



A Comparative Nutritional Study on the Leaves of *Amaranthus spinosus* L., *Telfairia occidentalis* Hook. F and *Talinum triangulare* Jacq. Cultivated in Anambra State

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ABSTRACT

Vegetables like *A. spinosus*, *T. occidentalis* and *T. triangulare* are those vascular plants whose portions or portion are consumed as complement food or prime dish. A Comparative proximate study on *A. spinosus*, *T. occidentalis* and *T. triangulare* was evaluated to determine their nutritional characteristics with regards to moisture, ash contents, carbohydrate, protein, fat contents and crude fibre using standard methods and compared. This was to ascertain the one with the highest nutrient for optimum utilization and usefulness as a vegetable. Data were analyzed using analysis of variance. The result showed that the investigated nutrients were present in the leaves of the three species but in varied amounts. *T. occidentalis* had the highest ash, protein, fiber and lipid contents (12.30 ± 0.01), (35.40 ± 1.2), (1.60 ± 0.08) and (13.70 ± 0.6) respectively, while *T. triangulare* had the highest moisture and carbohydrate contents (5.24 ± 0.14) and (56.32 ± 0.58) respectively. The data obtained from this study showed that these vegetables contain appreciable amount of proteins, fat, fiber and carbohydrate needed for normal body functions and maintenance of the body with *T. occidentalis* being the most nutritious based on its protein and lipid contents. It can therefore, be concluded that these vegetables can contribute significantly to the nutrition of man and animals and should be used as source of nutrients to supplement other major sources of foods.

Keywords: *Amaranthus spinosus*, Nutritional Study, *Talinum Triangulare*, *Telfairia Occidentalis*, Supplement, Vegetable

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1. INTRODUCTION

Vegetables are esculent plants or portions of a plant consumed as complement food or prime dishes and they may be fragrant, acrid or flavourless (Mensah et al. 2008). They are greatly encouraged to be eaten because they have a proportionally extreme nutritional quality and provide daily food intake and flavor to the diet (Airaodion et al. 2019e). In botany, a leaf is a plant shoot organ specialized for the process of photosynthesis (Idris, 2011). Typically leaves are broad, flat and thin (dorsoventrally flattened), thereby maximizing the surface area directly exposed to light and enabling the light to penetrate the tissues and reach the chloroplasts, thus promoting photosynthesis.

Effective use of leafy vegetables is part of Africa's cultural heritage and they perform significant functions in the customs, traditions and food culture of the African household (Mensah et al. 2008). The nutrient composition of various types of vegetables varies greatly and they are not main sources of carbohydrates compared to the starchy foods which form the bulk of food consumed, but contain vitamins, essential amino acids, as well as minerals and antioxidants (Fasuyi, 2006). Vegetables form vital compositions of the diet, by providing nutrients and food sources that are crucial to human health. A rational diet rich in sufficient fruits and vegetables forms a healthy circulatory system (Zheng, 2017). They make up a greatly various group of crop plants that are consumed for their edible leaves, which have adequate minerals and vitamin. They are mostly short-lived herbaceous plants available during wet and dry seasons of the year. Vegetables supply some elements in which other food materials are deficient; they are sources of essential minerals elements for proper growth and development (Dhellit et al. 2006). Leafy vegetables such as *Amaranthus* species, *Celosia argentea* (amaranth), *Vernonia amygdalina* (bitter leaf), *Talinum triangulare* (water leaf), *Telfairia occidentalis* (fluted pumpkin) have large amounts of carotene, ascorbic acid, riboflavin, folic acid and minerals like calcium, iron and phosphorous (Sheela et al. 2004; Nnamani et al. 2010).

T. triangulare is a leafy vegetable of the genus *Talinum*, family portulacaceae. It is found in open places with rich top soil. Aside its usage as a vegetable, *Talinum* is also used as fodder for snails and supplement for chickens and turkeys; the

carotenes make the yolk of the eggs of these birds yellow. Waterleaf is extremely nutritious, revitalizing and delicious and, as such, it is used in different cuisines for preparing a number of dishes. Aja et al. (2010) reported that the leaves contain significant amount of bioactive compounds necessary for preventing and treating various ailments.

A. spinosus usually known as prickly amaranth or spiny amaranth is a species belonging to the tropical Americas but now on most places as an introduced species. Amaranth leaves have lysine a vital amino acid required for energy production and calcium absorption. Eating amaranth leaves reduces appetite as they are high in protein. It suppresses insulin levels in the blood and makes one feeling satisfy (Okeke et al. 2020). As a vegetable, it is used in soups, stews and porridges. It is usually consumed as cooked complements to major carbohydrate staples such as yam, rice and plantain.

