Journal of Agriculture and Environment Vol. 17 No. 2, 2021: 123-131
ISSN: 1595-465X (Print) 2695-236X (Online)

ASSESSMENT OF SOME SELECTED EDIBLE WILD FRUITS (EWFs) AS POTENTIAL REMEDY TO MALNUTRITION IN THE RURAL AREAS OF SOKOTO STATE, NIGERIA

Z.Y. Gada and A. Ismaila

Department of Forestry and Environment, Usmanu Danfodiyo University
Sokoto, Nigeria

ABSTRACT

The current research was conducted to assess the dietary aptitudes of edible wild fruits (EWFs) to rural nutrition in Sokoto, North-western Nigeria. In this study, primary data were obtained from market survey, proximate and mineral analysis. While the secondary information on nutrition and malnutrition status of the inhabitants was obtained from the state centre for disease control and prevention (CDC). Data collected were analysed descriptively using frequencies and percentages. The results showed that EWFs contain both micro and macro nutrients at different proportions, that can be compared with the nutritional composition of the food supplements used in the rehabilitation of chronically malnourished children in the study area. Despite this, there was zero effort by the government in converting the EWFs into a valuable food material, while the locally made ones are considered unhygienic hence not certified by the relevant government agencies. Also, lack of processing and storage facilities always resulted in massive fruit failures annually. It was also gathered that, sufficient balanced diet is a major challenge to rural people in Sokoto, with malnutrition cutting across all age groups. Though, the most vulnerable are children under five years and women of childbearing age, who are branded with deficiencies in both macro and micronutrients. This resulted in stupendous expenditure annually for the control and prevention of malnutrition and other related diseases in the study area. Given this, there is an urgent need for reorientation of research into conversion of EWFs to a valuable food material. Similarly, domestication and conservation of WFTs should be prioritised in North-western Nigeria.

Keywords: Edible wild fruits (EWFs); Wild fruit trees (WFTs); Nutrition; Malnutrition; Sokoto State

INTRODUCTION

The Nigerian population is increasing rapidly, regrettably food production is relatively low due to banditry and climate change ravaging the most agriculturally productive areas of the country, which resulted in the prevalence of malnutrition especially among children and women of childbearing age (Ladan and Mutawalli, 2021). In Nigeria, about 10 million children are found to be stunted as a result of acute malnutrition, while anaemia resulting

from iron deficiency was reported to be responsible for 19% of the maternal mortality in the country (UNICEF, 2015; Erhabor, 2013). Given this, millions of dollars are allocated annually for the provision of nutrient and vitamins supplements to tackle malnutrition crises in the country (NNHS, 2015). Although strategies are underway, yet a lot needs to be done, as the plans fall short of the pace required to ameliorate malnutrition crisis in Nigeria (NSPAN, 2014).

Similarly, higher quality food materials are relatively expensive and not affordable to most rural populations, especially in North-western Nigeria, where the highest number of malnourished and stunted children are sited in the country (NNHS, 2015). This and other related hindrances raise the urgent need for approaches to diversify rural household income and improve agricultural productivity. However, while the government and other donor agencies emphasise on the provision of social amenities, advancing agriculture and improving environmental quality, at a local scale, the contribution of edible wild fruits (EWFs) to rural nutrition and livelihoods cannot be over emphasised.

Wild fruits provide nourishment during the hunger periods in the agricultural cycle. The fruits ripen at a different time of the year which can be targeted to meet specific needs whenever required. For example, a study conducted across rural communities in Zambia, Mozambique and Malawi revealed that 26 – 50% of rural households relied on EWFs as a coping strategy during critical hunger periods which usually last for three to four months annually (Akinnifesi *et al*., 2007).

