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Chemical Composition and Utilisation of Raw and Cooked Walnuts as a Soup Thickening Agent

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Abstract: The study examined the chemical composition of raw and cooked walnuts to determine the extent of its utilization as a soup thickening agent. It also considered the antinutrients of walnut which are phytate, oxalate and tannins. The study adopted an experimental research in which 20 panel lists evaluated the sensory attributes of the soup samples using 9-point hedonic scale questionnaires. The result revealed that all parameters determined showed a significant difference ($P<0.05$) in the soup samples. The soup samples had the following material compositions: Sample A (Raw walnut) Ca 88.61±0.01, Mg 70.83±0.01, P 58.30±0.01, K 204.22±0.02, Fe 0.78±0.01, Zn 2.02±0.01, Cu 2.49±0.01. Sample B (Cooked walnut) Ca 89.74±0.03, Mg 66.27±0.01, P 55.38±0.02, K260.01±0.01, Fe 1.06±0.01, Zn 3.28±0.00, Cu2.24±0.02. Sample C which served as the (Achi) Ca 44.67±0.02, Mg 21.09±0.02, P 52.63±0.03, K 211.53±0.04, Fe 0.70±0.00, Zn 0.64±0.05, Cu 2.04±0.02. Sensory evaluation showed significant difference ($P>0.05$) between the soup samples. In taste, appearance, color, flavor and general acceptability, sample B (cooked walnut) was most preferred. Walnut can be used to prepare a very delicious soup by families and also commercial food outlets.

Key words: Antinutrients · Walnut · Soup · Thickening Agents

INTRODUCTION

According to Wikipedia (Wikipedia.com), Micronutrient deficiency is not enough micronutrients required for optimal plant or animal health. Micronutrients also according to Wikipedia are essential elements required by organisms in varying quantities throughout life to orchestrate a range of physiological functions to maintain health. In summary, micronutrients needed by humans can be divided into 4 groups water-soluble vitamins, fat-soluble vitamins, micro-minerals and trace minerals.

Micronutrient deficiency is still a public health problem in Nigeria despite the effort that has been made to eliminate it. World Health Organization [1] reported that about 30% of the population in developing countries suffer currently from one or more of the multiple forms of nutritional deficiencies, especially that of micronutrient. Ajaiyeoba *et al.* [2] stated that incidence of malnutrition is higher in the rural areas than urban slums, particularly protein and micronutrient deficiencies.

AOAC [3] observed that in most developing countries three micronutrient deficiencies are common. These are vitamin A deficiency (VAD); iron deficiency anemia (IDA) and iodine deficiency disease (IDD). Nuts and vegetables are generally acceptable as good sources of nutrient and supplement for food in a world faced with scarcity. They are known to be excellent source of nutrients such as minerals and vitamins. The high incidence of malnutrition, especially in Nigeria has been seen as the core cause of major forms of anemia in children and pregnant /nursing mothers (that is nutritional deficiency and haemolytic anemia) [4]. Butler [5] stated that Nuts and vegetables have been linked to the management of anemia because they are rich in vitamins and minerals. Some of these vitamins are not directly

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involved in red blood cell production but they promote the absorption of other important minerals, example ascorbic acid promotes the absorption of iron from the small intestine.

Often times, in Nigeria, most staple foods are consumed without additional supplement and at times without adequate knowledge of its compositions. There are many wild Nuts and fruits wasting in forest. Carlson [6] reported that such Nut as Walnut (*Juglans regia L.*) also grows wild. They could be utilized to provide protein and micronutrient needs of the populace. Walnuts are among the most widely consumed commercially grown tree nuts in the world. Nuts and seeds are good sources of lipids and protein. In addition, nuts and seeds are widely used for their oils as well as in butters and cookies, and they are consumed directly as food due to their characteristic flavors. Nuts and seeds are lucrative and have anti-aging effects due to their abundance of in vitamins B and E. Among the fatty acids commonly found in nuts and seeds, 70-80% is essential fatty acids, which are components of the plasma membrane and contain a lipoprotein found in brain cells known as lecithin. Therefore, nuts and seeds are excellent nutrients for growing children and good snacks for adults. Chinese walnut production reached 1655.508 thousand tons in 2011, accounting for 48.42% of the world's total production of walnut, ranking first in the world production of walnut. In China, walnuts (*Juglans regia L.*) are a resourceful nut and distributed widely. Walnuts, the seeds of *Juglans regia L.,* are a highly nutritious food. It has been reported frequently that regular consumption of walnuts can decrease the risk of heart disease [7]. The FDA authorized a health claim indicating that diets including walnuts can reduce the risk of heart disease.