T. occidentalis is a perennial, dioecious herb. It is indigenous to and grows in the coastal zones of West and Central Africa. It is native to South-East Nigeria, and is widely cultivated in Nigeria, Benin and Cameroon. *T. occidentalis* is commonly grown for its palatable and nutritious leaves which are used mainly as vegetable. The tender shoots, fleshy leaves and immature seeds can also be cooked before consumption. It contains abundant calcium-containing crystals, phosphorus and sulphur, especially in its leaves; hence, its high mineral content value. Pregnant women and patients suffering from anaemia use the leaf juice as tonic and as blood booster (Okoli, 2013).

T. triangulare, *A. spinosus* and *T. occidentalis* are species of immense nutritional, agronomic and medicinal importance. A comparative nutritional study of these important vegetables has not been carried out or rather scanty, hence the need for the present study. The aim of this study was to evaluate their nutritional characteristics with regards to moisture, ash contents, carbohydrate, protein, fat contents and crude fiber and compared. This was for their optimum utilization and usefulness as vegetables.

2. MATERIALS AND METHODS

2.1. Study Area

The research was carried out in the Department of Botany, Nnamdi Azikiwe University, Awka, ($6^{\circ} 12N'$, $7^{\circ} 04E'$).

2.2. Procurement and identification of plant species

Talinum triangulare, *Amaranthus spinosus* and *Telfairia occidentalis* were collected between the months of March-April 2022 from farmers at Awka. The species were identified and given voucher number by a taxonomist in Botany Department, Nnamdi Azikiwe University, Awka, Anambra State.

2.3. Preparation of plant samples

The leaves were examined and confirmed to be disease-free. They were manually separated and dried in the oven for 2 days. The dried samples were then crushed with the hand and ground into powdered form using an electric grinder. The samples were weighed with an analytical weighing balance.

2.4. Nutritional analysis of the plant species

The analysis was done to assess the amount of nutrient (moisture, ash, crude fat, crude protein, and crude fiber) present in the plant samples. This was carried out using the standard methods described by Association of Official Analytical Chemist (AOAC, 2005).

2.5. Statistical Analysis

Data collected were analyzed using analysis of variance (ANOVA) and treatment means were separated using DMRT at 5% level of probability. Results were presented in Mean \pm Standard Deviation.

3. RESULTS AND DISCUSSION

The results of the study were presented in Table 1 and Plates 1-3

The result of the study showed that the investigated nutrients were present in the leaves of the three species but in varied amounts. According to Wang *et al.* (2004), the bioactive compositions of herbal extracts can differ widely with the plant variety. The result revealed that *T. occidentalis* had the highest ash, protein, fiber and lipid contents while *T. triangulare* had the highest moisture and carbohydrate contents (Table 1). Thus, *T.*

occidentalis is a better source of ash, protein, fiber and lipids while *T. triangulare* is a better source of moisture and carbohydrate. Moisture content makes impactful contribution to the texture of the leaves and help in keeping the protoplasmic content of the cells. Though high moisture composition of vegetables makes them to promote the digestion of food, however high moisture content also lower the shelf life of vegetables because they facilitate bacterial and fungal action resulting into spoilage (Akinwunmi and Omotayo, 2016). The moisture content value of the leaves of the sample vegetables were relatively low. Foods with low moisture content can stay longer. The low moisture content would therefore impede the growth of spoilage microorganisms and improve shelf life (Ruberto and Baratta, 2000).

T. occidentalis has the highest fats/lipid content (1.70 ± 0.60) among the three vegetables, *A. spinosus* and *T. triangulare* with low lipid/fat content (0.15 ± 0.03) and (0.38 ± 0.05) respectively. This low fat content might be an added advantage of consumption of Amaranths as high fat content is a predisposatory factor to cardiovascular diseases (Lovejoy, 2002). Consumption of *Telfairia occidentalis* is hereby recommended as it is of great source of fats and it benefits human health since vegetable fats and oils are known to lower blood lipids thereby reducing the occurrences of diseases associated with the damage of the coronary artery (Adenipenkun and Oyetunji, 2010). Dietary fat increases the palatability of food by absorbing and retaining flavors (Antia *et al.*, 2006). The consumption of *A. spinosus* and *T. triangulare* in large amount is a good dietary habit and may be recommended to individuals suffering from overweight and obesity (Akinwunmi and Omotayo, 2016). Gordon and Kessel (2002) reported that low fat foods help to reduce cholesterol level and obesity.