Moreover, the fruits are naturally low in calories, fat, and cholesterol and provide essential minerals such as Sodium, Magnesium, Calcium, Iron, Phosphorous, and Potassium (Hossain, 2015; Aboshara *et al.,* 2014; Waziri, *et al.,* 2011 & El-sohaimi *et al.,* 2010). Despite numerous nutritional benefits, consumption and overall utilisation of EWFs is branded with various inefficiencies. According to the 'FAO/WHO expert report on diet, nutrition and prevention of chronic diseases,' consumption of fruits and vegetables among the rural people in the developing countries has been the primary task of converting nutrient deficiency disorders. Although, stigma, convenience, taste and accessibility are among the major reasons rural people tend to shy away from fruits and vegetables (FAO, 2003; Fentahum and Hager, 2009). Nevertheless, EWFs are habitually affordable and play a crucial role in the nutrition and livelihoods of rural people (Iranbakhshi *et al.,* 2009; Akinnefesi *et al.,* 2007). Therefore, it is essential to ascertain their nutritional characteristics with a view to promote consumption and overall utilisation.

METHODOLOGY

Study Area

The study was conducted in Sokoto State, located in the extreme North-Western Nigeria. It lies between latitudes 12°57′ 30″N to 13°8′ 0″N and longitudes 05°9′ 0″E to 05°19′ 30″E. (Google Map, 2019). It falls within the Savannah region with an estimated area of forest reserve of 602, 631ha, while the area of forest plantation is 10, 943ha (NBS, 2020). Plantation establishments (involving multipurpose species such as *Acacia spp.*) are usually carried out with a view to convert desertification. Moreover, the edible wild fruit trees in the area include *Balanites aegyptiaca, Parinari curatellifolia, Ziziphus mauritiana, Ziziphus spina-cristi, Phoenix dactylifera, Borassus aethiopum, Sclerocarya birrea* and *Tamarindus indica* among others. The species are distributed at different concentrations in various parts

of the state. Although inadequate sources of energy for cooking and lightening coupled with climate change poses a threat to the overall vegetation productivity in the area (Yelwa and Isah, 2010).

The population of Sokoto is over 5.2 million people who are predominantly Hausa Muslims (NBS, 2021). The poverty level in the state is high (87.73%), and about 75% of the inhabitants live in rural areas and depend primarily on farming as the primary source of livelihood (NBS, 2020). Farming as a cultural practice is predominantly at subsistence level using manpower as the main source of labour which resulted in low food production. Given the growing population and low food production, malnutrition issues persist especially among the rural people in the state (NNHS, 2015).

Sampling and Sample Size

A multistage sampling procedure is a sampling method that divides the population into groups (or clusters) for conducting research (Sedgwick, 2015). However, in this research a multistage sampling technique was used to determine the abundance and market availability of the EWFs in the study area. Sokoto State has 23 local government areas (LGAs) and 10 were randomly selected (Figure, 1). Each sampled LGA was divided into "districts" according to the traditional ruling council of the state (NPC, 2006). In each LGA, two districts were sampled, and five (5) copies of the questionnaire were administered to the randomly selected heads of household in each district, making a total of 100.

Proximate and Mineral Analysis

Proximate and mineral analysis was conducted at the Agricultural Physical laboratory of Usmanu Danfodiyo University Sokoto, Nigeria. The analysis was carried out to determine the nutritional and mineral contents of the selected edible wild fruits, which includes Moisture content, ash content, crude fibre, crude lipid, crude protein and carbohydrate. The analysis was based on AOAC (2012) and Oyeleke (2014). While the mineral contents (Sodium, Magnesium, Phosphorous, Calcium and Potassium) were determined using elemental analysis based on AOAC (2012) and Uriyo and Singh (2017). The healthy fruits were obtained in dried forms from the sample LGAs. The edible parts were separated from the fruits in order to have a preferred powdered sample (10g) for the experiment.

Malnutrition Status in the Study Area

Data on malnutrition status as well as the procedure for rehabilitating chronically malnourished children in the study area was obtained from Sokoto State 'Centre for Disease Control & Prevention' (CDCP). This is to determine the deficient nutrient elements that are expected to be met by the edible wild fruits.

Data Analysis

The data generated from this research were analysed using descriptive statistics (frequencies and percentages).

RESULTS AND DISCUSSION

Market Survey

In this research, a total of 19 individual species belonging to eleven families were identified (Table, 1). Also, it was uncovered that, EWFs can be found either in fresh or dried forms all year round (Figure 2).