Micronutrients

Calcium: Calcium is one of the minerals found in the human body. The teeth and bones contain about (99% of calcium). Nerve cells, body tissues, blood and other body fluids contain the remaining calcium [8]. Calcium helps in maintaining healthy bone and teeth. Proper levels of calcium over a lifetime can prevent osteoporosis. Calcium assists in blood clotting, nerve signaling, muscle contraction and relaxation, and the release of certain hormones. It is also needed for normal heart beat. Calcium is one of the minerals believed to be an important factor governing fruit storage quality [9]. It has been reported to delay ripening senescence and reduce storage disorder in fruits [10]. Institute of Medicine (IOM) [11] reported the following to be daily dietary intake of calcium, 210mg-270mg for infants, 500mg-1,300mg for children, 1,300mg for male and female adolescents (14-18years), 1000mg for adults males and females 19 to 50 years.

Phosphorus: Phosphorus is a mineral that makes up 1% of a person's total body weight, Gajewsk *et al.* [12]. It is present in every cell of the body but most of the phosphorus in the body is found in bone and teeth. Phosphorus is needed in the formation of bone and teeth. It plays a vital role in the body in the utilization of carbohydrates and fats and in the synthesis of protein or the growth, maintenance and repair of tissue. It is crucial for the production of ATP, a mode to store energy in the body. Phosphorus works with vitamin D, assists in the contraction of muscles, in the functioning of kidneys, in maintaining the regularity of the heat beat, and in nerve conduction. They reported the recommended dietary intakes of phosphorus to be 700mg/day for adults, 1,250mg per day for pregnant and lactating women who are younger than 18 years, 5 500mg per day for children who are between four to five years, 275mg per day for children who are 7 to 12 months, 100mg per day for children birth to 6 months old.

Iron: Iron is an essential nutrient. Iron occurs in two forms in foods, heme ("organic") and non-heme ("inorganic"). The body require iron for the oxygen synthesis, transport of proteins heamoglobin and myoglobin, and other iron containing enzymes which participate in electron transfer oxidation –reduction reactions. They recommended the following daily dietary intake of iron, 10mg for adults males, 18mg for adolescents 11years and above, 6- 10mg for infants, 15mg for six months to three years old.

Zinc: Zinc is needed for the body"s defensive system (immune) to work properly. It plays a role in cell division, cell growth, wound healing and break down of carbohydrates. Zinc is also needed for senses of smell and taste [13]. The following recommended daily dietary intake were given by Gwtahum [14], 2mg for infants 0-6 months, 3mg for infants 7-12 months, 3mg for children 1-3 years, 5mg for children 4-8 years, 8mg for children 9- 13 years, 11mg for male adolescents and adults 14 years and over, 9mg for female adolescents and adults 14-18 years, 8mg for female adolescents and adults 19 years and over.

Iodine: Iodine is a trace mineral and an essential nutrient found naturally in the body. Iodine is needed for normal metabolism of cells. Human needs iodine for production of thyroid hormones.

Vitamin A: The first is retinol, vitamin A from animal sources, another one is carotenes, a yellow pigment found in fruits and vegetables [15]. They stated that carotene is not absorbed or utilized as efficiently as retinol, but it is an important source. Vitamin A is essential for maintaining healthy eyes and preventing night blindness. Vitamin A is involved in bone and teeth development. Vitamin A keeps the 6 tissue linings of the respiratory, digestive and genital tracts healthy. Vitamin A is also necessary for healthy skin.

