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Changes in Alkaoids Content of Some Selected Nigerian Vegetables during Processing

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Abstract: *Alkaloids, natural organic compounds present majorly in plants have been used in all culture as portion, medicine and poison. Vegetables are no exception; they contain varying degree of alkaloids. However, different processing methods are usually applied before consumption which may affect their alkaloids contents. Evaluation and effect of processing (blanching and juicing) were investigated on eight selected vegetables consumed in south western Nigeria. Standard Laboratory procedures were employed. Results showed highest level of alkaloids: in the fresh vegetable; Manihot esculenta 42.09±5.55mg/100d dry weight, in the blanched; Teleferia occidentalis 146.22±96.96 mg/100d dry weight while in the juiced vegetable Manihot esculenta leaf 296.69±61.02mg/100g dry weight. The lowest values were observed in the fresh; Amaranthus spp. (local name "Ebiden") 6.40±.47 mg/100d dry weight, in the blanched; Ipomoea batatas leaf 14.15±2.22 mg/100d dry weight and in the juiced extract; Amarantus cruentus 93.16±2.22 mg/100d dry weight.*
The study revealed that the alkaloids content of fresh vegetables varied while blanching and juicing increased its content.
Keywords: *Vegetable, alkaloids, blanched, fresh and juice*

I. Introduction

Alkaloids are natural, organic substances that are predominantly found in plants. They are active components of numerous medicinal plants or plant-derived drugs as well as poisons; their structural diversity and different physiological activities are unmatched by any other group of natural products [1]. From the beginning of civilization, alkaloids have been of great interest to humans because of their pronounced physiological and medicinal properties. Alkaloid-containing plant extracts have been used in all cultures as potions, medicines, and poisons [2].

Vegetables contain most of the essential nutrients necessary for human nutrition. However, there is also recognition that plant foods contain many other compounds that are non-nutrients such as dietary fiber, flavonoids, sterols, phenolic acids, glucosinolates and alkaloids. These compounds can either interfere with the availability of nutrients or influence the aetiology, progression and treatment of diseases, by modifying disease risk factors [3]. Some of these compounds such as alkaloids under normal conditions are localized to separate compartments in the plant tissues, but come in contact with the nutrients during processing and/or digestion in the gastrointestinal tract [4]. Different processing methods such as drying, cooking, blanching and juicing are used in preparing vegetables for consumption which may have positive or negative impact on the nutrients and other components of the vegetables such as alkaloids [5]

Juicing is the process of extracting juice from plant tissues such as fruit or vegetables; of recent there is a renewed interest in the use of vegetable juice because of the concentration of nutrients in the juice extract. Though the juicing may concentrate the nutrients, however the accumulation of non-nutrients which may be toxic at high dosage such as alkaloids ought to be evaluated.

In view of the above we set to investigate the variation in the alkaloid content of various vegetables and how different processing methods such as blanching and juicing affect the alkaloids content.

II. Materials And Methods

2.1 Sample collection

Vegetables for this study were sourced from four major markets; Ago-Iwoye, Ikenne and Sagamu markets in Ogun state and Ketu market in Lagos state, Nigeria .The weight of the samples varied from 1to 5 kg.

Identification of the samples were carried out at the herbarium of the Plant Science and Zoology Department, Olabisi Onabanjo University

2.2. Sample preparation

The samples were destalked to prepare edible portions that were used for experiment. Samples of each specimen (two from each market) were pulled together, thoroughly mixed and divided into four parts.

2.3. Blanching

Blanching was carried out using 200 g of vegetables, put in boiled water and allowed to stay for five minutes, removed and drained before further analysis.

2.4. Juicing

The juice extract was obtained by using master chef juice extractor (model no: mc-J2101) collecting the juice and the pulp separately.

2.5. Sample analysis

Moisture content

Ten g of sample were taken from each replicate (4 samples) into a 200 ml crucible, dried in oven at temperature of 105°C for 24 h and the moisture content was then determined.

2.6. Alkaloids content

The alkaloid content was analyzed by method of Harbone (1976) [6]. 0.5g of the sample was dissolved in 96% ethanol and 20% H_2SO_4 (1:1). 1ml of the filtrate was added to 5ml of 60% tetraoxosulphate (vi) and allowed to stand for 5minutes. Then, 5ml of 0.5% formaldehyde was added and allowed to stand for 3hours. The reading was taken at absorbance of 565 nm

2.7. Statistical analysis

The experimental design was completely randomized. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) 14. Significant difference between the data was determined at $p< 0.05$ using Duncan multiple range test.

III. Results

Table 1: Alkaloid contents of fresh leafy vegetables.

Botanical names	English/ Local names	Alkaloid contents (mg/100g dry weight)	Moisture contents
Amaranthus spp.	Ebiden	6.40 ± 0.47^{b}	85.20 ± 0.41^{ab}
Crassocephalum rubens	Ebolo	18.80 ± 1.02^{c}	87.13 ± 0.23^{cd}
Talinum triangulare	Water leaf	41.82 ± 1.69^{e}	84.58 ± 0.03^{ab}
Amaranthus cruentus	Green spinach	2.43 ± 0.15^{a}	83.53 ± 0.08^{a}
Ipomia batatas	Sweet potato leaf	15.83 ± 0.87^{c}	86.13 ± 0.25^{bcd}
Manihot esculenta	Cassava leaf	42.09 ± 5.55^{e}	85.08 ± 1.33^{ab}
Telfeira occidentalis	Pumpkin leaf	39.09 ± 3.97^{d}	85.60 ± 0.40^{bc}
Piper guineesis	Uziza	15.53±1.55c	85.33 ± 0.65^{b}

Results presented are mean ± SEM (n = 4); values in the same column with the same superscript are not significantly different from each other ($P > 0.05$).

