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Effect of Boiling on the Amino acid Composition of Some Green Leafy Vegetables in Nigeria

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ABSTRACT

Ten different leafy vegetables (*Adansonia digitata, Amaranthus hybridus, Arachis hypogaea, Cassia tora, Linn ceiba, Curcubita pepo, Hibiscus cannabinus, Hibiscus sabdarrifa, Manihot utilisima* and *Vernonia amygdalina)* were obtained from farmers and were analyzed for the presence of Na, Co, Zn, Fe, Cu, Ca and Mn, using Atomic Absorption Spectrophotometer. The amino acid profile was determined using amino acid analyzer (TSM). Seventeen (17) amino acids were found in varying proportions in the protein of all the vegetable samples, and the essential amino acids compared favorably with the FAO/Reference protein. Thus the effect of boiling on the amino acid profile of the leafy vegetable sample is negligible. Based on these findings, the leafy vegetables could be used as alternatives to the amino acids found in them, and could be used as a very good source of amino acid.

Keywords: Boiling, Amino acid, Green, Leafy Vegetables and Nigeria.

INTRODUCTION

All of the standard amino acids are necessary constituents of human protein [1,2,3,4,5]. Adequate amounts of all 11 of the 20 amino acids can be synthesized from Carbohydrates and lipids in the body if a source of nitrogen is also available because the human body is incapable of producing 9 of these 20 acids fast enough or in sufficient quantities to sustain normal growth, these 9 amino acids, called essential amino acids must be obtained from food. An essential amino acid needed in the human body that must be obtained from dietary sources because it cannot be synthesized within the essential amino acids for humans [6,7]. The human body can synthesize small amounts of some of the essential amino acids, but not enough to meet its need, especially in the case of growing Children [8,9,10]. A complete dietary protein is a protein that contains all the essential amino acids in approximately the same relative amounts in which the human body needs them [11,12,13]. A complete dietary protein may or may not contain all the non-essential amino acids. Most animal proteins, including casein from milk and proteins found in meat, fish and eggs, are complete proteins, although gelatin is an exception (it lacks tryptophan) [15,16,17,18]. Proteins from plants (vegetables, grains and legumes) have quite diverse amino acid patterns and some tend to be limited in one or more essential amino acids [19,20,21]. Some plant proteins (for example corn protein) are far from complete. Others (for example, Soy protein) are complete [22,23,24,25]. Thus Vegetarians must eat a variety of plant foods to obtain all of the essential amino acids in appropriate quantities [26,27,28].

Vegetables are the edible parts of plant that are consumed wholly or in parts, raw or cooked as part of main dish or salad. A vegetable includes leaves, stems, roots, flowers, seeds, fruits, bulb and tubers [29,30]. Green leafy vegetables occupy an important place among the food crops as they provide adequate amount of many vitamins and minerals for humans. They are rich sources of oil, carbohydrates, carotene, ascorbic acid, riboflavin, retinol, folic acid and minerals like calcium, iron, zinc, magnesium, manganese and selenium depending on the vegetable consumed [31,32,33]. [34] reported that vegetable fats and oil lower blood lipids thereby reducing occurrences of disease associated with damage of

coronary artery. Green leafy vegetables constitute an indispensable constituent of human diet in Africa generally and West Africa in particular [35,36,37]. Apart from the variety which they add to the menu [38,39.40] they are valuable sources of nutrients especially in rural areas where they contribute substantially to protein, mineral, vitamin, fibers and other nutrients which are usually in short supply in daily diets [40,41,42]. Generally they are consumed as cooked complements to the major staples like cassava, cocoyam, guinea corn, maize, millet, rice and plantain. Indeed most of the meals based on these staples are considered incomplete without a generous serving of cooked green leafy vegetables [43,44,45,46]. Vegetables are important protective foods and highly beneficial for the maintenance of health and prevention of diseases and also reinforce the resisting ability of the cells to counter bacterial infections due to the fact that they contain valuable food ingredient which is utilized to build and repair the body, the variety of green vegetables so utilized are diverse.

