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(Research Article)

Quality evaluation of 'Ewedu' (*Corchorus olitorus*) as affected by cooking methods

Babatunde-Ikare OV *, Adebayo MT, Aje OT and Ajagunna AO

Department of Hospitality and Management Technology, Rufus Giwa Polytechnic, Owo, Nigeria.

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Abstract

The quality of "ewedu" soups produced using chemical additives and milling before cooking was investigated. Four samples were produced as follows: "Ewedu" leaves + 1g Baking Soda using "Ijabe" (ELwBSuI); "Ewedu" leaves + 1g Potash using "Ijabe" (ELwPuI) and "Ewedu" leaves using blender (ELuB while "Ewedu" leaves using "Ijabe" (ELCuI) serves as the control. Proximate, mineral and Vitamin C compositions of the samples were evaluated using Standard methods. The results showed that there was no significant difference in the moisture, fibre and ash contents of the samples. A high moisture content range (82.56 - 82.65%) was recorded and this might be responsible for the low values of other proximate components of the samples. Potassium was the most abundant in all the mineral elements assessed (218.05 - 234.98mg (100g) and closely followed by calcium, sodium and magnesium in that order. ELwBSuI and ELwPuI showed a significantly higher sodium contents (13.47 and 12.08mg/100g) than ELCuI (10.37 mg /100g) and ELuB (10.30mg/100g). There was no significant difference in the Vitamin C contents of the groups and the values ranged from 63.07 - 63.73mg/100g. This study shows that milling before cooking can be adopted as a means of cooking ewedu soups as against the use of "ijabe"baking soda and potash.

Keywords: Cooking; Quality; 'Ewedu'; Composition; Vitamin; Milling; Additives

1. Introduction

Many people in sub-Saharan Africa consume the leaves of *Corchorus olitorius*. These green leafy vegetables serve as a main component of several dishes and are rich in fibre, minerals such as magnesium and iron, and serve as a good source of provitamin A carotenoids (Lewu *et al*., 2019). In spite of their vast usage, the consumption of these vegetables is limited to within a few days after harvest owing to the short storage life of the leaves (Oktavianingsih *et al*., 2017). This is mainly linked to the de-greening of the leaves by enzymes after harvest. Indeed, the intensity of greenness plays an important role in determining the quality and economic value of these vegetables. The inactivation of the relevant enzymes can therefore, help enhance the storage life and quality of these vegetables.

Ewedu (*Corchorus olitorius*) as popularly called in western part of Nigeria is commonly consumed in West Africa and other part of the world as vegetable usually prepared into soup. Common names include long fluted jute, Jew's marrow, African Sorrel and Bush Okra. Other local names for ewedu include lalo, krin krin, rama, yoyo, ahihiare. Ewedu leaves are consumed for food due to their flavour and nutritional value while the stalks are used for industrial products such as ropes, pulp paper, fiber, and composite (Doraswamey *et al*., 2020).

The leaves are used to flavor soups and vegetable dishes, used to make mucilaginous soups, and serve as soup thickeners. The succulent leaves of ewedu soften rapidly with little cooking and thicken into a viscous mucilaginous soup which can be eaten with starchy foods developed from processing of the common staple root and tuber crops. Leaf of ewedu is rich in calcium, galactose, galacturonic acid, glucose, galacturonic acid, rhamnose, magnesium and iron and contains high percentage of vegetable protein (Ndlovu and Afolayan, 2018). Ewedu as a leafy vegetable has also been

*Corresponding author: Babatunde-Ikare O.V

accredited with possession of high nutritional values of essential nutrient such as protein, carbohydrate, fat and a high calorific value. It contains abundance of antioxidants that have been associated with protection from chronic diseases such as heart diseases, cancer, diabetes, and hypertension (Islam, 2013). The leaves of *Corchorus olitorius* has also been reported to have hypoglycemic effect and high antibacterial activity (Adegoke and Adebayo, 2019).

