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Nutritional Evaluation and Vitamin Profiling of Fruits and Vegetables Grown Along River Yedzaram, Mubi North Local Government Area, Adamawa State

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Abstract: Fruits and vegetables are essential sources of nutrients, providing carbohydrates, proteins, vitamins, and minerals vital for maintaining health and preventing malnutrition. **Methodology**: This study evaluated theproximate composition and vitamin content of selected fruits and vegetables cultivated along River Yedzeram, Mubi, Adamawa State, Nigeria, with the aim of assessing their nutritional quality and potential health implications. Fresh samples ofmango (*Mangiferaindica*), banana (Musa spp.), guava (*Psidiumguajava*), pawpaw (*Carica papaya*), lettuce (*Lactuca sativa*), cabbage (*Brassica oleracea*), sorrel (*Rumexacetosa*), andspinach (*Spinaciaoleracea*) were collected and analyzed using standard methods. **Results** showed significant variations in nutrient composition among samples. Moisture content ranged from 70.75% to 94.2%, ash from 0.655% to 1.599%, protein from 0.495% to 2.495%, and carbohydrates from 4.59% to 22.75%. Vitamin A ranged from 0.199 to 444 mg/100g, Vitamin C from 9.45 to 229.5 mg/100g, and Vitamin B_1 from 0.0425 to 0.0795 mg/100g. **Discussion:** Leafy vegetables, particularly lettuce and spinach, were richer in minerals and Vitamin A, while fruits such as guava and banana provided higher energy and Vitamin C levels. The study **concludes** that fruits and vegetables grown along River Yedzeram are nutritionally valuable and suitable for promoting dietary diversity and public health.

Keywords: Nutritional composition; Micronutrients; Proximate analysis; Vitamins; Leafy vegetables.

I. INTRODUCTION

Fruits and vegetables are essential components of a balanced diet, providing vital macronutrients like carbohydrates and dietary fibre, alongside key micronutrients including vitamins and minerals (Pennington *et al*., 2017; FAO, 2023). They serve as affordable and accessible energy sources, particularly in developing nations like Nigeria, where they constitute a significant part of daily sustenance (Hussain *et al*., 2019; Balakrishna *et al*., 2011). Global and national health agencies continue to emphasize the role of nutrient-dense, plant-based foods in combating food insecurity and malnutrition (Hodder, 2017; Tiaga *et al*., 2018; Zaky *et al*., 2019).

Despite their nutritional importance, the quality and safety of fruits and vegetables can be affected by environmental contamination, especially in agricultural areas exposed to industrial activities or polluted water sources. In Nigeria, several studies have reported heavy metal accumulation in crops due to agrochemical use, industrial effluents, and contaminated irrigation water (Oluyemi *et al*., 2019; Sharma *et al*., 2018). Such contamination poses serious health risks through the food chain, making it critical to assess the proximate composition, vitamin content, and potential toxic elements in locally consumed produce.

The River Yedzeram basin in Mubi, Adamawa State**,** plays a vital role in local agriculture, serving as a major water source for irrigation. The river has supported human settlements and farming activities for centuries, contributing to regional economic and cultural development (Adegoke & Gadiga, 2017). However, as agricultural and urban expansion increases along its banks, there is growing concern about potential contamination and the nutritional quality of crops cultivated in the area.

Leafy and fleshy vegetables such as mango

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(*Mangiferaindica*), banana (*Musa spp*.), guava (*Psidiumguajava*), pawpaw (*Carica papaya*), lettuce (*Lactuca sativa*), cabbage (*Brassica oleracea*), sorrel (*Rumexacetosa*), and spinach (*Spinaciaoleracea*) are widely cultivated and consumed in Mubi. These crops are known for their high water content (averaging 80–90%), modest protein and fat levels, and rich concentrations of vitamins A, C, K, and various minerals (Jaishankar, 2018; Edogbo, 2020). Their nutritional importance lies in providing essential elements such as iron, calcium, and carotenoids**,** which are often deficient in rural diets. As reported by Raphael *et al*. (2017), regular consumption of such vegetables can significantly improve micronutrient intake among low-income populations.

The Mubiresidents depends on the fruits and vegetables grown along River Yedzeram, it is necessary to assess their proximate composition, vitamin profile, and potential microelement accumulation. This study therefore aims to determine the nutritional quality and safety of selected fruits and vegetables cultivated along the River Yedzeram basin, contributing to the broader understanding of food quality and public health in northern Nigeria.