Importance of Nuts: Nuts are highly beneficial in human diet. The main physiological actions of Nuts are as follows:

- Hydrating effect: Nuts are the most pleasant way of hydrating the organism [16]. The water absorbed by sick person in this manner has added advantage of supplying sugar and minerals at the same time.
- Diuretic effect Clinical observations have showed that potassium, magnesium and sodium contents act as diuretic. The diuretic frequency of the urination is considerably increased when taken [17]. They lower the urine density and thereby accelerate the elimination of nitrogenous waste and chloride. The diuretic effect of vegetables like.
- Potatoes, beans, spinach, radish, turnip are important in cases of edema or swellings, kidney and heart conditions [18].
- Alkalinizing effect The organic acids of the salts in Nuts provide alkaline.
- Carbonates when transformed within the organism, which
- Mineralizing effect Nuts and Fruit furnish minerals to the body. Some are rich in calcium and iron. These minerals are essentials for strong bone and teeth, respectively [19]. Two important minerals, calcium and iron, found in vegetables are useful, calcium is for strong bone and teeth, iron is needed for blood formation and an essential constituent of hemoglobin [20].
- Laxative effect Cellulose, the fibrous matter in Nuts aids in the smooth passage of food in the digestive tract and easy bowel action. The sugar and organic acids contained in fruits also increase their laxative effect.

  Hence, regular uses prevents and cure constipation. He stated that certain types of fibre are referred to as fermentable because they are fermented by the "friendly" bacteria that live in the large intestine. The fermented dietary fibre in the large intestine produces a short-chain fatty acid called butyric acid which serves as the primary fuel for the cells in the large intestine and help in maintaining the health and integrity of the colon. Fibre that are not fermentable in the large intestine help maintain bowel regularity by increasing the bulk of the faeces and decreasing the transit time of faecal matter through the intestine. Bowel regularity is associated with a decreased risk for colon cancer and hemorrhoids when the hemorrhoids are related to screening and constipation.
- Extremely beneficial in normalizing all the body processes. They supply needed elements for the body's own healing activity and cell regeneration and speed up the recovery.

Statement of the Problem: Chemical composition and Medical properties of certain plants have contributed immensely to the enhancement of the immune system of humans. Despite the availability of drugs for this enhancement, we still battle with poor recovery from ailments as a result of poor immunity. Unavailability of genuine drugs that comes from viable nuts like walnuts and inability of the people to access the drugs for some economic reasons created the need to study the chemical composition and utilization of raw and cooked walnuts.

- The general objective of the study was to determine chemical composition and utilization of raw and cooked walnuts in Ikwuano local government Local Area of Abia state. Also, to identify the Chemical composition of Walnuts and the anti nutrients (phylate, oxalate and tannins) and examine the extent of utilization of walnuts.

MATERIALS AND METHODS

The materials and methods used in this study were discussed under the following subheadings: research design, area of study, source of raw materials, sample preparation, instrument for data collection.

Research Design: The study is an experimental study used to investigate the chemical composition and utilization of walnut in making of soup.

Area of Study: The study was carried out at Ikwuano Local Government Area of Abia State.

Source of Raw Material: The walnut that was used in this study was identify and collected from the market in Ikwuano Local Government Area.

Sample Preparation: Steps for processing walnut into flour.

Harvesting: Walnut is a tree crop, which is harvested using harvesting tool or can be harvested manually by climbing the walnut tree.

Depodding: Since the seeds of walnut are enclosed in a pod, after harvesting the seeds are separated from the pod. Thus depodding involves the act of separating the seeds from the pod. Either by using knife, cutlass, hand or hitting the pod on a hard surface to extract the seed.

Sorting: Sorting and grading are usually carried out with the aim of selecting only the good seeds, healthy seeds. Thus the activity is manually done.