Aim of the Study

The aim of this study research was to assess and compare the effect of Boiling on the Amino acid Composition of Some Green Leafy Vegetables in Niger

MATERIALS AND METHODS

Sampling and Sample Treatment

Ten types of indigenous leaf y vegetables that are widely used in soup preparation in Nigeria. (Adansonia digitata, Arachis hypogaea, Cassia tora, Linn ceiba, Curcubita pepo, Hibiscus cannabinus, Hibiscus sabdarrifa, Manihot utilisima, Amaranthus hybridus and Vernonia amygdalina) was procured from farmers, samples were young and tender at harvest, each of the samples was destalked as practiced locally, washed with tap water, Half of each of the vegetables was chopped, this was labeled as the raw sample. The other half of each of the vegetables was chopped, two litres of clean water was put inside a pot and boiled at the temperature of 100 0c and 500 g of the chopped vegetables were placed inside the boiling water and allowed to boil for 15 minutes. This was labeled as the boiled sample. Both raw and boiled samples were each air dried separately for some days. The samples were ground into fine powder using stainless steel mortar and pestle, sealed in transparent polythene bags and labeled appropriately for analysis.

Determination of Amino Acid Profile

The Amino Acid profile in the known sample was determined using methods described by [13]. The known sample was dried to constant weight, defatted,hydrolyzed, evaporated in a rotary evaporator and loaded into the Technicon sequential Multi-Sample Amino Acid Analyzer (TSM).

Defatting the sample

The sample was defatted using chloroform/methanol mixture of ratio 2:1. About 4g of the sample was put in extraction thimble and extracted for 15 hours in soxhlet extraction Apparatus [8].

Nitrogen determination

A small amount (200 mg) of ground sample was weighed, wrapped in what man filter paper (No.1) and put in the Kjelcihal digestion flask. Concentrated sulphuric acid (10 ml) was added. Catalyst mixture (0.5 g) containing sodium sulphate (Na_2SO_4), copper sulphate ($CuSO_4$) and selenium oxide (SeO_2) in the ratio of 10:5:1 was added into the flask to facilitate digestion. Four pieces of anti-bumping granules was added. The flask was then put in Kjeldhal digestion apparatus for 3 hours until the liquid turned light green. The digested sample was cooled and diluted with distilled water to 100 ml in standard volumetric flask. Aliquot (10 ml) of the diluted solution with 10 ml of 45 % sodium hydroxide was put into the Markham distillation apparatus and distilled into 10 ml of 2 % boric acid containing 4 drops of bromocresol green/methyl red indicator until about 70 ml of distillate was collected [8]. The distillate was then titrated with

standardized 0.01 N hydrochloric acid to grey coloured

$$\text{Percentage Nitrogen} = \frac{(a-b) \times 0.01 \times 14 \times V \times 100}{W \times C}$$

Where:
a. = Titre value of the digested sample
b. = Titre value of blank sample
v. = Volume after dilution (100ml)
W. = Weight of dried sample (mg)

Data Analysis

Data was statistically analyzed by a one way analysis of variance (ANOVA) using SPSS/Pc + Package. Differences between means were compared by the use of Duncan's multiple ranges set. Significance was accepted at a p-value of less than 0.05 ($p<0.05$).