Thermal processing methods such as blanching can be used to inactivate enzymes and help stabilize the quality of these vegetables prior to their usage (Hong-wei *et al*., 2017). Blanching involves exposing vegetables to high temperatures for a short period (Rawson *et al*., 2021). This process can help sustain the color, flavor and overall quality of these vegetables. Additionally, blanching can help minimize non-enzymatic browning reactions and also destroy contaminating microorganisms (Hong-wei *et al*., 2017). Blanching, however, can cause a decrease in quality. Especially, heat-labile nutrients such as ascorbate can easily be degraded due to blanching (Xanthakis *et al*., 2018). In addition, blanching can lead to loss of chlorophyll, which is responsible for the green color, therefore leading to a reduction in greenness of the leaves. It is, therefore, important to gain a deeper understanding into how blanching can be used to inactivate enzymes and how it will affect the quality of these leaves (Rawson *et al*., 2021).

Ewedu like other vegetable is subject to high post-harvest losses (30-40%) resulting in high nutritional and economic losses (Byaruhanga *et al*., 2021). Drying of Vegetables such as ewedu can reduce postharvest losses and extend shelf-life for off-season use. However, drying of vegetables may results in loss of essential nutrients including vitamins and mineral, stability of phytochemicals and change in appearance, if not properly done. Hence, the best drying techniques should be done, and sometimes, extra preparation is needed to retain the vegetable leaves colour and to curtail the nutrient loss. Therefore, it is necessary to study and identify appropriate methods of processing and preserving ewedu to minimize losses and maintain quality attributes of ewedu soup after rehydration, hence this study.

2. Material and methods

2.1. Collection of Raw Materials

The fresh *Corchorus olitorius* (Ewedu) leaves was purchased from Department of Agricultural Technology farm, Rufus Giwa Polytechnic, Owo, Ondo state, Nigeria. All chemicals and reagents used were of analytical grade.

2.2. Sample Preparation

The leaves were prepared based on modified method of Traore *et al*. (2019). The leaves were detached from the stalks, then thoroughly washed under tap water before using distilled water and wrung out. The washed leaves were chopped into tiny bits then divided into four groups of 100g each. Group A is chopped jute mallow leaves boiled in 300ml of water for 15 minutes and coded as ELCuI. Group B contain the chopped jute mallow leaves boiled in 300ml of water to which 1g baking soda was dissolved at 80^{o}Cbefore addition of the leaves (ELwBSuI). Group C contain the chopped jute mallow leaves boiled in 300ml of water to which 1g potash was dissolved at 80°C before addition of the leaves (ELwPuI). The 100g of jute mallow leave in group D were milled in 200ml of distilled water with an electric blender for 3 minutes. The resulting slurry was poured into 100ml of 80°C water and cooked for 15mins (ELuB). Following cooking, Group A- C were pulverized with the aid of “ijabe”, the traditional utensil (broom).

2.3. Proximate Analysis.

Protein, fat, crude fibre, moisture and ash were determined by the methods of analysis of the Association of Officials Analytical Chemists (2005) while carbohydrate was determined by difference. Energy contents were calculated using at water factor.

2.4. Determination of Mineral Properties

Mineral composition of prepared *Corchorus olitorius* leaves samples was determined by dry ashing procedure of AOAC (2005).

2.5. Determination of Vitamin C

AOAC official method was used for the determination of vitamin C content of prepared *Corchorus olitorius* leaves samples using the 2, 6-Dichloroindophenol titration method (AOAC, 2005).

2.6. Statistical Analysis

Data obtained were subjected to statistical analysis using SPSS 16 software to compare the differences between treatment means.

3. Results

The tables below shows the results of the proximate, mineral and ascorbic acid compositions of “ewedu” soups as affected by cooking methods.

Table 1 Proximate Composition of “ewedu” soups

Proximate Composition	ELCuI	ELwBSuI	ELwPuI	ELuB
Moisture (%)	82.56^a	82.64^a	82.62^a	82.65^a
Ash (%)	6.37^b	6.36^b	6.46^a	6.33^b
Crude Fibre (%)	2.61^a	2.54^a	2.56^a	2.60^a
Protein (%)	4.36^b	4.46^a	4.34^b	4.36^b
Fat (%)	0.97^a	1.08^a	0.96^a	0.97^a
Carbohydrate (%)	3.13^a	2.92^b	3.06^a	3.09^a
Energy (Kcal)	38.69^b	39.24^a	38.24^c	38.53^b