Dehulling: This involves the removal of hull from the nuts using pocket knife. After dehulling, wash the hulled nuts.

Sun-Drying: Sundry them in a single layer or on a smooth flat shaded area, stir the nuts round on a daily basis to promote drying. Sun-drying is carried out to facilitate easy grinding of the hulled nuts.

Grinding: This involves the reduction of the nuts size into aggregates, to produce a powerdery form product. It may be done either manually or mechanically depending on the choice of the producer.

Sieving: This involves the separation of the grinded nut from unwanted residues.

Packaging: This involves the process of putting the grinded sieved nut into a container to protect it against damage.

Sample Preparation: A nine-point hedonic scale questionnaire was used by the panellists to determine the sensory qualities of soup. The sensory qualities examined were the soup sensory attributes with regard to colour, appearance, taste, mouth feel and general acceptability.

Proximate Analysis of Soup Samples: The samples were weighed to the nearest gram and transfer to the laboratory for analysis. Each sample will be homogenized separately and aliquots were taken from each sample for moisture analysis. All analysis was done in triplicate. Proximate, mineral, vitamin, anti-nutrient and food toxicant composition of the samples will be determined using [21] methods.

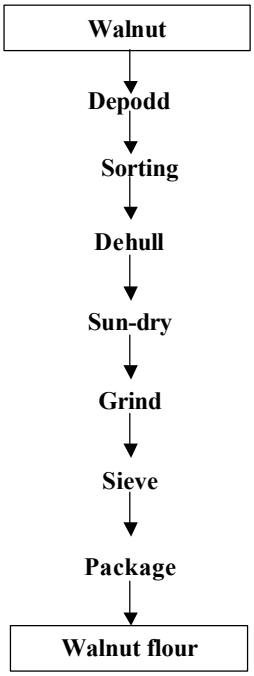

Fig. 1: Flow diagram for the preparation of walnut flour Instrument for Data Collection

Fat Determination: Fat will be estimated by the Soxhlet extraction [22], Two (2y) grammes of samples was weigh into dry Soxhlet thimbles, The thimbles was suspended in a beaker and dried to a constant weight in an oven and then placed in a soxhlet condenser containing ether, A reflux condenser was attached to the contracted tube and heated, the ether was returned to the flask with fat when the thimble was full, the extraction was continued for about 6 hours at 120°C, The flask and fat was drained in air to vaporiate the ether and weighed to a constant weight.

Fat was washed off with a fat solvent, dried and weighed again.

$$\% \text{ Fat} = \frac{x^1 - x^2}{W} \times \frac{100}{1}$$

where
X_1 = Initial weight of flask
X_2 = Final weight of flask
W = Weight of samples

Moisture Determination: This was done by hot air oven method of Nemoto and Packers [23]. Two (2a) grammes of samples were weighed into an empty aluminum dish with a known weight. The dish and samples was dried in an air oven at 1000C for 24 hours and cooled in dessicator and re-weighed.

This process was repeated until weight is obtained.

$$\% \text{ fat} = \frac{X^1 - X^2}{W} \times \frac{100}{1}$$

where:
X_1 = Initial weight of flask
X_2 = Final weight of flask
W = Weight of samples

Ash Determination: One (1g) of sample was placed in a clean crucible of known weight. The crucible was placed in a muffle furnace (600°C) over night or 24 hours.

The crucible and content was cooled in a dessicator and weighed again

$$\% \text{ Ash} = \frac{z - x}{1gm} \times \frac{100}{1}$$

where:
X = Weight of crucible
Z = Weight of crucible and ash

Crude Fibre Determination: The crude fibre content of the samples was determined by using [24]. method.

