Journal of Agriculture and Agricultural Technology
(JAAT)
Journal of Agriculture and Agricultural Technology 13 (2) 2024

EVALUATION OF NUTRITIONAL COMPOSITION OF DEHYDRATED EWEDU SOUP MIX

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ABSTRACT

Leafy vegetables play a significant role in the diet as they are important sources of nutrients. Ewedu leaves (Corchorus Olitorius) are abundant during the rainy season in Nigeria and many other tropical African countries but become scarce during the dry season. This aimed to dehydrate ewedu leaves and produce an instant soup mix. The jute leaves (ewedu leaves) were sorted, destemmed, washed, drained, and frozen in the dryer under a vacuum at 20 Pa for 3 hours. The dry leaves were blended with different levels of ingredients in the ratio of 86:2:0: 10:2, 76:2:10:10:2, 96:2:0:0:2, 88:0:0:10:2 and 98:0:0:0:2 for ewedu leaf, dry paper, dry fish, iru, and potash at 100g. The samples were labelled A, B, C, D and E. The samples were subjected to nutritional analysis (proximate, minerals and vitamins) to provide information on the nutrient composition of the samples. The dehydrated instant ewedu soup mix samples recorded a value of 5.02-5.89% moisture, 21.97-35.01% protein, 5.15-7.43% fat, 5.08-6.45 ash, 14.23-15.38% crude fibre, and 30.99-47.40% carbohydrate. The samples were also high in iron (11.00-15.65 mg/100 g), calcium (210.53-240.95 mg/100 g), sodium (88.99-100.48 mg/100 g), potassium (251.97-286.45 mg/100 g), phosphorus (355.09-372.61 mg/100 g), vitamin B3 (51.13-80.45 mg/100 g) and Vitamin C (52.12-63.43 mg/100 g) respectively. Dehydrated instant ewedu soup mix should be prepared by freeze-drying using sample B formulations (76:2:10: 10:2) as it was higher in nutrients due to adding 10% dried fish and "iru."

Keywords: Dehydrated, *Ewedu, Iru,* Soup

INTRODUCTION

In many Nigerian homes, green leafy vegetables play a significant role in the diet as they are excellent sources of phenolic compounds, vitamins, and minerals compared to cereal grains. They have high mineral elements like iron and calcium, the only natural folic acid sources (Natesh*et al.,* 2017). Leafy vegetables such as *Corchorus Olitorius ewedu* leaves are rarely processed in Nigeria, most likely because of inadequate dehydrating, canning, or freezing preservation facilities. However, a small quantity is sun-dried or shade-dried, producing poor-quality products with inconsistent moisture contents and microbial loads that compromise their stability during storage (Mepba *et al.,* 2007). The leafy vegetables are abundant during the rainy season in Nigeria and many other tropical African countries, but they become scarce during the dry season. Some of the traditional vegetables grown in Nigeria are *ogumo, worowo,* water leaf*, soko,* bitter leaf, *ugu,* scent leaf, *iyana ipaja, tete, utazi* leaf*, oha* leaf*, uziza* leaf *and ewedu* leaf (Sanni *et al.,* 2019).

Instant soup is a major element of instant food, and it is highly preferred in modern society for its simple, easy, and instant preparation characteristics (Islam *et al.,* 2018). Since millions worldwide suffer from malnutrition, dehydrated soup mixes are in high demand and a great way to provide these people with nutrients (Sarker *et al.,* 2019). A dehydrated *ewedu* soup mix can be a convenient solution for busy individuals, saving time and effort in traditional soup preparation, shelf life extension, food waste reduction and ensuring a readily available option. This instant soup can significantly contribute to fulfilling people's nutritional requirements, making it an ideal option for various segments of the population, including older individuals. Institutions, hotels, restaurants, medical facilities, and working families can easily reconstitute them. The extended shelf life of dehydrated soup powders, up to six months, is one of their main advantages (Rekha, 2010). Using predictive models, it was found that the shelf-life of freeze-dried *ewedu* soup was longer than 35 days at room temperature (Balogu *et al.,* 2020). There is currently limited research on producing and evaluating instant *ewedu* soup mix. Hence, this study will provide information on the best formulations and nutritional composition of the soup mix and solve the problem of seasonal availability of the leaves.