II. MATERIALS AND METHODS

Study Area

The study was conducted in Mubi, Adamawa State, Nigeria**,** located between latitudes 10°11′30″ and 10°22′30″ N and longitudes 13°13′00″ and 13°30′00″ E (Figure 1). The area is drained by River Yedzeram**,** one of the major rivers feeding into Lake Chad. The river originates from the Hudu Hills southeast of Mubi and flows northward for approximately 330 km**.** The study area, covering about 35.1 km²**,** includes the middle course of River Yedzeram between Va'atita (Mubi South) and Mayo Bani (Mubi North) (Adegoke & Gadiga, 2017). The river's fertile banks support intensive vegetable and fruit cultivation, which forms a primary source of livelihood for local communities.

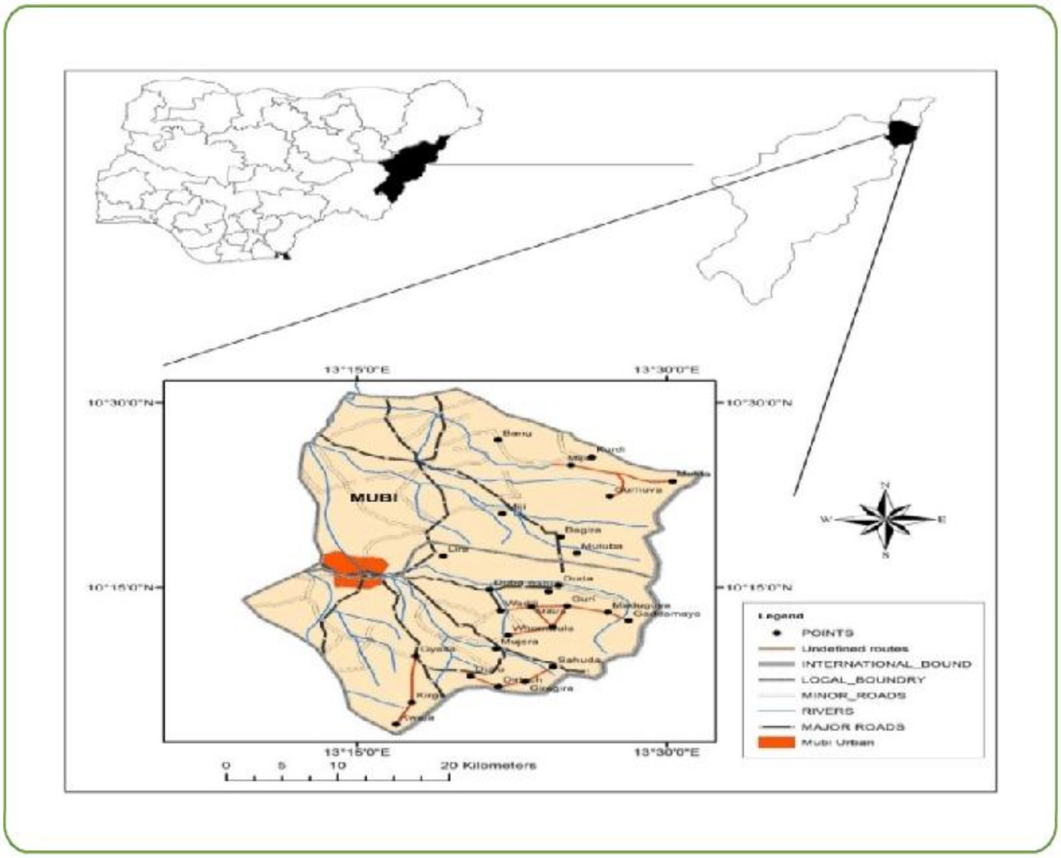

Figure 1: Sample location

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Sample Collection

Eight common fruit and vegetable samples were collected from farms located along River Yedzeram. The fruit samples were collected in April 2023, while the vegetable samples were collected in December 2023. The samples included:

Fruits: Mango (*Mangiferaindica*), Banana (*Musa spp.*), Guava (*Psidiumguajava*), and Pawpaw (*Carica papaya*) and **v**egetables: Lettuce (*Lactuca sativa*), Cabbage (*Brassica oleracea*), Sorrel (*Rumexacetosa*), and Spinach (*Spinaciaoleracea*). All samples were authenticated by Dr. Samuel Waja**,** Department of Biological Sciences, Federal Polytechnic Mubi. Fresh samples were placed in sterile, labeled polyethylene bags and transported to the laboratory for analysis under controlled conditions to prevent spoilage or contamination.