Table: 1: Checklist of the identified EWFTs in the study area

S/NO	Species	Family	Common Name	Local Name
1	*Adansonia digitata*	*Malvaceae*	Baobab	Kuka
2	*Balanites aegyptiaca*	*Zygophyllaceae*	Desert date	Aduwa
3	*Borassus aethiopum*	*Arecaceae*	African fan palm	Giginya
4	*Detarium microcarpum*	*Caesalpiniaceae*	Tallow tree	Taura
5	*Dialium indum*	*Fabaceae*	Velvet tamarind	Tsamiyar Biri
6	*Diospyros mespiliformis*	*Ebenaceae*	Jackal berry	Kaiwa/kanya
7	*Hyphaene thebaica*	*Arecaceae*	Doulm palm	Goriba
8	*Lannea macrocarpa*	*Anacardiaceae*	Lannae	Faru
9	*Parinari curatellifolia*	*Chrysobalanaceae*	Hissing tree	Gawasa
10	*Parkia biglobosa*	*Fabaceae*	African Locust	Dorawa
11	*Phoenix dactylifera*	*Arecaceae*	Dates palm	Dabino
12	*Piliostigma reticulatum*	*Fabaceae*	Camel's foot	Kalgo
13	*Sclerocarya birrea*	*Anacardiaceae*	Marula	Danya/Nunu
14	*Tamarindus indica*	*Fabaceae*	Tamarind	Tsamiya
15	*Vitellaria paradoxa*	*Sapotaceae*	Shear tree	Kade
16	*Vitex doniana*	*Lamiaceae*	Vitex	Dunya
17	*Ximenia americana*	*Olacaceae*	Wild plum	Tsada
18	*Ziziphus mauritiana*	*Rhamnaceae*	Jujube	Kurna
19	*Ziziphus spina-christi*	*Rhamnaceae*	Christ's thorn	Magarya

