

Valorization of wild fruits for human nutrition in demographic pressure challenges: Perception of fruit traders on plants species under anthropogenic threats

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International Journal of Frontiers in Life Science Research, 2022, 03(02), 001–006

Publication history: Received on 04 October 2022; revised on 20 November 2022; accepted on 22 November 2022

Article DOI: <https://doi.org/10.53294/ijflsr.2022.3.2.0066>

Abstract

The present study aims to assess the perception of fruit traders on plant species under anthropogenic threats in natural ecosystems of southern Benin. To do this, a semi-structured survey was conducted among fruit traders in local markets of *Tangbo-Djevié* and *Dantokpa* (Southern Benin). From the results obtained, it appears that the fruit sales activity is exclusively female (100%) and the majority of women (84.74%) are between 31 and 60 years old. According to surveyed people, fruit trade activities are closely depended on the fruiting period of each fruit species. Fruits sold in these markets are commonly pineapple (*Ananas comosus*), avocado (*Persea americana*), banana (*Musa acuminata*), soursop (*Anona muricata*), lemon (*Citrus limon*), orange (*Citrus sinensis*), grapefruit (*Citrus maxima*), papaya (*Carica papaya*), chapokin (*Ceiba pentandra*), guava (*Psidium guajava*), cinnamon apple (*Annona squamosa*), star apple (*Chrysophyllum albidum*), wild apple (*Irvingia gabonensis*), black tamarind (*Dialium guineense*) and watermelon (*Citrullus nanatus*). The fruits sold in these markets came mainly from four departments of southern Benin, such as *Atlantique*, *Zou*, *Couffo* and *Borgou*. The fruits mostly cited by surveyed people as to be under anthropogenic threats are chapokin (*Ceiba pentandra*), soursop (*Anona muricata*), guava (*Psidium guajava*), cinnamon apple (*Annona squamosa*), star apple (*Chrysophyllum albidum*), wild apple (*Irvingia gabonensis*), mombin plum (*Spondias mombin*) and black tamarind (*Dialium guineense*). This study therefore shows that particular attention should be given to this activity sector through the awareness of the nutritional opportunity that these wild fruits represent for the population and also the development of technological processes allowing their real industrial valorization

Keywords: Fruit markets; Traders; Perception; Anthropogenic threats; Valorization; Benin

1. Introduction

Since the beginning of civilization different types of plants are useful in food production. In Africa, agroforestry species are alternative sources of food commonly used by people of various socio-economic categories as a supplement to the daily diet and therefore contribute greatly to diversity, food security and reduction of poverty (Fandohan et al., 2010). Forests also provide a large number of animal and plant resources which are sources of food, medicine, supply of wood for energy and work for local populations (Goussanou et al., 2011). Apart from agriculture, livestock or fishing, the collection of non-timber forest products is an important source of income for rural communities (Salhi et al., 2010; Allabi et al., 2011). This indicates how plants have become true cultural and economic markers of human history (Chibembe et al., 2015).

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Many researches have focused on different aspects of their use, production and resilience, as well as their economic importance at the local, regional, national and international levels (Ruiz and Arnold, 1995; Adepoju and Salau, 2007). Non-Timber Forest Products (NTFPs) therefore play an essential role in the daily life of millions of rural and urban populations in the world (Tabuna, 2000). According to Kalaba et al. (2010), 80% of rural populations in sub-Saharan Africa depend on plant NTFPs for their health needs.

Moreover, biochemical and nutritional investigations underlined their high content in proteins, lipids, carbohydrates, minerals and various vitamins and fibers (Augustino et al., 2011) as well as their potential to contribute to the resolution of many health problems related to nutritional deficiencies (Okolo et al., 1995; Chadare et al., 2010; Ahenkan and Boon, 2011; Sossa-Vihotogbé et al., 2012).