Sample Preparation

Samples were thoroughly washed with distilled water to remove soil, dust, and surface residues. They were then chopped and air-dried (or oven-dried at 60°C) to constant weight. The dried materials were ground into a fine powder using a clean mortar and pestle or laboratory mill and stored in airtight containers.

For elemental and vitamin analysis, sub-samples were digested using acid digestion following 4Association of Official Analytical Chemists (AOAC) (2019) procedures to ensure efficient extraction and accurate quantification.

Proximate Analysis

The collected fruit and vegetable samples were carefully washed, chopped, and air- or oven-dried before being ground into fine powder for analysis. The proximate composition—including moisture, ash, crude protein, crude fat, crude fibre, and carbohydrate was determined following the standardized methods of the Association of Official Analytical Chemists (AOAC, 2019)**.** Specifically, moisture was determined by oven drying, ash by muffle furnace incineration, crude protein by the Kjeldahl method, fat by Soxhlet extraction, and fibre by acid-alkali digestion. Carbohydrate content was obtained by difference (Horwitz & Latimer, 2019; Adeyeye *et al*., 2021).

Determination of Vitamins

The fruit and vegetable samples were similarly washed, sliced, and freeze-dried to preserve heat-sensitive vitamins. The dried powders were extracted using appropriate solvents and analyzed for vitamins A, C, and B_1 following the official AOAC procedures (AOAC, 2019). High-performance liquid chromatography (HPLC) and UV–Vis spectrophotometry were used for the quantitative determination of vitamins, as recommended by Nielsen (2017) and FAO (2023)**.**

Data Analysis

All data were analyzed using descriptive and inferential statistics**,** including means, standard deviations, and analysis of variance (ANOVA), to determine significant differences among samples. Macro and micro-nutrient concentrations were compared across different fruit and vegetable types to identify patterns related to plant species or environmental factors.

III. RESULTS AND DISCUSSION

The proximate and vitamin compositions of the selected fruits and vegetables revealed wide variations in nutrient contents, reflecting their nutritional diversity and dietary significance.

Figure 1 shows the proximate analysis of the fruits and vegetable. Ash content ranged from 0.655% in lettuce **to** 1.599% in sorrel**,** showing that leafy vegetables generally contain more minerals than fruits. These minerals including calcium, potassium, and iron are vital for bone formation, enzyme activation, nerve transmission, and fluid balance**. This** pattern agrees with the findings of Obinna-Echem *et al.* (2021)**,** who observed that green vegetables accumulate more minerals than fruits due to differences in root absorption and soil mineral availability.

Fat content was low across all samples (0.0975–0.895%), with guava recording the highest value and pawpaw the least. The low fat content aligns with Obinna-Echem *et al*. (2021) and Adebayo *et al*. (2021)**,** confirming that fruits and vegetables are naturally low-energy foods suitable for weight control and cardiovascular health. Low fat also enhances shelf stability and reduces lipid oxidation.

Crude protein ranged from 0.495% in mango to 2.495% in spinach. Leafy vegetables such as spinach and sorrel contained more protein than fruits, consistent with Adebayo *et al.* (2021). Though their protein content is modest compared with legumes, it contributes to tissue repair, enzyme production, and immune function**,** especially in plant-based diets.

Crude fibre ranged from 1.39% in lettuce to 5.405% in

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guava**,** showing that guava is a strong source of dietary fibre, which aids digestion, bowel regularity, cholesterol reduction, and blood-sugar control**.** Similar findings were reported by Okorie and Ogbuehi (2022)**,** who emphasized that fibre-rich fruits help prevent obesity and heart disease.

Moisture content was high in all samples (70.75–94.2%), with lettuce and spinach recording the highest levels typical of fresh leafy vegetables. This high water content promotes hydration and nutrient transport but limits shelf life. The pattern agrees with FAO (2023)**,** which noted that leafy vegetables commonly contain 85–95% moisture.

Carbohydrate content varied from 4.59% in spinach **to** 22.75% in banana, indicating that banana and mango are major energy-yielding fruits, while low-carbohydrate vegetables like spinach and lettuce are suitable for diabetic or weight-control diets (Aremu *et al*., 2021).