Methods:

- Two (2g) grammes of the sample was placed in a 250ml beaker, boiled for 30 minutes with a 100ml 0.12 MH_2SO_4 and filtered through a funnel.
- The filtrate was washed with boiling water until the washing will be no longer acidic.
- The solution was boiled for another 30 minutes with 100ml of 0.12m sodium hydroxide solution filtered three times with hot water and methylated spirit.
- The residue was transferred into a crucible and dried in an oven for 1 hour. The crucible and its content will be cooled in a dessicator, and re-weighed (W_2). The crucible and its contents will be taken to a furnace for ashing for 1 hour.
- The ash sample was removed from the furnace after temperature had cooled and put into a dessicator and later reweighed (W_3). The crude fibre content was obtained between the weight before and after incineration. The percent of the crude fibre was calculated thus.

$$\% \text{ Crude fibre} = \frac{W_2 - W_3}{W1} \times \frac{100}{1}$$

where;
W_1 = Weight of crucible
W_2 = Initial weight of sample and crucible
W_3 = Final weight of sample and crucible
100 = Percentage

Crude Protein Determination: The micro-kjedahl method [25], involve digestion, distillation and titration was used to obtain the crude protein content of the samples.

Digestion:

- One (1g) gramms of each sample was weighed into a 100ml Kjeldahl flask.
- Twenty five (25) grammes of anhydrous sodium sulphate, 05g copper sulphate (catalyst) and 5ml of concentrated sulphuric acid was added.

The flask was placed in fume chamber and heated gently until the solution turns black, then the heat was cool, washed and transferred into a 250 volumetric flask and rinsed down with distilled water.

Distillation:

- A combination of boric acid and methyl red indicator will be poured into conical flask and placed under a condenser in such a way that the condenser tip will be under the liquid.
- About 5ml of the digest plus 10ml of 60% concentrated sodium hydroxide was placed in a Markham distillation apparatus.
- Steam was let down through the distillation apparatus for 5 minutes. Ammonia was evolved, which changed the color of the indicator from purple to green characteristics of alkaline gas.

Titration:

- The distillate was titrated with 0.1 hydrochloric acid (HCl) until a neutral point was reached (faint purple)
- Titre value (T) = final biuret reading-initial biuret reading.

$$\% \text{ Crude protein} = \frac{(14.01 \times 100 \times 6.25) \times T}{1000 \text{ mg}}$$

Carbohydrate Determination: This was determined by difference ie. % carbohydrate = 100- (%protein + % fat + fibre + % ash + % moisture).

Determination of Iodine, Iron, Copper, Calcium, Zinc and Phosphorus: Okigbo [26] wet digestion procedure was used in estimating iron (Fe), iodine, (12), copper, calcium, zinc and phosphorus.

- Five millitres (5ml) of perchloric acid and 10ml of neuric acid was heated under fume chamber until the solution turned colourless and free of nitrogen. One (1g) gramme of the sample was weighed into a 100ml round bottom flask and diluted into a known volume before used for absorption spectrophotometer.
- A spectrometric atomic absorption spectrophoto meter was used on a general principle that minerals are absorbed at different wavelength, Fe (248.30), 12(353.0, Cu (324.70), Zn(213.90), Ca(230.0) and P(470)
- Readings was obtained against standard for each mineral and distilled water was used to zero the spectrophotometer after each reading. Calibration curve was constructed for each mineral and used to calculate its concentration.

Pro-vitamin A (RE) Determination: Provitamin A was determined using the method adopted from IVACG (2001). The vitamin A activity, as retinol equivalent (RE) was calculated based on the vivo concentration factor [27].

Caratenoids (RS) (U-V-spectrophotometric method
Reagents
Cyclohexane
Carotenoids (RS)

Principle: The principle was based on the use of U-V-spectrophotometric method as ashing with cyclohexane.

Method: The samples or prepared portions was dissolved in cyclohexane such that it contains 9-15 units per ml and obtained the wavelength of maximum absorption.

The extinctions at the wavelength were measured and calculated as fractions relative to that at 328nm. The Eicm figure was calculated at 328nm if the wave length of maximum absorption is 326 – 329nm and observed relative extinction will be within 0.02.

Calculation: Potency (units 1g) = 1900x E328nm. The following correction was applied if the maximum lies in the same range, but the relative extinction are not within 0.02 E238 (corrected 3.52(2E328 – E328 – E316 – E340).