Table 2: Alkaloid contents of blanched leafy vegetables

Botanical names	English/ Local names	Alkaloid contents (mg/100g dry weight)	Moisture contents
Amaranthus spp.	Ebiden	47.58 ± 12.54^{a}	86.10 ± 0.50^{b}
Crassocephalum rubens	Ebolo	$72.08 \pm 9.14^{a,b}$	89.00 ± 0.08^{cd}
Talinum triangulare	Water leaf	$76.41 \pm 2.08^{a,b}$	94.18 ± 0.23^{e}
Amaranthus cruentus	Green spinach	$75.57 \pm 10.70^{a,b}$	87.65 ± 1.76^{bcd}
Ipomia batatas	Sweet potato leaf	94.15 ± 2.22^{b}	85.93 ± 0.43^{b}
Manihot esculentus	Cassava leaf	$62.29 \pm 8.41^{a,b}$	78.13 ± 0.61^{a}
Telfeira occidentalis	Pumpkin leaf	146.22 ± 9.96^{b}	87.28 ± 0.60^{bc}
Piper guineesis	Uziza	29.87 ± 6.20^{a}	87.78 ± 0.35^{bcd}

Results presented are mean ± SEM (n = 4); values in the same column with the same superscript are not significantly different from each other (P > 0.05).

Table 3: Alkaloid contents of leafy vegetable juice extract.

Botanical names	English/ Local names	Alkaloid contents (mg/100g dry weight)	Moisture contents
Amaranthus spp.	Ebiden	104.21±13.05^{a}	95.23 ±0.46^{abc}
Crassocephalum rubens	Ebolo	169.27±11.47^{abc}	96.33 ±0.39^{cd}
Talinum triangulare	Water leaf	232.13 ±13.55^{cde}	94.03 ±0.33^{ab}
Amaranthus cruentus	Green spinach	93.16 ±2.22^{a}	93.35 ±0.09^{a}
Ipomia batatas	Sweet potato leaf	145.01 ±27.83^{ab}	95.70 ±1.02^{bcd}
Manihot esculentus	Cassava leaf	269.69 ±61.02^{de}	95.20 ±1.34^{abc}
Telfeira occidentalis	Pumpkin leaf	142.15 ±18.21^{ab}	95.55 ±0.45^{bc}
Piper guineesis	Uziza	208.24±19.42^{bcd}	95.08 ±0.52^{abc}

Results presented are mean ± SEM (n = 4); values in the same column with the same superscriptare not significantly different from each other (P > 0.05).

Table 1 showed the alkaloids content in fresh vegetables, the lowest value was observed in Amaranthus cruentus 2.43±0.15 followed by Ebiden 6.40±0.47 while the highest value was observed in Manihot esculenta leaves 42.09±5.55. No significant difference (p>0.05) was observed in alkaloids content of Talinum trangulare 41.82±1.69 and Manihot esculenta 42.09±5.55; Crassocephalum rubens 18.80±1.02, ipomoea batatas leaf 15.83±0.57 and Piper guineesis 15.53±1.55.

Shown in Table 2 is the effect of blanching on alkaloids content of the vegetables. No significant difference (p>0.05) was observed in virtually all the vegetables.

Table 3 showed the alkaloids content of the vegetable juice. Highest value was observed in Manihot esculenta leaves 269.69±61.02 while the lowest value was observed in Amaranthus cruentus 93.16±2.2. However, no significant difference (p>0.05) in alkaloids content of Crassocephalum rubens, Talinum triangulare, 232.13±13.05 and Ipomoea batatas, 145.01±27.83mg/100g dry weight.

IV. Discussion

Research studies have shown the variation in alkaloids content of vegetables and effect of processing on its level in plant foods [7].

This work showed the various levels of alkaloids in the vegetable studied could be adduced to environmental factors [8] and genetic constituents of the plants [9]. High alkaloids content observed in fresh Talinum triangulare and Manihot esculenta 41.82±1.69 and 42.09±5.55 mg/100g dry weight respectively were close to the observed value reported by Aja and others (2010) for vegetables [10], however, different from that of Oduse and others (2012) which reported a value of 12.23mg/kg [11].

Effect of processing on alkaloids content in plants and its product is controversial and inconclusive. While Oyenka and Nwambekwe (2002) reported decrease in alkaloids content of vegetables with boiling [12], Judy (2006) reported stable alkaloids content of vegetables when heated or freeze-dried [13]. Also, Ebuehi et al., 2005 reported on relative stability of alkaloids when food is subjected to heat treatment [14]. However, this study indicated increase in alkaloids content of most vegetables examined when subjected to blanching. Though this appeared cofounding, the plausible explanation could be increased synthesis of alkaloids in these vegetables occasioned by tempering heat of blanching.

Juicing concentrated both nutrients and nutrient alike, in the previous study saponin was concentrated by juicing [15], Cassava leaf juice appeared to have highest content of alkaloids. This is consistent with the report of Tesleem et al., (2009) who reported increase in alkaloids content in blanched vegetable when compared with sundried [16].

Previous study indicated high level of alkaloids in Cassava leaves extracts [14]. Since juicing increased alkaloids contents of vegetables tremendously, thus it is expedient to exercise caution in taking juice of vegetables high in alkaloids content because of adverse effect associated with certain alkaloids [17, 18]. It is therefore recommended that until those types of alkaloids present is known, juice of plants with high concentration of alkaloids should be taking with caution.

V. Conclusion

This study revealed variation in alkaloids content of various vegetables studied and also the levels as affected by blanching and juicing. Juicing increased the level dramatically in all the vegetables, thus care must be exercised in consuming juice extract of vegetables with high content of alkaloids.

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