MATERIALS AND METHODS

Source of Materials

Fresh jute leaf (*ewedu* leaf), dried pepper, fermented locust bean (*iru*), dried fish and potash were purchased from Lapai Central Market, Niger state. The reagents used were of analytical standard.

Sample Preparation

Preparation of Dehydrated Jute Leaves (*Ewedu*)

The jute leaves were sorted, and the stem was removed and washed under running tap water until they were free from all adhering soil and impurities. The clean leaves were freeze-dried in the vacuum chamber of a freeze dryer (LGJ-18, SHKY, Chin) at a pressure (20 Pa) for 3 h and blended into a coarse texture using a blender (Panasonic, MX-AC300, Japan). The coarse leave powder was mixed with different ingredients (*iru*, potash, dried pepper, and dried fish) at different blend ratios, as shown in Table 1. They were uniformly blended into a smooth texture and sieved (1.0 mm aperture). The powdered *ewedu* was stored in an airtight container for further analysis.

Preparation of *Ewedu* Soup

Boiling water (100 mL) was measured into five different containers, to which 4 g of *ewedu* powder was added, mixed with a whisk for 1 minute, and covered for 3 minutes to produce the *ewedu* soup samples.

Table 1: Blend Formulation for Dehydrated *Ewedu* Soup Mix

Items	Sample A(g)	Sample B(g)	Sample C(g)	Sample D(g)	Sample E (g)
Ewedu	86	76	96	88	98
Dry pepper	2	2	2	----	----
Dry fish	----	10	---	----	----
Iru	10	10	---	10	----
Potash	2	2	2	2	2

A=86% *Ewedu* + 2% Dry pepper + 0% Dry fish + 10% Iru + 2% Potash, B=76% *Ewedu* + 2% Dry pepper + 10% Dry fish + 10% Iru + 2% Potash, C=96% *Ewedu* + 2% Dry pepper + 0% Dry fish + 0% Iru + 2% Potash, D=88% *Ewedu* + 0% Dry pepper + 0% Dry fish + 10% Iru + 2% Potash, E= 98% *Ewedu* + 0% Dry pepper + 0% Dry fish + 0% Iru + 2% Potash

Determination of the Proximate Composition of Dehydrated Ewedu Soup Mix

The proximate composition of dehydrated *ewedu* soup mix was determined according to AOAC (2015) methods, and carbohydrate content was determined by difference according to Ihekoronye and Ngoddy (1985).

Moisture Content Determination

Moisture content was determined using the air oven dry method. A clean dish with a lid was dried in an oven (Uniscope Surgifriend Medicals, England) at 100 ^{o}C for 30 min. It was cooled in desiccators and weighed. Two grams of sample was then weighed into the dish. The dish with its content was then put in the oven at 105^{o}C and dried to a fairly constant weight. The loss in weight from the original sample (before heating) was reported as a percentage of moisture.

$$\%\ Moisture = \frac{Weight\ Loss\ (W_2 - W_3)}{Weight\ of\ Sample\ (W_2 - W_1)}\ x\ 100$$

$where$:

$W_1 = Weight\ of\ dish,$

$W_2 = Weight\ of\ dish + sample\ before\ drying,$

$W_3 = Weight\ of\ dish + sample\ before\ drying.$

Ash Content Determination

Two grams of sample was weighed into an ashing dish, which had been pre-heated, cooled in a desiccator and weighed soon after reaching room temperature. The crucible and content were then heated in a muffle furnace at 55 ^{o}C for 6 h. The dish was cooled in a desiccator and weighed soon after reaching room temperature. The total ash was calculated as a percentage of the original sample weight

$$\%\ Ash = \frac{(W_3 - W_1)}{(W_2 - W_1)}\ x\ 100$$

$$where: W_1 = weight\ of\ empty\ crucible, W_2 = weight\ of\ crucible + sample\ before\ ashing,$$