Ascorbic Acid Determination: Ascorbic acids was determined by official methods [28] of analysis was used. Ascorbic acid was determined by using a dye solution of 2.6 dichophenol, indophenol (4 tablets of dye will be dissolved in little water and transferred to stopered measuring cylinder making volume to $100cm^3$ and mixing well and labeled $1cm^3$ = 0.4mg AA. The quantity of samples was weighed, mashed and liquidized with $50cm^3$ dilute acetic acid and transferred to stopered measuring cylinder and made to $100cm^3$ with water. The sample was homogenized, allowed to settle and the supernatant liquid was decanted off. This was filtered with a muslin cloth and labeled $10cm^3$. An aliquot was transferred to a small conical flask using a pipette and titrated against the dye solution to pale pink that pointed persisting for 15 seconds. Ascorbic acid content was calculated in mg per 100g of sample. If average titration result = Vcm3dye (0.4mg $Aacm^3$). 100 extract contains V x 0.4 x 100 x100/wmg- AA =40v/wmg AA.

Determination of Antinutrients

Phytate: The method described by Pamphloma-Rogers [29] was adopted. About 0.5g of each sample was extracted with 100ml of 24% of hydrochloric acid. The diluted extract was passed through the amberite resin. Inorganic phosphate will be eluted h 0.1ml of sodium chloride and 0.7m sodium chloride. Colour was developed with 1ml of modified Wade reagent, 0.03% Fecl,6 Hz 0 and 0.3% sulphur salicylic acid. The absorbance was read at 500 m in a CE 2343. Digital grading spectrophotometer was made up to mark 25 ml 30% HCL.

Tannins: Tannins were determined by using the spectrophotometric method described by [30]. About 0.5g of each sample will be extracted with 3ml methanol. The extract was mixed with 5.0ml water 3ml of 1.0ml ($Fecl_2$ in 0.1N and 0.8 ml2 Fe (W_2) was added to 0.1ml of the solution. The extract was read at 720nm on a spectrophotometer.

Saponins: About 0.1g of the sample was boiled and filtered with Whatman No.1. Five (5) ml of the titrate will be pipetted into a test tube and 2ml of olive oil was added.

The solution will be shaken vigorously for 30 seconds and read at 620 against a blank.

Saponins = reading from convex dilution.

$$\frac{\text{Factor x 100 (mg/100g)}}{\text{Weight of sample x 10}}$$

Oxalate Determination: Two (2g) grammes of the sample were prepared into 300ml flask. Twenty (20) ml of 30% HCL was added and allowed to stand for 20 minutes. Four (4) grammes of ammonium sulphate was added and solution was filtered into 200ml volumetric flask and made up to 25ml 30% HCL. Ten mililitres (10) ml of the filtrate will be transferred in 100ml centrifuge and adjusted to 7.0 with ether NH_40H (ammonium hydroxide) or CH_3C00H (acetic acid). It was centrifuged at 10000rpm for 15minutes. The supernatant was deducted with 0.10 potassium tetraoxomanganate (Kmn04) and volume was recorded.

Calculation:

$$\text{Oxalate} = \text{Fibre x molk.}\frac{\text{Mno 4 x dilution factor x 10}}{\text{Weight of the sample}}$$

Sensory Evaluation: Sensory evaluation of the soups was carried out in the food research laboratory. Twenty (20) panellists were used for the evaluation comprising of students and staff in College of Applied Food Science and Tourism Michael Okpara University of Agriculture Umudike. These panellists were selected because they already have prior knowledge not need to be trained. A score of a represented extremely liked while a score of 1 represented extremely disliked.

Statistical Analysis: The scores from the nutritional analysis and the sensory evaluation were analyzed using ANOVA significance was accepted at $p<0.05$.