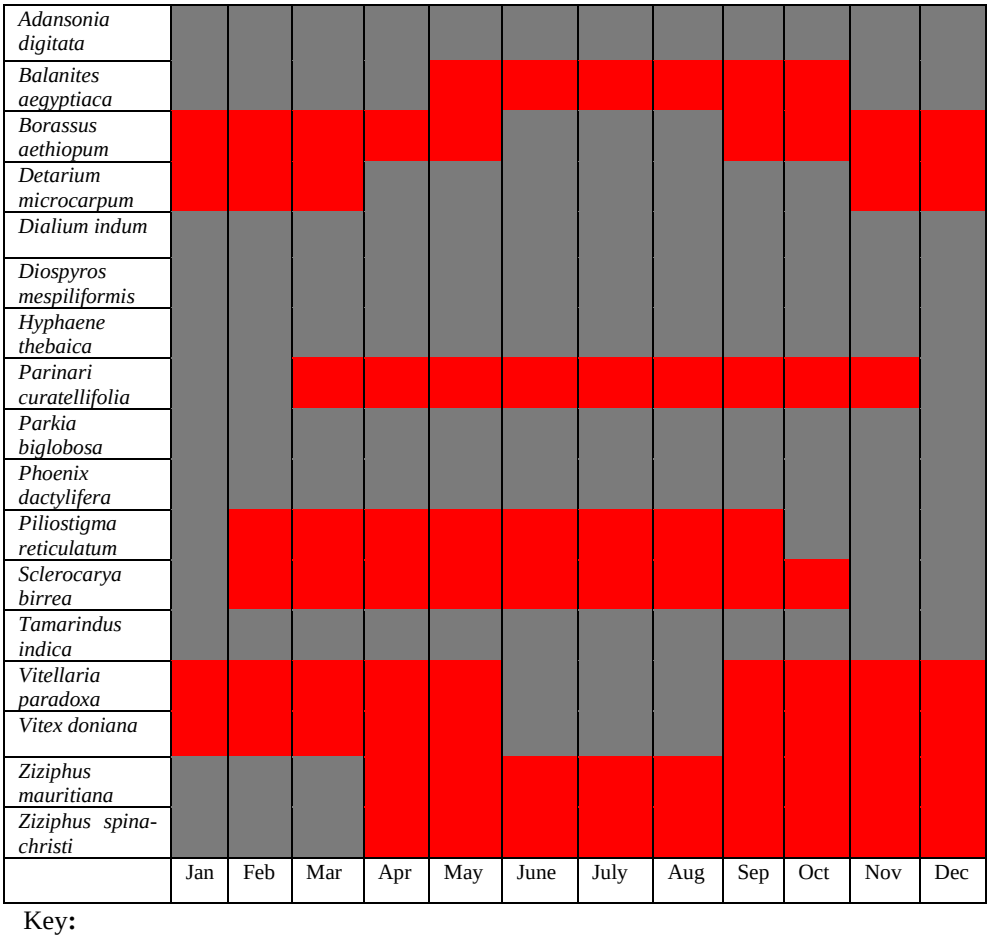

Figure 2: Market availability of some EWFs in Sokoto State (2017 – 2021)

Malnutrition and Mechanism of Rehabilitating Chronically Malnourished Children in the Study Area

Data obtained from the centre for disease control revealed, that in the last six years, about 141, 086 cases of malnutrition were identified, 82, 052 children admitted to the hospitals, 46,687 treated and 910 Died. However, the main causes of this menace include Poverty, poor child feeding practises (unbalanced diets), limited access to health care, inadequate sanitation, insecurity, climate change and lack of potable drinking water (CDCP, 2019; MAM, 2019). Similarly, cases of females with iron deficiency anaemia were cited in the study area.

Moreover, data gathered in this research revealed that malnourished children are branded with deficiencies in Protein, carbohydrates, Vitamins C, A, and E as well essential elements such as Ca, Mg, P, K and Fe. Given this, large sums of monies are spent by government and NGOs annually to provide portable drinking water, drugs and dietary supplements to the malnourished children (CDCP, 2019). The nutritional support is given to curtail the malnutrition crisis and rehabilitates the identified malnourished and stunted children in the study area. Examples of nutritional supplements found in the study area include, F-100, F-75 and Plumpy nuts among others, which proved to be effective in rehabilitating the chronically malnourished children.

The dietary supplements are not adequately supplied to satisfy the demand of the teeming malnourished people in the area. Given this, to complement shortage of dietary food supplement in the area, the state 'Center for Disease Control and Prevention' trained all the local government nutrition staff officers as well as a group of rural women representatives on the formulation of food supplements using locally produced food materials such as *Glycine max, Arachis hypogea, Pennisetum spp,* Fish and dried Plantain. However, success recorded in this program was quite insignificant, which is largely attributed to lack of commitment by the participants.

Nutritional and Mineral Analysis

Tables 2 and 3 shows the nutritional and mineral contents of the four (4) EWFs.

Table 2: Nutrient content

EWFs Samples (100g)	Moisture content (%)	Ash content (%)	Crude fibre (%)	Crude lipid (%)	Crude protein (%)	Carbohydrate (%)
Hyphaene thebaica	4.00	8.50	17.00	0.50	2.98	67.02
Adansonia digitata	3.50	10.00	2.00	0.00	2.54	81.96
Ziziphus mauritiana	3.00	6.00	3.50	0.50	4.55	82.45
Ziziphus spina-christi	7.50	6.00	3.00	0.50	2.98	80.02

Table 3: Mineral content

EWFs Samples (100g)	Calcium (mg/100g)	Magnesium (mg/100g)	Phosphorus (mg/100g)	Sodium (mg/100g)	Potassium (mg/100g)
Hyphaene thebaica	0.130	0.340	0.403	8.250	240.000
Adansonia digitata	0.105	0.410	0.465	12.250	220.000
Ziziphus mauritiana	0.115	0.390	0.414	3.750	190.000
Ziziphus spina-christi	0.105	0.340	0.459	1.000	200.000

Optimum nutrition at each phase of the lifecycle is a fundamental human right while malnutrition is considered as a denial of that right (NSPAN, 2014). However, nutritional or food security remained a complex and unresolved issue in the underdeveloped countries (Mahapatra and Panda, 2012). For instance, five 'servings' (400 g) of fruits and vegetables per day are recommended for individuals as per 'WHO dietary guidelines' (MAM, 2019).