$W_3 = weight\ of\ crucible + content\ after\ ashing$

Crude Fibre Determination

Two grams of the sample was extracted using diethyl ether. This was digested and filtered through the California Buchner System. The resulting residue was dried at 130 ^{o}C for 2 h, cooled in a desiccator and weighed. The residue was then transferred into a muffle furnace (Uniscope Surgifriend Medicals, England), ignited at 550 ^{o}C for 30 minutes, and cooled and weighed. The percentage of crude fibre content was calculated as

:

$$\%\ Crude\ Fibre\ = \frac{Loss\ in\ weight\ after\ incineration}{Weight\ of\ original\ food} \times 100$$

Crude Fat Determination

Fat was determined using the Soxhlet method. Samples were weighed into a thimble, and loose plug fat-free cotton wool was fitted into the top of the thimble with its content inserted into the bottom extractor of the Soxhlet apparatus. A flat bottom flask (250 mL) of known weight containing 200 mL of hexane was fitted to the extractor. The apparatus was heated, and fat was extracted for 8 hours. The solvent was recovered, and the flask (containing oil and solvent mixture) was transferred into a hot air oven (UNISCOPE SURGIFRIEND MEDICALS, ENGLAND) at 105 ^{o} C for 1 h to remove the residual moisture and to evaporate the solvent. It was later transferred into a desiccator to cool for 15 min before weighing. Percentage fat content was calculated as:

$$\%\ Crude\ Fat = \frac{weight\ of\ extracted\ fat}{Weight\ of\ Sample}\ x\ 100$$

Crude Protein Determination

The Kjeldahl method was used to determine the percentage of crude protein. Two grams of sample was weighed into a Kjeldahl digestion flask using a digital weighing balance (Uniscope Surgifriend Medicals, England: Max. 180 g). A catalyst mixture weighing 0.88 g (96% anhydrous sodium sulphate, 3.5% copper sulphate and 0.5% selenium dioxide) was added. Concentrated sulphuric acid (7 mL) was added and swirled to mix content. The Kjeldahl flask was heated gently in an inclined position in the fume chamber until no particles of the sample were adhered to the side of the flask. The solution was heated more strongly to make the liquid boil with intermittent shaking of the flask until a clear solution was obtained. The solution was

allowed to cool and diluted to 25 mL with distilled water in a volumetric flask. Ten mL of diluted digest was transferred into a steam distillation apparatus. The digest was made alkaline with 8 mL of 40 % NaOH. To the receiving flask, 5 mL of 2 % boric acid solution was added, and 3 drops of the mixed indicator were dropped. The distillation apparatus was connected to the receiving flask with the delivery tube dipped into the 100 mL conical flask and titrated with 0.01 M HCl. A blank titration was done. The percentage of nitrogen was calculated from the formula

:

$$\% \, Nitrogen = \frac{(S-B)\times 0.0014\times 100\times D}{Sample\ Weight}$$

$where$

$S = sample\ titre, B = blank\ titre, S - B = corrected\ titre, D = diluted\ factor$

$\% \, Crude\ Protein = \% \, Nitrogen \times 6.25\ (correction\ factor)$

Carbohydrate Determination

Carbohydrate content was determined by difference according to Ihekoronye and Ngoddy (1985) as follows:

$\% \, Carbohydrate\ = 100 - (\% \, Moisture + \% \, Ash + \ \% \, Fibre + \% \, Fat + \ \% \, Protein)$

Determination of the Mineral Content (Mg/100g) of *Ewedu* Soup Mix

Determination of Iron

The determination of iron was carried out using the AOAC (2015) method. A standard solution, containing 100 mg/mL of Fe3+ ions, was prepared from 1 g pure iron wire. The wire was dissolved in 20 mL of concentrated HNO3, boiled in a water bath, and diluted to 1000 mL with distilled water. A standard solution containing 0, 0.5, 1.0, 2.0, and 4.0 ppm was prepared. Two millilitres of sample aliquot were diluted to 100 mL and used to determine the absorbance of the sample using an atomic absorption spectrophotometer (Uniscope Surgifriends Medicals, England) at 510 nm. The standard and sample absorbance were noted, and the concentration of iron in the sample was determined from the standard curve.