RESULTS AND DISCUSSION

Table 1 show the result for the proximate composition of soup sample. The moisture content of the sample ranged from sample A (62.47%) sample B (63.73) sample C (61.83). the moisture content of sample C (61.33) has the least score. There was a significant difference in the moisture content of all the three samples. The protein content of the sample ranged from sample A (10.6%) sample B (18.79) sample C (13.37) sample B contains the highest protein while sample A (10.62has the least protein content). There was a significant different in the sample. The crude fibre content of the sample ranged (2.05- 7.46%) sample B (7.46) contains the highest while sample C (2.05) has the least crude fibre content and there was a significant difference. The Ash content ranged (2.34) C (3.67) A (3.91) B which has the highest content of Ash while C (2.34) has the least, there was a significant difference. The carbohydrate content ranged, sample A (13-35) B (4.79) C (11.52%) sample A has the highest value while sample B (4.79) has the least score.

Table 1: Proximate composition of soup samples

Proximate components %	Soup sample A	B	C
Moisture	62.47±0.03	63.73±0.02	61.83±0.04
Protein	10.62±0.02	18.79±0.01	13.37±0.02
Fibre	3.25±0.03	7.46±0.01	2.05±0.02
Fat	7.13±0.02	6.62±0.02	4.26±0.03
Ash	3.67±0.02	3.91±0.02	2.34±0.03
CHO	13.35±0.01	4.79±0.4	11.52±0.00

Values are means±standard deviation of duplicate samples

Table 2: Mineral composition of soup sample

Minerals (mg/100g)	Soup sample A	B	C
Ca	88.61±0.01	89.74±0.03	44.67±0.02
Mg	70.83±0.01	66.27±0.01	21.09±0.02
P	58.30±0.01	55.38±0.02	52.63±0.03
K	204.22±0.02	260.01±0.01	211.53±0.04
Fe	0.78±0.01	1.06±0.01	0.70±0.00
Zn	2.02±0.01	3.28±0.00	0.64±0.05
Cu	2.49±0.01	2.24±0.02	2.08±0.02

Values are means±standard deviation of duplicate samples

Values are means + standard deviation of duplicate samples

Table 2 shows the result for mineral composition of soup sample. The calcium content of samples ranged from (44.67-89.74%) the calcium content of sample B (cooked walnut) has the highest value (89.74) and sample C (44.67) has the least score. The calcium content of sample B was significantly higher than the rest of the soup sample. The magnesium content of the samples ranged from (21.09-70.83%) with the content of sample A (70.83) recording the highest score, while sample C (21.09) has the least score. There was a significant difference. The phosphorous content of the soup sample are significantly different. It ranged from (52.63-58.30%). The potassium content of sample B (260.0.01) has the highs value while sample A (204.22) has the least value there was a significant difference in all the samples. The iron content of the sample ranged from (0.70-1.06). The iron content of sample B (1.06) has the highest score while sample C (0.70%) scored the least.

There was a significant difference in the entire sample.

The zinc content of sample ranged from (0.64-3.28) scored the highest while the sample C (0.64) scored the lowest score. There was a significant difference. The copper content of the sample ranged (2.08-2.49) the copper content of the sample A has the highs while sample C (2.08) scored the least.

Discussion of Findings: The nutrient composition from the result shows that the moisture content of the of the soup sample A (62.47±0.03) sample B (63.73±0.02) C (61.83±0.04) are lower compared to the moisture content of ogbono value (68.70±0.14%) recorded by [31]. This indicates that it has slightly higher keeping quality than the ogbono soup. It is known that food that has higher moisture content stays lesser than those with lower moisture. The observed ash content from the study ranged between (2.34±0.03 – 3.91±0.02) with sample B (3.91±0.02) cooked walnut is higher than that of others.

The proximate analysis revealed that in this study, protein content of sample (raw walnut) with the value (10.62±0.02) while sample B (cooked walnut) with this (18.79±0.01). this observation contradicts the report given by [32]. The soup where the protein content of ofe achara was (4.13±0.03%). This implies that the soup samples will be good source of protein, protein is required for the structural function and regulation of the body's tissues and organs. Carbohydrate content of sample A (13.35±0.01%) was observed to be the highest followed by sample C (11.52±0.00) which records the lowest. It was observed that the CHO content of the sample in this was lower when compared to the value reported by [33] where the content of Achara soup was (30.68±0.10) function of this is to provide energy to the body.