Regrettably, adequate nutrition has been a major challenge, which makes this requirement not achievable by most rural people in these regions. Higher quality food materials are relatively expensive and not affordable to most rural populations (Ladan and Mutawalli, 2021).

Given the World Health Organization (WHO) recommended dietary nutrient and mineral requirements, it can be concluded that, if efficiently utilised, EWFs has the potential of reducing the nutritional deficiencies affecting the rural people in the study area. For example, WHO recommended dietary intake (RDI) of carbohydrates in food ranges from 27% - 59%, while in this research it was uncovered that the carbohydrate content ranges from 67.02% - 82.45% per 100g. Similarly, the RDI for Ca, Mg, P, Na and K was capped at 1300mg, 400mg, 700mg and 4,700mg respectively. This further confirmed that EWFs have the potential of adequately supplying the above-mentioned nutrient elements in sufficient quantities to enhance normal body growth and development.

Moreover, minerals are important elements found in food that are essential for normal body function, growth and development. For example, Ca is an important nutrient element needed for body rigidity and support, formation of teeth, regulation of muscle concentration and the transmission of nerve impulse (Theobald, 2005). In this research it was found to be between 011mg/100g to 0.13mg/100g in *A. digitata* and *Z. spina-christi* respectively. This shows that consumption of *Z. spina-christi* can ameliorate the effects of Ca deficiency in the human body. Similarly, the quantity of K was found to be high in *H. thebaica* (240mg/100g), which is a common fruit that can be found (either in dried or fresh form) all year round (Figure, 2). Vanhamen *et al*. (2011) stated that, diets rich in K reduces the risk of high blood pressure and diabetes. Therefore, consumption of *H. thebaica* could be recommended for diabetic patients and people with high blood pressure.

CONCLUSION

The state of rural livelihood in the study area is critical due to a high level of poverty, inflation, insecurity and agro-ecological pressures induced by climate change which together exacerbate malnutrition prevalence in the area. Malnutrition is higher among children under five years and women of childbearing age, who suffer from deficiency in both macro and micronutrients. In view of this, efforts are made by the government and donor agencies to tackle the menace yet, the issue persists due to inadequate supply of nutrient supplements to rehabilitates the identified chronically malnourished children in the area.

However, the findings of this research showed that EWFs contain essential nutrients such as Carbohydrates, Protein, Fibre, Lipids and Ash, which are needed for normal growth and development of the human body. Also, elemental analysis confirmed the presence of essential nutrient elements such as Ca, Mg, P, K, and Na which are needed for body rigidity and support, formation of teeth, regulation of muscles, concentration and the transmission of nerve impulse, reduces the risk of high blood pressure and diabetes among others. In view of this, it can be concluded that, if efficiently utilised, EWFs have the potential of meeting the nutritional requirements of the inhabitants in the study area. Therefore, considering their availability and affordability, conservation and domestication of the EWFTs should be prioritised.

REFERENCES

Akinnifesi, F.K., Leakey, R.R.B., Ajayi, O.C., Sileshi, G., Tchoundjeu, Z., Matakala, P. and Kwesiga, F.R. (2008). *Indigenous Fruit Trees in the Tropics*: *Domestication, Utilization and Commercialization.* World Agroforestry Centre. 65-242.

Akinnifesi, F.K., Ajayi, O.C., Sileshi, G., Kadzere, I. and Akinnifesi, A.I. (2007). Domesticating and Commercializing Indigenous Fruit and Nut Tree Crops for Food Security and Income Generation in Sub-Saharan Africa. The New Crops International Symposium, South Hampton, United Kingdom. 3-4th September, 2007.

AOAC (2012). *Official Methods of Analysis of AOAC International*. 19th Edition. Gaithersburg, MD, USA, 2012.

CDCP (2019). Center for Disease Control and Prevention. Annual Report on Malnutrition Prevalence in Sokoto State, North-western Nigeria. 2019.