Determination of Potassium

Potassium was determined by Flame Photometry (AOAC, 2015). One gram of sample was dissolved in 20 mL of acid mixture (650 mL of concentrated HNO3; 80 mL PCA; 20 mL conc. H2SO4), and aliquots of the diluted clear digest were taken for photometry using a Flame analyzer.

Determination of Calcium

The standard AOAC (2015) method was used for calcium determination using the atomic absorption spectrophotometer. Calcium carbonate (2.495 g) was dissolved and diluted to 100 mL with de-ionized water. This solution contains 1000 mg Ca2+ ions, and from this stock solution, calcium standards of the following concentration levels: 0.0, 3.0, 6.0, and 9.0 were prepared. The absorbance of both the sample and the standard working aliquot was determined in the atomic absorption spectrophotometer (Uniscope Surgifriends, England) at 239.9 nm. The concentration of the test mineral in the sample was calculated with reference to the graph (standard curve) and obtained as follows:

$$Calcium(mg/kg) = \frac{100 \times Y \times Vf \times D}{W \times 100 \times Va}$$

Where

W = weight of the sample analyzed,

Y = Concentration of Calcium obtained from the standard curve,

Vf = Total volume of extract

Va = volume of extract used

D = Dilution factor

Determination of Phosphorus

The standard method of AOAC (2015) was phosphorus determination using a spectrophotometer. Phosphorus in the sample was determined by the molybdate method using hydroquinone as a reducing agent. Sodium sulphate (1.0 mL), 1.0 mL of ammonium molybdate and 1 mL of hydroquinone were added to 1 mL of the sample digest. The mixture was agitated and allowed to stand for 30 minutes for the blue colour to develop. The absorbance of the

sample was determined using the spectrophotometer at 600 nm. The phosphorus standard was prepared by dissolving 1.1 g of monobasic potassium phosphorus (KH_2PO_4) into a 500 mL volumetric flask containing 500 mL of distilled water. Five drops of toluene were added to diminish microbial activity. Twenty millilitres of the standard stock was collected and made up to 100 mL. This contained 100 ppm. Standard stock (0.1 mL) = 0.2 ppm. Zero to one millilitre of the 100 ppm phosphorus stock solution was poured into a 100 mL volumetric flask separately and treated the same way as the sample. The reading of the standard was taken at 600 nm in UV/VIS spectrophotometer (Uniscope Surgifriend Medicals, England) and a standard curve was plot

$$P(mg/kg) = \frac{100 \times Au \times C \times Vf}{W \times As \times Va}$$

Where

W = Weight of sample analyzed

Au = Absorbance of test sample

As =Absorbance of standard phosphorus solution

C =Concentration (in mg/ml) of sample

Vf = Total vomule of extract

Va =Volume of extract analyzed

Determination of Sodium

The determination of sodium concentration was achieved using the standard method of AOAC (2015). A weight of 0.2542 g of NaCl was dissolved in 1 litre of distilled water to give a 100 ppm Na solution. This working standard solution was then diluted to produce a range of 0-10 ppm sodium. A 2 mL sample aliquot (sample stock solution) was read using a flame photometer. The concentration of sodium in the sample was then calculated with reference to the standard curve, as follows:

$$Sodium(mg/kg) = \frac{100 \times Y \times Vf \times D}{W \times 100 \times Va}$$

Where:

W =Weight of the sample analyzed

Y =Concentration of Na obtained from the standard curve

Vf =Total volume of digest/extract (100 ml)

Va = Volume of extractused

D = Dilution factor

Determination of Vitamins Content of the *Ewedu* Soup Mix

Determination of Vitamin B (B1 and B2)

The standard fluorimetric method of the AOAC (2015) was followed, and the procedure for pyridoxine is as follows. A portion (30 mL) of hydrochloric acid (0.1) solution was added to about 5 g of sample, and the content was mixed thoroughly; 1 mL of the solution was transferred to a cleaned test tube and 4 mL of distilled water. In the second test tube, 5 mL of standard solution was put (standard), and in the third test tube, distilled water was used as the mobile phase. For the blank determination, sodium hydrosulphite (Na_2SO_4) was dissolved in 0.4% sodium acetate as specified in the AOAC semi-automated method. The sample was aspirated into the sample loop, and fluorescence was recorded.