However, demographic pressure, deforestation, wildfires, agriculture and livestock, climate change also contribute to the loss of useful native plants (Assogbadjo et al., 2011). Indeed, the annual losses in forest cover in Benin over the period from 2005 to 2010 are estimated at 50,000 ha according to the United Nations Food Organization (FAO, 2011), resulting in the disappearance of useful plant species from their natural ecosystems (Adomou et al., 2017). On the socio-economic level, income-generating activities linked to the trade of by-products from these plant species are also threatened. Thus, the present study aims to assess the perception of fruit market traders on agroforestry edible fruit species under anthropogenic threats in their natural ecosystems in southern Benin, in order to identify the relevant information and points of interest capable of supporting future research.

2. Material and methods

2.1. Zone of study

The study was carried out in Benin, a country located between the meridians 0°40' and 3°45' East longitude and the parallels 06°15 and 12°25' North latitude (Gbemavo et al., 2014). The study sites are fruit markets of *Tangbo-Djevié* and *Dantokpa* located in the municipalities of *Zè* and *Cotonou* (Southern Benin).

2.2. Sampling and data collection

The main target of this study is traders in investigated fruits markets. Taking into account preliminary investigations, the size of the sample to be investigated was determined using the formula of Dagnelie, (1998). Then a total of fifty-nine (59) fruit traders were surveyed. The survey was carried out by semi-direct interview. Information collected mainly concerned: (i)- reasons that motivated the choice of the fruit sales activity, (ii)- varieties of fruit sold, (iii)- areas of origin of fruits, (iv) – fruits under anthropogenic threats, (v)- number of years in fruit sales activity.

2.3. Statistical analysis

Data were processed using Microsoft Excel 2007 and SPSS 16.0 software. SPSS16.0 software was used for the statistical analysis of the data for the comparison of means. A probability of less than 0.05 was considered significant.

3. Results and discussion

The use of plant products for survival dates back to the prehistoric period. All parts of plant such as fruits, leaves, barks and roots are used. Then, according to Adjanohoun et al. (1989) nearly 501 species of plants are traditionally used by populations for their health care, while Sinsin and Owolabi (2000) listed 814 species of importance in folk medicine in Benin. In terms of food supply, Assogbadjo et al. (2011) reported that 43 agroforestry species are mainly used. However, real threats, linked to demographic pressure, make the natural ecosystems of these useful species vulnerable. Indeed, apart from the main role of biodiversity and ecosystems sustaining life, they also constitute a significant source of income for local populations. Formerly, the traditional picking or collecting of forest fruits, have nowadays been replaced by better organized transactional systems with more structured technical itineraries.

Thus, alongside traditional exchanges organized in markets, more and more areas dedicated to the fruit trade are developing. This is the case of the fruit markets of *Tangbo-Djevié* which is located near the conventional market of the Arrondissement of *Tangbo-Djevié* and that of *Dantokpa* which is located in the main market of the commune of Cotonou. Thus, the results from the socio-demographic characteristics of traders of this commercial transaction, make it possible to classify the surveyed population according to the criteria of age, sex, education, and number of years in the activity (Table 1). The analysis of the results indicated that fruit sales activity is exclusively female (100%). The majority of traders (84.74%) are between 31 and 60 years old. Concerning the number of years carried out in the fruit sales activity,