Values followed by different superscripts within a row are significantly different ($p \leq 0.05$); Keys: ELCuI – Ewedu Leaves (Control) using “Ijabe”; ELwBSuI - Ewedu Leaves + 1g Baking Soda Using “Ijabe”; ELwPuI- Ewedu Leaves + 1g Potash Using “Ijabe”; ELuB- Ewedu Leaves using blender

Table 2 Mineral Compositions of “ewedu” Soups

Mineral Contents	ELCuI	ELwBSuI	ELwPuI	ELuB
Magnesium (mg/100g)	8.72^a	8.75^a	8.74^a	8.72^a
Sodium (mg/100g)	10.37^b	13.47^a	12.08^a	10.30^b
Calcium (mg/100g)	49.77^a	49.73^a	49.75^a	49.72^a
Potassium (mg/100g)	222.38^b	223.27^b	234.98^a	218.05^c

Values followed by different superscripts within a row are significantly different ($p \leq 0.05$); Keys: ELCuI – Ewedu Leaves (Control) using “Ijabe”; ELwBSuI - Ewedu Leaves + 1g Baking Soda Using “Ijabe”; ELwPuI- Ewedu Leaves + 1g Potash Using “Ijabe”; ELuB- Ewedu Leaves using blender

Table 3 Vitamin C composition of “ewedu” Soups

Ewedu Soups	Vitamin C Content (mg/100g)
ELCuI	63.73^a
ELwBSuI	63.71^a
ELwPuI	63.20^a
ELuB	63.07^a

Values followed by different superscripts within a row are significantly different ($p \leq 0.05$); Keys: ELCuI – Ewedu Leaves (Control) using “Ijabe”; ELwBSuI - Ewedu Leaves + 1g Baking Soda Using “Ijabe”; ELwPuI - Ewedu Leaves + 1g Potash Using “Ijabe”; ELuB ;Ewedu Leaves using blender

4. Discussion

Table 1 shows the effect of cooking methods on the proximate composition of “ewedu” soups. There were significant differences in the proximate composition of the four samples for ash, protein, carbohydrate and energy value while no significant difference exists for moisture, fibre and fat contents of the soups. The moisture contents ranged from 82.56 – 82.65%. The high moisture content obtained in this study may be due to the addition of water (300ml) during the preparation of the soups; and this value was lower than the 92% value reported for cooked jute mallow (Samuel *et al*., 2020). Soup produced from “Ewedu” leaves using blender (ELuB) recorded the highest moisture content of 82.65%. It should be noted from the results (Table 1) that the high moisture content brought about a great reduction in the values of other proximate components.

Ash contents ranged from 6.33 – 6.46% in the samples. Soup produced from Ewedu leaves + 1g Potash using “Ijabe” (ELwPuI) recorded the highest ash contents (6.46%). However, there was no significant difference in the ash contents of the other samples. The range of values for ash in this study was lower than the range obtained for steam blanched (7.70 – 11.75%) and water blanched (6.50 – 7.25%) “ewedu” leaves (Adejumo *et al.,* 2022). The lower fibre contents ranging from 2.54 – 2.61% in the samples may probably be due to the crushing of the leaves into a fine, smooth homogenized slimy puree (Adejumo *et al.,* 2022). There was no significant difference in the fibre contents of the four samples.

All the samples had low protein contents ranging from 4.34 – 4.46%. Soup produced from “ewedu” leaves + 1g baking soda using “Ijabe” (ELwBSuI) had the highest protein content. The range of value for protein obtained in this study was similar to what was reported by Abdalla *et al*. (2016). The low protein content may be due to the presence of high moisture content in the samples. The fat content of the samples were also low and ranged between 0.96 – 1.08%. There was no significant difference in the fat contents among the samples.