Figure 2 shows the concentration of vitamin found in the selected fruits and vegetables, Vitamin A levels ranged from 0.199 mg/100 g in cabbage to 444 mg/100 g in lettuce, showing that leafy vegetables are rich in carotenoids, which support vision, cell growth, and immune function. Similar high β-carotene values were observed in green vegetables by Obinna-Echem *et al*. (2021) and Aremu *et al*. (2021). However, the lettuce value should be verified for possible unit conversion error, as recent studies by Medina-Lozano *et al*. (2021) reported lettuce Vitamin A mainly in micrograms or IU, not milligrams.

Vitamin C content was highest in guava (229.5 mg/100 g), followed by sorrel (133.5 mg/100 g) and pawpaw (62.45 mg/100 g), while lettuce (9.45 mg/100 g) and banana (9.9 mg/100 g) had the lowest. Vitamin C plays essential roles in collagen synthesis, iron absorption, immune defense, and antioxidant protection. These results align with Fernandes *et al*. (2024), who reported guava as an exceptionally rich natural source of ascorbic acid (180–290 mg/100 g).

Vitamin B1 (thiamine) levels ranged narrowly from 0.0425 mg/100 g in banana to 0.0795 mg/100 g in sorrel. Although low, these values indicate that fruits and vegetables can supplement thiamine intake when combined with cereals and legumes. Thiamine is necessary for energy metabolism and proper nerve function, and comparable results were observed by FAO (2023) in tropical produce and reported by Czerwiecki and Wilczyńska (1999).

IV. CONCLUSION

The study revealed that fruits and vegetables grown along the River Yedzeram are rich in essential nutrients that support human health. Fruits like banana and mango were high in carbohydrates, while leafy vegetables such as spinach and lettuce contained more protein, ash, and moisture. Guava showed the highest Vitamin C content, and lettuce was particularly rich in Vitamin A, highlighting their importance in nutrition and disease prevention. Overall, these locally grown crops contribute significantly to food security and public health in the region. Continuous monitoring of soil and water quality is recommended to ensure their safety and sustainability.

V. RECOMMENDATION

i. Individual should be encourage to take more fruits and vegetables
ii. There should be improve in storage, preservation, and transportation in other to prevent post-harvest lost
iii. Need for continuous monitoring of soil and water for irrigation in other to prevent contamination.
iv. The Government should developed strategies to integrate nutritional sensitive agriculture with public health initiatives.

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Table 1: Proximate Analysis (%) of Some Fruits and Vegetables