The leaves of *A. spinosus* and *T. triangulare* show the highest crude fiber content (16.33 ± 0.08) and (26.12 ± 0.05) compared to *T. occidentalis* with (1.60 ± 0.08). Fiber cleanses the digestive tract by removing potential carcinogens from the body and prevents the absorption of excess cholesterol. Fiber also adds bulk to the diet and prevents the intake of excess starchy food (Mensah *et al.* 2008). Fiber may therefore guard against metabolic conditions such as hypercholesterolemia and diabetes mellitus (Henry, 2004). Dietary fiber has a positive effect in the

management of diabetes by controlling post-prandial hyperglycemia. It delays gastric emptying or increase the viscosity of gastro-intestinal tract content thereby suppressing digestion of carbohydrate and delays its absorption. The substantial amount of fiber in *T. triangulare* and *A. spinosus* leaves shows that they can help in keeping the digestive system healthy and functioning properly. Fiber aids and speeds up the excretion of waste and toxins from the body,

preventing them from sitting in the intestine or bowel for too long, which could cause a build-up and lead to several diseases. Adequate intake of dietary fiber can lower the serum cholesterol level, risk of coronary heart disease, hypertension, constipation, diabetes, colon and breast cancer (Rao and Newmark, 1998; Ishida et al. 2000).

Table 1: Percent Quantitative Proximate Composition of Leaves of *Amaranthus spinosus*, *Telfairia occidentalis* and *Talinum triangulare*

S/N	<i>Amaranthus spinosus</i>	<i>Telfairia occidentalis</i>	<i>Talinum triangulare</i>
Ash	3.62±0.02	12.30±0.01	4.27 ± 0.05
Moisture	4.90±0.01	4.60±0.60	5.24±0.14
Carbohydrate	48.74±0.14	33.40±2.40	56.32±0.58
Protein	26.11±0.09	35.40±1.20	8.51±0.09
Crude fiber	1.53±0.08	1.60±0.08	1.32±0.05
Crude fat	0.15±0.003	1.70±0.60	0.38±0.05

Results are in mean ± Standard deviation



Figure 1-3. *T. occidentalis*, *A. spinosus* and *T. triangulare* in their natural habitat respectively

The leaves of *T. occidentalis* has a high crude protein content of (35.40±1.2) followed by *A. spinosus* with (26.11±0.09) with the least value in *T. triangulare* (8.51±0.09). Plant proteins are a source of food nutrient especially for the less-privileged population in developing countries including Nigeria. Proteins are one of the macromolecules and are an alternate energy source when other energy sources are in short supply. They are building block units and food protein is needed to make vital hormones, important brain chemicals, antibodies, digestive enzymes, and necessary elements for the manufacture of DNA. Some proteins are involved in structural support, while others are involved in bodily movement, or in defense against germs (Bailey, 2008).

The result of the analysis reveals that the three vegetables have moderately high carbohydrate

content and therefore contributes to great amount, the energy level in those vegetables. Carbohydrates are essential for the maintenance of life in both plants and animals and also provide raw materials for many industries (Egun-Oluwa and Alade, 2007). Carbohydrates produced by plants are one of the three main energy sources in food, along with protein and fat. When animals eat plants, energy stored as carbohydrates is released by the process of respiration, a chemical reaction between glucose and oxygen to produce energy, carbon dioxide, and water. Glucose is also used by animal cells in the production of other substances needed for growth (Westman, 2002).

It is generally known that the ash content in a sample is indication of the amount of minerals present in it (Fagbohun et al. 2012) and as such high ash content

would mean a corresponding high mineral element in the sample. *T. occidentalis* had ash value of (12.30±0.01) compared to *A. spinosus* and *T. triangulare* with lesser values (3.62±0.02) and (4.27±0.05). The result therefore suggests a high deposit of mineral elements in *T. occidentalis* leaves. Generally, mineral are significantly important to cell and system functions.

4. CONCLUSION

People eat vegetables not just because they like vegetable but also for the nutritional benefits derived from them. The data obtained from this study showed that these vegetables contain appreciable amount of proteins, fat, fiber and carbohydrate needed for normal body functions and maintenance of the body with *T. occidentalis* being the most nutritious based on the protein and lipid content. It can therefore, be concluded that these vegetables can contribute significantly to the nutrition of man and animals and should be used as source of nutrients to supplement other major sources of foods.

Authors' contributions

This work was carried out in collaboration between all authors. Author CVI designed the study and all authors wrote the first draft of the manuscript and managed the literature searches. Author CVI and ONT managed the analyses of the study and Author CVI supervised the work

Competing interests

Authors have declared that no competing interests exist.

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