47.45% of the surveyed people declared to be between 0-10 years old and 45.76% declared to be between 11-20 years old. The majority of traders surveyed (67.79%) are uneducated. This structuring differs from the typical structure of African markets described by Sindzingre (1998). Figure 1 indicated the distribution of fruit traders surveyed according to the motivations for choosing the activity of selling fruit. It appears from the results obtained that for the majority of them (80.8%), it was a personal choice, either by desire or by passion for fruits. However, 10.8% of surveyed people declared that for them, the sale of fruit is a family activity, transmitted from mother to daughter. Considering the importance of selling fruit activity for the traders surveyed (Figure 2), it appears that for 78% of traders, selling fruits is their main activity. However, 22% of them said that it was a secondary activity for them, because apart from market days, they devote themselves to other income-generating activities. According to them, the fruits trade depends closely on the fruiting period of each fruit species. Results from this surveyed also reveal that the main fruits sold in these markets are pineapple (*Ananas comosus*), avocado (*Persea americana*), banana (*Musa acuminata*), soursop (*Anona muricata*), lemon (*Citrus limon*), orange (*Citrus sinensis*), grapefruit (*Citrus maxima*), papaya (*Carica papaya*), chapokin (*Ceiba pentandra*), guava (*Psidium guajava*), cinnamon apple (*Annona squamosa*), star apple (*Chrysophyllum albidum*), wild apple (*Irvingia gabonensis*), black tamarind (*Dialium guineense*) and watermelon (*Citrullus nanatus*). According to fruit traders surveyed, the main supply areas of fruits sold in the markets are Zè (Atlantic Department), Zinvié (Atlantic Department), Sékou (Atlantic Department), Allada (Atlantic Department), Houégbo (Atlantic Department), Toffo (Atlantic Department), Ouidah (Atlantic Department), Bohicon (Department of Zou), Dassa (Department of Collines), Parakou (Department of Borgou), Azovè (Department of Couffo), Klouekanmè (Department of Couffo) (Figure 3). Some traders (5%) declared that they obtained fruits mainly from neighboring countries, particularly Togo and Nigeria, especially during the off-season. Wild fruits mainly mentioned by the traders as being under anthropogenic threats are chapokin (*Ceiba pentandra*), soursop (*Anona muricata*), guava (*Psidium guajava*), cinnamon apple (*Annona squamosa*), star apple (*Chrysophyllum albidum*), wild apple (*Irvingia gabonensis*), mombin plum (*Spondias mombin*) and black tamarind (*Dialium guineense*). According to Aslantas et al. (2007), wild fruits have an important place in agricultural systems as source of wild foods, and also contribute to socio-economic development through their use by population in medicines, religious and cultural ceremonies. Due to their high nutritional values they are also a good material for industries.

Table 1 Socio-demographic characteristics of fruit traders surveyed

	Fruit traders surveyed	Sex		Age (years)			Years in the fruit sales activity			School education	
		Female	Male	18-30	31-60	61-70	0-10	11-20	21-30	educated	uneducated
Number of people	59	59	00	7	50	2	28	27	4	19	40
Percentage (%)	100	100	00	11.86	84.74	33.89	47.45	45.76	6.77	32.20	67.79

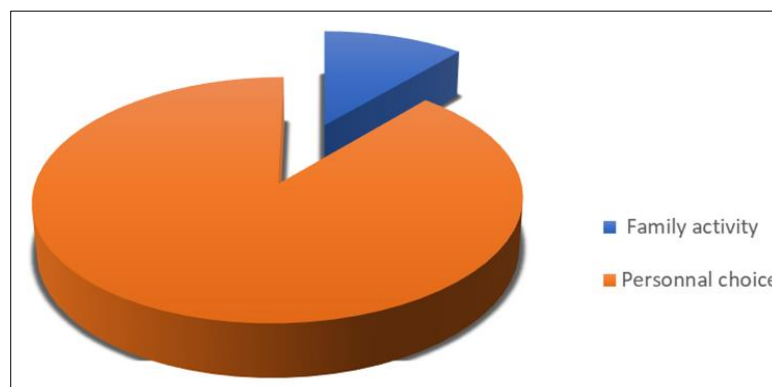


Figure 1 Distribution of fruit traders surveyed based on motivations for choosing fruit selling activity

However, based on the fifth national report on the implementation of the Convention on Biological Diversity in Benin (CBD, 2014), about 2807 species of plants belong to the Beninese flora, of which 3.77% are threatened with two species already extinct (*Caesalpinia bonduc* and *Garcinia kola*). Concerning cultivated plants, Dansi et al. (2012) identified forty-

one (41) species considered neglected and underutilized. In terms of traditional vegetables, two hundred and forty-five (245) species have been listed, including twenty-four (24) identified as threatened (CBD, 2014; Achigan-Dako et al., 2011). Among the main causes are prominently the destruction of natural habitats due to intense human activities, such as agriculture and carbonization. It is therefore important that national policies on the development of agroforestry species pay particular attention to these under anthropogenic threats plants, through the awareness of the nutritional opportunity that these wild fruits represent for the population and also the development of technological processes allowing their real industrial valorization