An expected low carbohydrate content was obtained in all the samples since moisture content have shown to be significantly high in the samples. The carbohydrate content ranged from 2.92 – 3.13%. The low carbohydrate contents obtained in this study might have resulted in the low energy value range (38.24 – 39.24kcal) of the samples. Moreover, low fat and protein contents might also be partially due to the low energy value in the samples. It should be noted that protein and fat form a major factor of calculating energy values of food products (The results of the mineral compositions of ewedu soups produced using different cooking methods are shown in Table 2. Soups produced from “ewedu” leaves using blender (ELuB) was observed to have the lowest values in all the mineral elements assessed in this study with values of 8.72mg/100g (magnesium); 10.30mg/100g (sodium); 49.72mg/100g (calcium) and 218.05mg/100g (potassium). This may be due to a larger surface area of the crushed leaves using blender before cooking unlike other ones that were cooked before crushing with “ijabe”.

The most abundant of the minerals was potassium ranging from 218.05 – 234.98mg/100g. Soups made from ewedu leaves + 1g potash using “ijabe” (ELwPuI) had the highest potassium content probably due to the addition of potash as a tenderizer. D’elia *et al.* (2019) reported that increasing the dietary intake of potassium reduces blood pressure, contribute to bone mineral density and decreases cardiovascular disease risk. Calcium is responsible for bone formation in conjunction with phosphorous, magnesium, manganese Vitamin A, C and D, chlorine and protein (Akinhanmi *et al.,* 2018). The control sample (ELCuL) had the highest calcium content (49.77mg/100g). There was no significant difference in the calcium contents of all the soup samples in this study.

Soups made from ewedu leaves + 1g baking soda using “Ijabe” (ELwBSuI) and ewedu leaves + 1g potash using “Ijabe” (ELwPuI) showed a significant higher sodium contents (13.47 and 12.08mg/100g respectively) than the other two samples. This may be because of the chemical additives (Baking soda and Potash) since potash contains more sodium than potassium (Imafidon *et al.,* 2016). There was no significant difference in the magnesium contents of the soups produced and the values ranged from 8.72 – 8.75mg/100g. The control sample (ELCuI) and soups produced from ewedu leaves using blender (ELuB) had same magnesium value of 8.72mg/100g.

It should be noted that the ratio of sodium to potassium (Na/K) in the body is of great concern for prevention of high blood pressure (Omosuli *et al.,* 2009). Na/K ratio of less than 1 is recommended (Schlucter and Johnson, 2021). The Na/K ratio range in this study (0.05 – 0.06) is an indication that the consumption of the soups would help in reducing high blood pressure disease.

Table 3 shows the vitamin C compositions of the “ewedu” soups. There was no significant difference in the vitamin C composition of the soup samples. This implies that none of the cooking methods had any effect on the vitamin C contents. The vitamin C contents ranged from 63.07 – 63.73mg/100g with the control sample (ELCuI) having the highest value and this result is similar to what was reported in the literature (Islam, 2013). Moreover, the vitamin C contents in this study are within the recommend dietary allowance (RDA) of 45 – 90mg/100g daily (Schlucter and Johnson, 2021).

Vitamin C deficiency causes scummy that has several symptoms such as bleeding gums, bruising, weakness, swollen and painful legs and so on (Schlucter and Johnson, 2021). Vitamin C is found in varying quantities in fruits and vegetables and its scavenging activity help to prevent tissue damage, and speedy recovery of cold, cough, influenza, sores, malaria and bacterial infections (Ogunlesi *et al.,* 2020).

5. Conclusion

The quality of "ewedu" soups using chemical additives (baking soda and potash) and milling before cooking was investigated in this study. The results obtained shows that there was no significant difference in the moisture, fibre and fat contents of the four soup samples. A very high moisture content range (82.56 – 82.65%) was recorded; and this seriously reduced other proximate compositions in the soup samples. Potassium was found to be the most abundant out of all the mineral elements assessed in this study followed by calcium, sodium and magnesium in that order. However, the sodium – potassium ratio (Na/K) of less than 1 obtained in this study is an indication that the consumption of the soups would help in reducing high blood pressure.

The vitamin C content range (63.07 – 63.73 mg/100 g) obtained in this study was within the recommended dietary allowance of 45 – 90mg/100g daily. There was no significant difference in the vitamin C contents of all the four soup samples produced in this study.

From the results obtained in this study, I recommend that, milling before cooking can be adopted as a method of cooking "ewedu" soups without the addition of chemical additives, which can pose serious health risks following accumulation over a period.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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