solution of borates, acetonitrile, and MilliQ water; The flow rate was 1 ml/min and the column temperature was 35°C. Amino acids were quantified by a fluorescence detector with excitation and emission wavelengths of 340 nm and 450 nm, respectively [13].

- Methods for determining sensory criteria

The sensory criteria of the igname yam tubers were determined by a descriptive method, which is used to describe in detail the sensory criteria of the igname yam tubers, such as colour, odor, taste, and texture. The sensory panel consists of 9 members, the members are trained and familiarized with the sensory criteria of color, smell, taste, and structure of the igname tuber, then determine the intensity scale as a 9 point scale. Members will receive a scorecard and samples of igname yam to be evaluated, then evaluate the sample and determine the intensity of each required criterion on the used 9 point scale. The descriptive method is performed through the following steps: Select the features to be evaluated. Carry out preliminary tests so that the members agree on how to use the given intensity scale. Rate the intensity of the selected characteristics on a scale [14].

- Data processing methods

Using data processing method, by EXCEL software to systematize information and data for analysis and evaluation. The analyzed data were processed for SAS 9.0 statistical analysis. Statistical hypothesis analysis by ANOVA and mean values were compared by LSD at $p < 0.05$ [15].

2.2. Results and discussion

2.2.1. The nutritional components of igname yam

Determining the nutritional components of igname yam before processing is of great practical significance. Because of these nutritional components, appropriate processing measures will be taken to ensure effectiveness. The experiment was repeated 3 times. The results on the nutritional components of igname yam are presented in Table 1.

Table 1. The nutritional components of igname yam

No.	Nutritional components	Unit	Result
1	Water	%	69.3 ± 0.2
2	Total lipids	%	4.2 ± 0.1
3	Total glucid	%	20.5 ± 0.1
4	Total protein	%	2.6 ± 0.1
5	Vitamin B ₁	mg%	28.5 ± 0.1
6	Vitamin B ₂	mg%	12.3 ± 0.1
7	Ca	mg%	28 ± 0.1
8	Mg	mg%	1.8 ± 0.1
9	Mn	mg%	2.1 ± 0.1
10	P	mg%	34 ± 0.1
11	K	mg%	26 ± 0.1
12	Na	mg%	2.9 ± 0.1
13	Zn	mg%	1.7 ± 0.1
14	Cu	mg%	1.4 ± 0.1
15	S	mg%	2.4 ± 0.1
16	Fe	mg%	3.7 ± 0.1

Table 1 shows that the water content in igname yam is 69.3 ± 0.2%, the total lipid content is 4.2 ± 0.1%, the total glucide content is 20.5 ± 0.1%, the total protein content is 2.6 ± 0.1%, vitamin B₁ is 28.5 ± 0.1mg% and vitamin B₂ is 12.3 ± 0.1mg%. Besides, the content of minerals, such as Ca, Mg, Mn, P, K, Na, Zn, Cu, S, and Fe, fluctuates in the range of 1.4 to 34mg%. These nutritional components also contribute to an increase in the sensory value of the igname yam, such as protein, lipid and aroma components, contributing to the fatty taste, fleshy taste, and aroma characteristic of the crop, this agricultural product.

The results of this study are similar to those of Mbome L. I et al [2], Adewale O. O et al [3], Marlyse S. L et al [4] when studying the nutritional composition of igname yam.