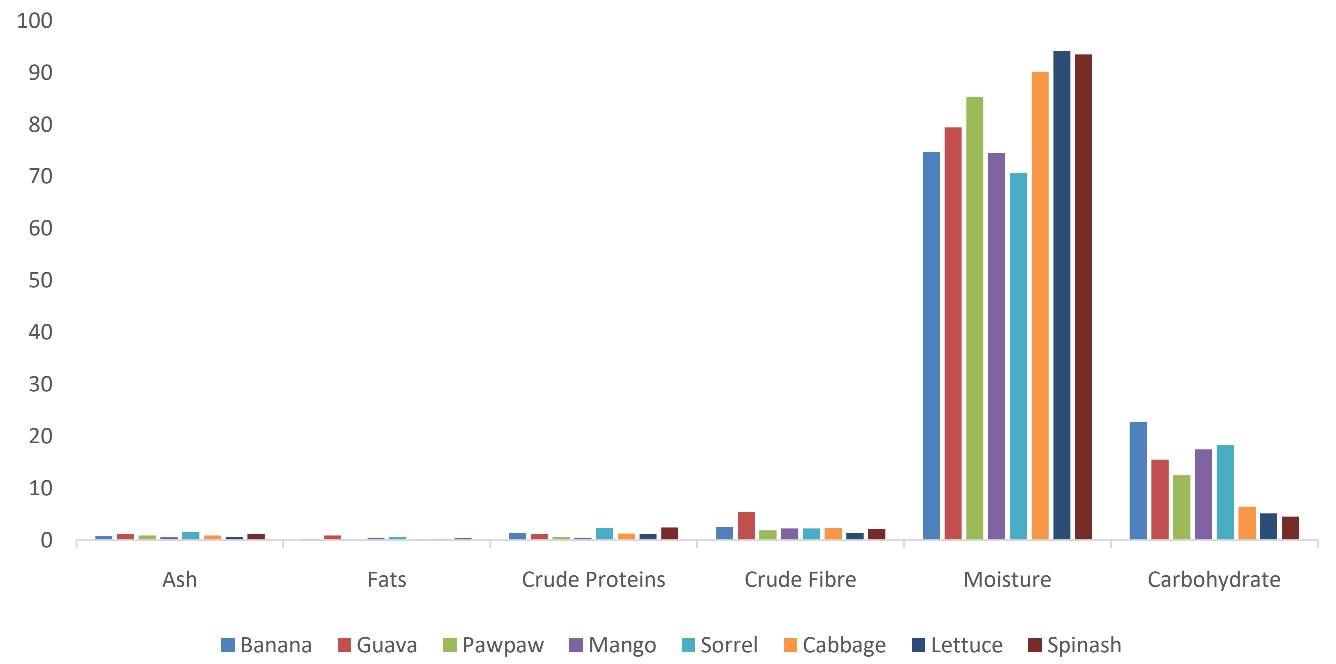
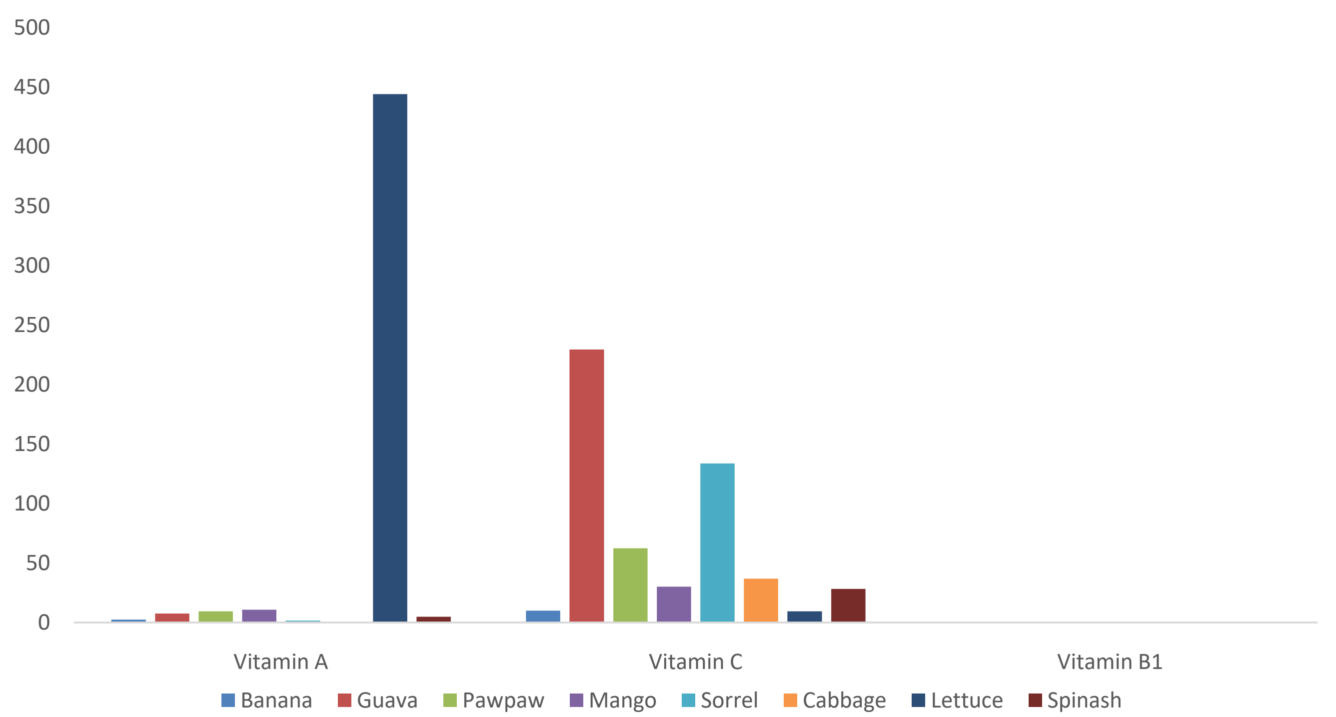


Figure 2: Vitamin Content of Some selected Fruits and Vegetables



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