Determination of Vitamin B3

These were determined using the method described by AOAC (2015). Five grams of the homogenized sample was weighed into a 100 mL volumetric flask. 0.1 N hydrogen chloride was added and mixed, then autoclaved for 30 minutes at 121 ^{o}C. The samples were allowed to cool. Interfering substances were precipitated by adjusting the pH to 6.0, followed immediately by readjusting the pH to 4.5. This was then diluted to volume with water and filtered. Five mL of 6 % enzyme (mylase 100) was added and incubated for 3 hours at 45-50 ^{o}C. This was then cooled, with pH adjusted to 3.5, diluted with water to volume, mixed, and filtered. Ten mL of diluted extract was oxidized by passing through a sepak C18 cartridge followed by 5 mL 0.01 M phosphate buffer at pH 7.0. The vitamins were separated by high-performance liquid chromatography (HPLC) (Model: BLC-10/11, Buck scientific, USA) using a 4.6 mm × 25 cm

ultra-sphere ODS (operational data store), 5 column or equivalent and detected by florescence at 360 nm/415 nmex/em. The pyridoxine, riboflavin and thiamin contents were measured by the calculation below

:

$$\mu g/g = C \times V(Df \times Wt)$$

$Where$:

$$C = Conc.ofvitamin\ in\ \mu\frac{g}{ml} obtained\ from\ height\ or\ area\ of\ sample\ and\ standard$$

$\mathrm{V} = \text{Sample volume (ml)}$

$\mathrm{Df} = \text{Dilutionfactor}$

$\mathrm{Wt} = \text{Weight of sample (g)}$

Determination of Vitamin C (Ascorbic Acid)

Vitamin C was determined by the titration method as described by (AOAC, 2015). A standard solution of ascorbic acid (5 mL) was pipetted into a 100 mL conical flask, 10 mL of oxalic acid was added, and the solution was titrated against the dye (V1) until a pink colour persisted for 15 seconds. The dye consumed is equivalent to the amount of ascorbic acid. Also, 0.5 g of the sample was extracted in 4% oxalic acid and made up to 100 mL. The solution was titrated against the dye solution (2,6 dichlorophenol indophenols). The volume of the dye was recorded as V2. The calculation below was used to calculate vitamin C:

Data Analysis

The GENSTAT Statistical Software (version 17.0) was used for data analyses. Data were subjected to analysis of variance (ANOVA), and the separation of means was done using Duncan's Multiple Range Test (DMRT) at ($P \leq 0.05$).

RESULTS AND DISCUSSION

Proximate Composition of Dehydrated Instant *Ewedu* Soup Mix

The results of the proximate compositions of the different dehydrated instant *ewedu* soup mix samples are presented in Table 2. There was a significant ($p<0.05$) difference in the proximate composition of the samples. The moisture content of the samples ranged from 5.02 -

5.89%. This value is close to 5.21%, as reported by Ncube (2022) in *Corchorus Olitorius.* However, the result of this study is lower compared to 7.44-13.5% for *Corchorus Olitorius* (*ewedu* leaf) by Adesina*et al.* (2022) and 8% by Balogu *et al*. (2020) for *ewedu* leaves. The variation in moisture content may be due to climatic conditions and the maturity stage of harvest (Ncube, 2022). Abdel-Haleem and Omran (2014) reported that food powders with less than 10% moisture content have better keeping qualities as soup ingredients. Thus, longer shelf life. The protein content of the samples ranged between 21.97 - 35.01%. These values are higher than the 17.5% reported for *the Sooro* variety of *Corchorus Olitorius* (Adesina *et al.,* 2022) and 14% reported for *ewedu* leaf (Balogu*et al*., 2020). Dried locust beans (*iru*) have a crude protein content of 32.51% - 33.52% (Famuwagun and Taiwo, 2023). The higher crude protein content of samples B and A can be attributed to including animal protein (fish) and *iru*. Thus, they are good sources of protein needed in the body for growth and tissue replacement. Deepa *et al*. (2021) reported that plant foods when rightly combined with other foods, can be of high biological value and satisfactorily meet the protein needs of children and adults.