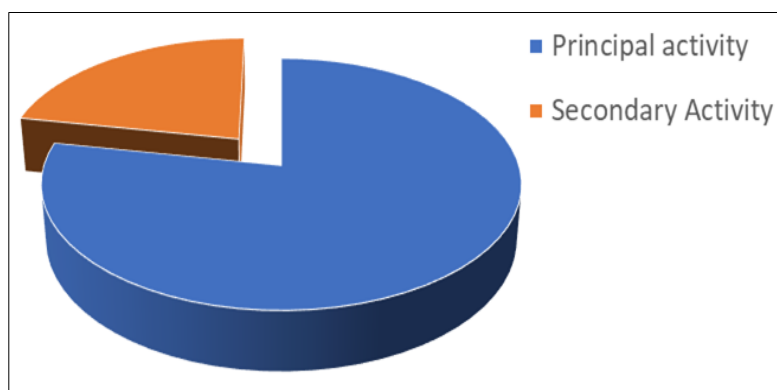


Figure 2 Distribution of traders based on the importance of fruit selling activity

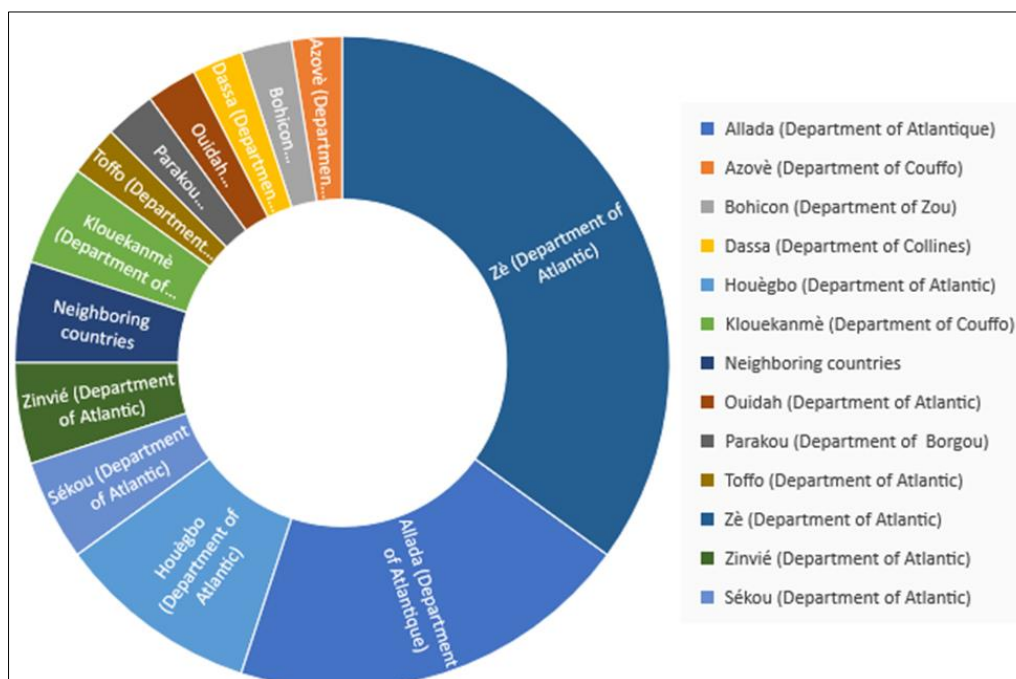


Figure 3 Distribution of fruit traders base on their main supply areas

4. Conclusion

Benin has a rich and varied biodiversity which constitute a significant food source for the populations and also a source of income-generating activity through the trade of fruits. However, nowadays, there are real threats to these wild fruit species due to the intensification of human activities, including agriculture and carbonization. It is therefore important that measures be taken to preserve the natural ecosystem of these plants, as well as their industrial development through the implementation of innovative technologies.

Compliance with ethical standards

Acknowledgments

The authors sincerely thank fruit traders for their participation in this study. They would also like to thank the local language translators for their appreciated contribution.

Disclosure of conflict of interest

Authors have declared that no competing interests exist.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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