2.2.2. The amino acid content of igname yam

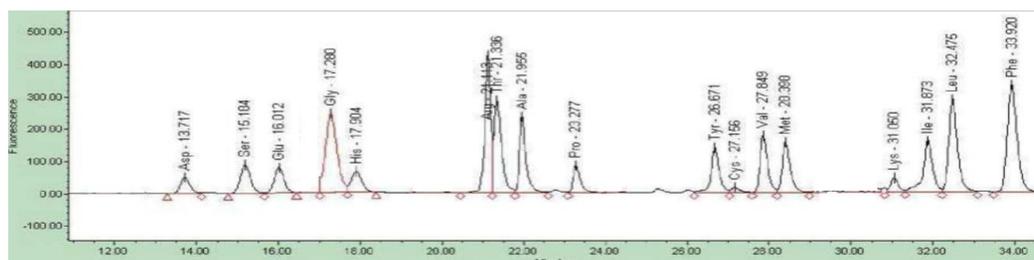
Determination of amino acid composition in igname yam is an important criterion for evaluating the quality of this agricultural product. The results of determining the amino acid content of igname yam are shown in Table 2.

Table 2. The amino acid content of igname yam

No.	Amino acids	Retention time (min)	Proportion (%)
1	Aspartic	13.717	2.82
2	Serine	15.184	2.64
3	Glutamic	16.012	2.48
4	Glycine	17.280	7.53
5	Histidine	17.904	2.49
6	Arginine	21.113	11.74
7	Threonine	21.336	9.93
8	Alanine	21.955	8.68
9	Proline	23.277	3.94
10	Tyrosine	26.671	5.46
11	Cysteine	27.156	1.54
12	Valine	27.849	6.07
13	Methionine	28.390	5.83
14	Lysine	31.050	1.98
15	Isoleucine	31.873	5.74
16	Leucine	32.475	9.94
17	Phenylalanine	33.920	10.36
Total			99.17

Note: The ratios (%) were calculated according to the chromatographic peak areas

By the HPLC method, 17 amino acids have been identified in igname yam. Among those, there were 9 non-substituting amino acids, including histidine, arginine, threonine, valine, methionine, lysine, isoleucine, leucine, and phenylalanine. Some amino acids account for a high percentage such as arginine 11.74, phenylalanine 10.36%, leucine 9.94%, threonine 9.93%, alanine 8.68%, glycine 7.53%, and valine 6.07%. This result is also consistent with the research results of Adewale O. O et al [3].



Figures 2. Chromatogram of the amino acid of igname yam

2.2.3. The sensory criteria of igname yam

The sensory criteria of igname yam are indicated by the color, smell, taste, and texture of this type of this product. The results of the sensory criteria of the igname yam were carried out by descriptive method and are presented in Table 3.

Table 3. The sensory criteria of igname yam

No.	The sensory criteria	Sensory results
1	The color of meat igname yam	Ivory white
2	The smell of meat igname yam	Characteristic aroma
3	The taste of meat igname yam	Fatty taste
4	The fleshy texture of meat igname	Spongy and friable

Table 3 shows that when steamed, the igname yam meat has an ivory white color, a characteristic aroma, a fatty taste, a spongy and friable structure. When dried and ground into powder, the powder structure is fine, ivory white and fragrant. Compared to the igname yam grown in Nigeria [3], the igname yam grown in Bac Giang have a spongy and friable structure more, a richer and more fleshy taste.

3. Conclusions

From the above research results, some conclusions are drawn as follows: By analytical methods, the protein content was determined that the water content in igname yam is $69.3 \pm 0.2\%$, total lipid content $4.2 \pm 0.1\%$, total glucide content $20.5 \pm 0.1\%$, total protein content was $2.6 \pm 0.1\%$, vitamin B₁ was $28.5 \pm 0.1\text{mg}\%$ and vitamin B₂ was $12.3 \pm 0.1\text{mg}\%$. Besides, the content of minerals, such as Ca, Mg, Mn, P, K, Na, Zn, Cu, S, Fe, fluctuates in the range of 1.4 to 34mg%. By the HPLC method, 17 amino acids have been identified in igname yam. Among those, there were 9 non-substituting amino acids, including histidine, arginine, threonine, valine, methionine, lysine, isoleucine, leucine, and phenylalanine. The igname yam meat has an ivory white color, a characteristic aroma, a fatty taste, a spongy and friable structure. These are important scientific bases for selecting igname yam for processing food products.

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