The crude fat content of the samples ranged between 5.15 and 7.43%. The level of fat content in this study is higher than 1.98-2.22% by Adesina *et al.* (2022) for *ewedu* varieties and lower than 34% and 19.76 % by (Balogu *et al*., 2020) and (Ncube, 2022) for *ewedu* leaf. Sample B had the highest percentage of fat (7.43 %). This might be due to the inclusion of dried fish, a fat source. Dried fish contain fatty tissues with varying amounts of fat (Fitri *et al.,* 2022). This explains the significantly higher fat content of sample B. This indicates sample B is a good source of fat and energy. The ash content of the samples ranged between 5.08-6.45%. The values were lower than 9.36-11.7% for *ewedu* varieties by Adesina *et al.* (2022). The ash contents of the soups are suggestive that they can be good sources of minerals, especially macro minerals. The moderately high ash values for the samples may be attributed to the ingredients (pepper, *iru*, potash, and dried fish) used in preparing the soups. This indicates that sample B contained some inorganic substances (minerals) necessary for body utilization.

The crude fibre content of the samples ranged from 14.23-15.38%. These values were higher than 11.2-12.9%, as Adesina *et al.* (2022) reported for a similar sample. According to Ishida *et al*. (2000), vegetables are often abundant in dietary fibre, significantly benefiting consumers by lowering their risk of colon cancer, diabetes, hypertension, constipation, and heart disease. It has also helped in faecal elimination. The carbohydrate content of the samples ranged from 30.99-47.40%. The values in this study were lower than 31.8-48.5% reported for *ewedu*

varieties by Adesina *et al.* (2022). The available carbohydrates constituted almost one-third of the soups. The carbohydrate content of the soups is relatively low when compared with that of roots, tubers, grains and legumes, indicating that soups are generally not a major source of energy for body use but rather a supplementary source of carbohydrates and energy. Omah *et al.* (2015) reported that the carbohydrate contents of soups were lower probably because of the products' high protein, fat, ash, and fibre content. Since soups that are low in carbohydrate content are usually consumed with carbohydrate-based meals, taking these soups and accompanying dishes will promote good health among consumers.

Table 2: Proximate Composition *Ewedu* Soup Mix

Sample	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Crude fibre (%)	Carbohydrate (%)
A	5.33 ^{a}±0.11	31.12^{a}±0.36	6.60^{a}±0.13	6.25^{a}±0.11	15.01^{a}±0.11	35.69^{a}±0.71
B	5.89^{b}±0.15	35.01^{b}±0.22	7.43^{b}±0.10	6.45^{b}±0.09	14.23^{b}±0.19	30.99^{b}±0.50
C	5.10^{c}±0.02	24.51^{c}±0.54	5.79^{c}±0.25	5.29^{c}±0.07	15.25^{c}±0.21	44.29^{c}±0.87
D	5.19^{c}±0.10	27.01^{d}±0.37	6.52^{a}±0.43	6.01^{d}±0.04	14.95^{d}±0.28	40.32^{d}±0.43
E	5.02^{c}±0.17	21.97^{e}±0.36	5.15^{d}±0.49	5.08^{e}±0.08	15.38^{e}±0.30	47.40^{e}±0.55

values are means of duplicate determinations. values with same superscript along the same column are not significantly different at $p<0.05$

Key:

A=86% *Ewedu* + 2% Dry pepper + 0% Dry fish + 10% Iru + 2% Potash

B=76% *Ewedu* + 2% Dry pepper + 10% Dry fish + 10% Iru + 2% Potash

C=96% *Ewedu* + 2% Dry pepper + 0% Dry fish + 0% Iru + 2% Potash

D=88% *Ewedu* + 0% Dry pepper + 0% Dry fish + 10% Iru + 2% Potash

E= 98% *Ewedu* + 0% Dry pepper + 0% Dry fish + 0% Iru + 2% Potash

Mineral composition of Instant *Ewedu* Soup Mix

The results of the mineral composition of the different dehydrated instant *ewedu* soup mix samples are indicated in Table 3. There was a significant ($p<0.05$) difference in the mineral composition of dehydrated instant *ewedu* soup mix samples. The iron content of the samples ranged from 11.00-15.65 mg/100 g. The values are lower than (25.98 mg/kg) by Musa and Ogbadoyi (2012) for sun-dried *ewedu* leaves. Sample B had moderate iron content, which is believed to be bioavailable, as the soups contained ingredients from animal sources, which

contributed significantly to the iron values of the soups. The sodium content of the samples ranged between 88.99 and 100.48 mg/100 g. The sodium contents are very high. The value is low compared to 180 mg/100 g reported by Famuwagun and Taiwo (2023) for *miyan kuka* and higher than 28.5 mg/kg for *Oniyaya* leaf of *Corchorus Olitorius* (*ewedu*). The high value of this study may be attributed to the potash added to all samples, which aided the sliminess of *the ewedu* soup samples. Sodium has been implicated in cardiovascular disease risk, particularly hypertension (Ross *et al.,* 2016). However, sodium is essential for absorbing glucose in the kidney and intestine and transporting other nutrients across membranes (Vishwanath, 2012).

The potassium content of the samples, ranging from 251.97-286.45 mg/100 g, was notably high. This can be attributed to the potash added, which enhances the sliminess of *ewedu* soups. This value was higher than the 167-424 mg/100 g reported for ewedu varieties by Adesina *et al.* (2022) and *the* 25.08- 38.61 mg/100 g for *ewedu* leaves by Adejumo *et al*. (2022). However, it was lower than the 840 mg/100g in *miyan kuka*, *Onugbu* soups reported by Kayode *et al*. (2010). The high potassium content is advantageous, as it plays a crucial role in balancing intracellular fluid and is associated with lower blood pressure values. Sample B had a significantly higher potassium Value compared to other samples.

The calcium content of the samples, ranging from 210.53-268.39 mg/100 g, is significantly high. This value is higher than the 35.6- 46.5 mg/100 g reported by Adesina *et al.* (2022). The high calcium content can contribute meaningfully to the daily calcium requirements of both adults and children. This high calcium value could be attributed to the contribution from the ingredients, especially *iru*, which has been reported to contain high amounts of calcium (711.56 - 745.16 mg/100 g) (Famuwagun and Taiwo, 2023). The phosphorus content ranged from 255.09-272.51 mg/100 g, indicating high levels. This may be attributed to the presence of dried fish and *iru*, which have good levels of phosphorus. Hence, the observed high value of phosphorus in sample B.

Vitamin Content of Instant *Ewedu* Soup Mix

The results of the vitamin content of the dehydrated instant *ewedu* soup mix samples are shown in Table 4. There was a significant ($p \leq 0.05$) difference in the vitamin content of the samples. Vitamin B1, B2, B3, and vitamin C ranged from 1.41-1.72 mg/100 g, 0.43-0.77 mg/100 g, 60.67-80.45 mg/100 g and 53.25-63.43 mg/100 g, respectively. These values were higher than 0.04 mg/100 g (vitamin B1), 0.06 mg/100 g (vitamin B2) and 0.61 mg/100 g (vitamin B3)

reported by Adeniyi *et al*. (2012) in *Corchorus Olitorius* (*ewedu* leaves). However, vitamin C content in this study was lower than 316.80 mg/100 g reported by Adeniyi *et al*. (2012 The soup mixes contained appreciable amounts of vitamins B1, B2, B3 and C. The appreciable amounts of water-soluble vitamins observed in this study might have been due to their retention during freeze-drying and the ingredients used. This may explain the higher value of these vitamins in the soup mixes with dried fish in this study.