The vitamin C content of sample A (63.49%) was very highly, this implies that the soup sample is a good source of vitamin C. the high amount of vitamin observed in this study suggest that it could serve for the maintenance of healthy skin, good vision and as a powerful antioxidant which has been shown to help guard against cancer and heart disease.

In this study the phytate content of the soup sample was observed to be (2.44-8.63%). Phytate are the most efficient plant substances used theiapeutically, pure isolated phytates and the synthetic derivatives are used as the basic medicic and bacterial properties. The presence of tannis in the soup can support its strong use for healing of haemorrhoids, frost bite and varicose ulcers in herbal medicine. Tannis reported to have possible anti carcinogenic [34]. The result of mineral composition clearly shows that walnut contains rich source of mineral element. The presence of copper may be responsible for the absorption of iron, it is therefore often seen with iron naturally copper is important for cellular difence and protection of the mucous membrane, antianaemic and essential for the formation of haenoglobin from iron [35]. The presence of meganese in the soup sample shows that walnut can be used to protect bone disease. The activity of the element is noticed in the metabolism of food incorporated into the bone. According to WHO [36] manganese is necessary for the functioning of the pituitary gland, the pineal gland and the brain, it promote hepatorenal function, combat anamia and also essential for growth. The presence of zinc is an indication that walnut may have some effect on the nerve function and male fertility. It is important for normal sexual development, especially for the development of testes and ovaries, it is also essential for reproduction. Zinc stimulates the activity of vitamins formation of red and white corpuscles and healthy functioning of the heart and normal growth [24].

CONCLUSION AND RECOMMENDATION

This study focused on the chemical composition and utilization of raw and cooked walnut (*Tetracarpidum conophorum*). The chemical composition, nutritional benefits and medical benefits were determined.

The sensory evaluation of this work was conducted using semi-trained and untrained panelist and the result shows that there is untrained panelist and the result shows that there is variation on taste, colour appearance, mouthfeel and general acceptability level. This sensory evaluation was carried out at the food laboratory Home-economics/HMT of the Michael Okpara Univerisyt of Agriculture Umudike. Also mineral composition of different food blends was determined, calcium, iron phosphorus, sodium and magnesium, copper, zinc. The result gotten from this research shows that there is a general acceptability of soup made from walnut.

CONCLUSION

The use of walnut improved the taste, appearance mouth feel, colour and general acceptability of the soup sample, it was observed that the study has shown the proximate, vitamins, minerals and secondary metabolites composition of walnut. From the present study, it was observed that the 3 soup sample are in both vitamins A and B but is more abundant in sample B. this study has also shown that walnuts may be used in herbal medicine for curative purposes as being claimed in some traditional quarters because of the present of phytate, saponin and tannis, couple with the presence of the essential vitamins and minerals.

Recommendation:

- I recommend the use of walnut to prepare soup should be adopted by home makers and as well as individual.
- considering the nutritive and health benefits of this under – utilized nut, there is need for increase awareness on the nut for a better utilization of it's health benefits moreover, it is suggested that soup prepared with walnut should be encouraged so as to reduce cost for most families in Africa, especially in eastern part the use of this nut is not fully recognize. Attention should focus on the processing of walnut into flour that can be stored or preserve. This will reduce post – harvest losses as well as making walnut almost available all seasons and affordable.
- Walnuts production should be encouraged particularly in the rural areas. In the same vein, free, roads should be built and already built ones maintained this will help transport these products to the urban areas. This will also promote availability and Affordability of these products.
- Extension and intensive nutrition education programme is imperative to improve the diet of the masses by making walnut soup well known, because economic growth and development depends on good health of the nation of citizens.

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