RESULTS

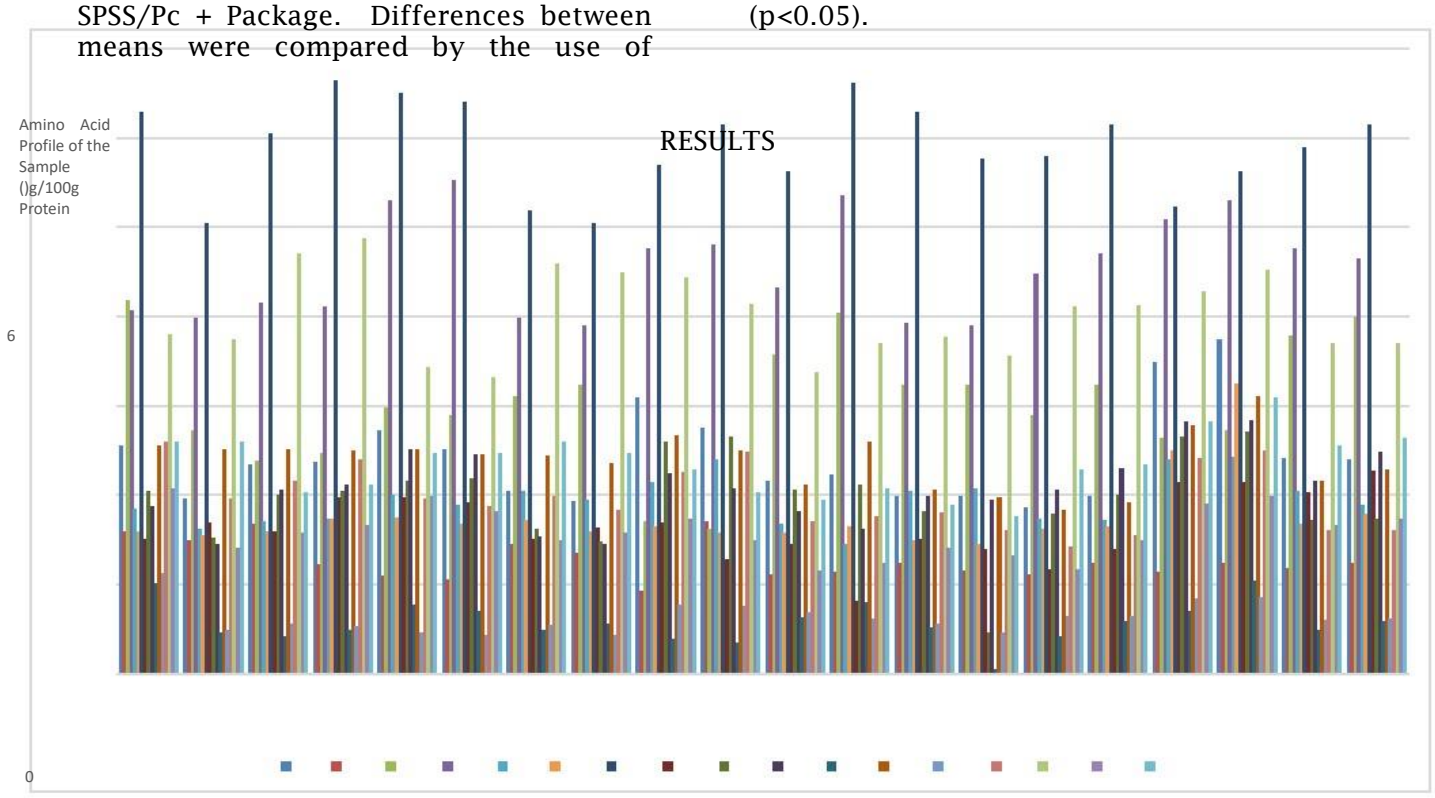

Figure 1: Amino Acid Profile of the Sample (g/100g Protein)

Amino Acid Profile of the Samples

The amino acid profile in g/100 g protein of the samples is presented in figure 1 overleaf. In this study seventeen (17) amino acids, instead of the twenty (20) amino acids commonly found as components of proteins [17] were found in varying proportions in all the samples. This is due to the conversion of glutamine and asparagines to glutamic acid and aspartic acid respectively [9] and the complete destruction of tryptophan during acid hydrolysis [34]. Glutamic acid had the highest values in all the vegetable samples while cysteine had the lowest values. Evaluation of the nutritional quality of the sample vegetables made by comparing the percentages of the essential amino acid profile established for both adults and preschool children by [18], the result indicates that all the essential amino acids exceeded the reference value for preschool children and adults with the exception of cysteine and methionine. These results support the claim that the protein in leafy vegetables although low, is of a very high grade [21].

SUMMARY

The results from this research show that, green leafy vegetables are nutrition goods that provide sufficient amount of nutrients needed for normal body function and maintenance. It was found that nutrient compositions in all vegetable samples were different. The result suggests that the vegetables if consumed in sufficient amount would contribute greatly towards meeting human nutrition requirement for normal growth and adequate protection against diseases arising from malnutrition. It might as well be summarized that on the basis of the amino acid compositions obtained, all of the samples tested had proteins of high nutritional quality. This indicates that these vegetables may be useful in helping to alleviate demand on much more expensive animal proteins.

CONCLUSION

It can be concluded according to findings in this research work that the vegetables analyzed are good sources of amino acids and the effect of boiling on the amino acid profile is negligible. Thus the leafy vegetables could be used as a source of amino acids.

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