Table 3: Mineral Composition *Ewedu* Soup Mix

Samples	Iron (mg/100g)	Calcium (mg/100g)	Sodium (mg/100g)	Potassium (mg/100g)	Phosphorus (mg/100g)
A	$13.00^{a}\pm0.91$	$240.95^{a}\pm2.75$	$96.55^{a}\pm1.85$	$274.65^{a}\pm0.35$	$360.79^{a}\pm0.15$
B	$15.65^{b}\pm0.41$	$268.39^{b}\pm2.01$	$100.48^{b}\pm1.19$	$286.45^{c}\pm0.25$	$372.61^{b}\pm0.50$
C	$11.20^{c}\pm1.20$	$231.12^{c}\pm1.25$	$91.11^{c}\pm1.35$	$258.33^{b}\pm1.30$	$364.01^{a}\pm0.10$
D	$13.40^{d}\pm0.02$	$245.80^{a}\pm1.05$	$96.93^{a}\pm1.05$	$275.78^{a}\pm1.25$	$365.34^{a}\pm0.10$
E	$11.00^{c}\pm1.35$	$210.53^{d}\pm1.09$	$88.99^{d}\pm1.40$	$251.97^{b}\pm1.80$	$355.09^{c}\pm0.21$

values are means of duplicate determinations. values with same superscript along the same column are not significantly different at $p<0.05$

Key:

A=86% *Ewedu* + 2% Dry pepper + 0% Dry fish + 10% Iru + 2% Potash, B=76% *Ewedu* + 2% Dry pepper + 10% Dry fish + 10% Iru + 2% Potash , C=96% *Ewedu* + 2% Dry pepper + 0% Dry fish + 0% Iru + 2% Potash, D=88% *Ewedu* + 0% Dry pepper + 0% Dry fish + 10% Iru + 2% Potash, E= 98% *Ewedu* + 0% Dry pepper + 0% Dry fish + 0% Iru + 2% Potash

Table 4: Vitamin Content of Instant *Ewedu* Soup Mix

Samples	Vitamin B1 (Thiamine) (mg/100 g)	Vitamin B2 (Riboflavin) (mg/ 100 g)	Vitamin B3 (Niacin) (mg/ 100 g)	Vitamin C (Ascorbic acid) (mg/100 g)
A	$1.69^{a}\pm0.05$	$0.53^{b}\pm0.06$	$60.67^{a}\pm0.09$	$58.600^{a}\pm0.11$
B	$1.72^{a}\pm0.06$	$0.43^{c}\pm0.08$	$60.94^{a}\pm0.11$	$53.25^{b}\pm0.06$
C	$1.43^{c}\pm0.08$	$0.77^{a}\pm0.06$	$80.45^{b}\pm0.13$	$63.43^{b}\pm0.03$
D	$1.61^{b}\pm0.03$	$0.45^{c}\pm0.02$	$51.13^{c}\pm0.10$	$52.12^{c}\pm0.13$
E	$1.41^{c}\pm0.08$	$0.56^{b}\pm0.03$	$71.26^{d}\pm0.07$	$60.70^{d}\pm0.09$

Values are means of Duplicate determinations. Values with same superscript along the same column are not significantly different at $p<0.05$.

Key:

A=86% *Ewedu* + 2% Dry pepper + 0% Dry fish + 10% Iru + 2% Potash, B=76% *Ewedu* + 2% Dry pepper + 10% Dry fish + 10% Iru + 2% Potash, C=96% *Ewedu* + 2% Dry pepper + 0% Dry fish + 0% Iru + 2% Potash, D=88% *Ewedu* + 0% Dry pepper + 0% Dry fish + 10% Iru + 2% Potash, E= 98% *Ewedu* + 0% Dry pepper + 0% Dry fish + 0% Iru + 2% Potash

CONCLUSION AND RECOMMENDATION

Dehydrated instant *ewedu* soup mixes are rich in nutrients such as protein, vitamins (B3 and C), and minerals (calcium, phosphorus, and potassium). This study indicated that dehydrated instant *ewedu* soup mixes prepared using dried fish and "*iru*" (sample B) were highly nutritional. This blend's good value indicates that the recipe should be adopted and utilized.

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