Christian, O. and Ukhun, K. (2006). Nutritional studies of indigenous fruit trees in support of conservation. *Journal on African Academy of Sciences*, 57 (1): 51-55.

Erhabor, S. (2013). Iron deficiency anaemia among antenatal women in Sokoto, Nigeria. *British Journal of Medical and Health Sciences*, 1 (4), 47-57.

FAO (2003). The state of Food Insecurity in the World. Food Security and Nutrition; the drivers of change. http://www.fao.org/3/a-i4646e/i4646e03.pdf

Hossain, A.B.M. (2015). Dried dates fruit and its biochemical and nutrient content: Uses as diabetic food. *Asian Journal of Clinical Nutrition*, 7(3), 90-95.

Iranbakhsh, A., Ebadi, M. and Zare, Z. (2009). The contribution of indigenous fruit frees in sustaining rural livelihoods and conservation of natural resources. *Journal of Horticulture and Forestry*, 1(1): 1 – 6

Ladan, H. and Mutawalli, B. (2021). Impacts of Banditry on Food Security in Katsina State, Nigeria: A recent study. A report on appraisal of insecurity in Katsina State, Nigeria. Chapter III. PP. 16 – 27.

Mahapatra, A. K. and Panda, P.C. (2012). Wild edible fruit diversity and its significance in the livelihood of indigenous tribes: Evidence from eastern India. *Food Security*, 1(4): 219-234.

MAM (2009). Management of Acute Malnutrition. Report on Modern Acute Malnutrition in Humanitarian Emergencies in Africa.

NBS (2020). Annual Abstract of Statistics 2020. National Bureau of Statistics. Federal Republic of Nigeria.

NBS (2021). LSMS-Integrated Surveys on Agriculture. General Household Survey Panel. A Report by the Nigerian National Bureau of Statistics in Collaboration with the Federal Ministry of Agriculture and Rural Development and the World Bank 2021.

NNHS (2021). National Nutrition and Health Survey. A report on the Nutrition and Health Situation in Nigeria 2021. By USAID and UKAID, compiled by Lorenza Rossi.

NPC (2006). National Population Commission of Nigeria and ICF International. Nigeria Demographic and Health Survey. 170-172

NSPAN (2014). Nigeria's National Strategic Plan of Action for Nutrition 2014 – 2019. Compiled and published by health sector component of national food and nutrition policy, Federal Ministry of Health, Nigeria. 2014.

Oyeleke, L. (2014). Nutritional composition of *Balanites aegyptiaca* (Desert Date) and *Hyphaene thebaica* (Doum Palm) fruits consumed by Hamadryas Baboons (*Papio*

hamadryas hamadryas) in Awash National Park, Ethiopia. *Journal on Nutrition Ecology*, *Food Resource*, 1(1**)**: 198–206.

Sedgwick, P. (2015). Multistage Sampling. BMJ Clinical Research Report. Report No. H351. 2 Pages

Theobald, H. E. (2005). Dietary calcium and health. *Journal on Nutrition*, 30 (1): 237–277.

UNICEF (2015). Summary Findings of Cross-Sectional Nutrition Surveys in Northern Nigeria, September 2015. PP. 30 – 403.

Uriyo, A.P. and Singh, B. R. (2017). Medicinal applications of edible wild fruits. *Journal of Science*, 1(7): 3-10.

Vanhanen, L.P. and Emmertz, G.P. (2011). Savage mineral analysis of mono-floral New Zealand. *Journal on Honey Food Chemistry*, 128(1): 236-240

Waziri, M., Akinniyi, J and Chidi, M. (2011). Elemental composition of 'Dalang': A food condiment from evaporated extract of *Borassus aethiopum* fruit ash. *American Journal of Food and Nutrition*, 1(3): 123-125.

WHO (2012). Recommended Dietary Guidelines. Daily iron and folic acid supplementation in pregnant women. Geneva, 2012.

Yelwa, S. A. and Isah, A.D. (2010). Analysis of trends in vegetation AVHRR-NDVI data across Sokoto State 1982 – 1986 using remote sensing and GIS. *Nigerian Journal of Basic and Applied Science*, 18(1): 90-96.