Diversity and Socio-Economic Value of Fruits and Leafy Vegetables Sold in the Markets of the City of Soyo, Northern Angola

Zassala Garcia[1*], Agnaldo de Assunção Cardoso Fernando, Maria Pedro António Isabel Dias, Monizi Mawunu

[1]Department of Agronomic Engineering – Nimi Ya Lukeni Higher University Institute

[2]Department of Agronomy – ISP, Bengo

[3]Department of Agronomic Engineering – Nimi Ya Lukeni Higher University Institute

[4]Department of Agronomy, Kimpa Vita University

[*]Corresponding Author

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ABSTRACT

This study aimed to document the fruits and leafy vegetables sold in the markets of Soyo City, Angola. The data were collected from May to November 2025. Data collection was carried out through a semi-structured questionnaire, followed by direct field observations. In total, 81 fruit and leafy vegetable vendors were surveyed, of which 62.96% were men and only 37.04% were women. The main occupation of the respondents is trade (66.67%). The ethnobotanical inventory identified a total of 36 species of fruits and leafy vegetables, distributed across 33 genera and 18 botanical families. The most represented families are Malvaceae, Cucurbitaceae, and Solanaceae (4 species), and Arecaceae, Brassicaceae (3 species). Fruits are more abundant (62.96%) than leaves (37.04%). Most of the leafy fruits and vegetables (93.83%) documented in this study are cultivated, with only 6.17% being native. It is recommended that scientific research on this topic be conducted throughout the entire Angolan territory in order to better document all the different leafy fruits and vegetables produced nationally and to establish economic policies that allow their export, thus contributing to the country's economic diversification. Finally, it is also recommended to carry out economic studies to assess the quantities produced and harvested annually.

Keywords: Inventory; Fruits; Leafy vegetables; Socioeconomic value; Soyo City.

INTRODUCTION

Fruits and vegetables were defined, on the occasion of the International Year of Fruits and Vegetables, as "the edible parts of plants (for example, seed-bearing structures, flowers, buds, leaves, stems, shoots, and roots), which are cultivated or harvested in the wild, in raw or minimally processed form" (FAO, 2020). In this study, we consider leafy vegetables to be the leaves and buds of cultivated and wild plants consumed raw, as salad, or cooked and sold in markets.

Recent studies indicate that the consumption of adequate amounts of vegetables and fruits may have preventive properties against many diseases (WHO/FAO, 2014). The consumption of fruits and fruit-derived products is associated with protective effects against various chronic diseases (Faredet et al., 2019), particularly cardiovascular diseases (He et al., 2007 and Aune et al., 2017), hypertension (Li et al., 2016), type 2 diabetes (FAO/WHO, 2003; Mamluk et al., 2017), different types of cancer (He et al., 2007; Wang et al., 2017; Koushik et al., 2007; Vieira et al., 2017), asthma (Hosseini et al., 2017), obesity (FAO/WHO, 2003; Schwingshackl et al., 2015), cognitive disorders (Jiang et al., 2017), and depression (Głąbska et al., 2020; Liu et al., 2016).

In addition, they provide us with a valuable set of nutrients that our body needs. Due to their low caloric density and their favorable effect on satiety, they help prevent weight gain (Le petit Journal en Couleurs, 2015).

Furthermore, leafy vegetables are important protective foods and highly beneficial for maintaining health and preventing diseases, as they contain valuable food components that can be used to build and repair the body (Falade et al., 2003).

They are valuable sources of nutrients, particularly in rural areas, where they contribute substantially to the production of proteins, minerals, vitamins, fibers, and other nutrients, whose intake is generally insufficient in daily diets (Gupta and Prakash, 2011; Sikora and Bodziarczyk, 2012). Leafy vegetables are excellent sources of minerals such as iron, magnesium, phosphorus, zinc, calcium, and potassium, as well as vitamins A, B, C, E, and K. In addition, they contain phytonutrients such as beta-carotene, lutein, zeaxanthin, and omega-3 fatty acids, which protect cells from damage and aging-related problems (Li Thomas, 2006; Sreenivasa, 2017; Mawunu et al., 2020a; Monizi et al., 2021).

They are rich in compounds with antidiabetic (Keshari et al., 2005), antihistamine (Yamamura et al., 1998), and anticancer (Rajeshkumar et al., 2002) properties. Enriched with folic acid, leafy vegetables fight anemia. The antioxidants present in leafy vegetables protect against various diseases by eliminating free radicals in our body (Moller et al., 2000). Due to their nutritional and therapeutic benefits, leafy vegetables can be considered as future phytomedicines and superfoods (Noor and Satapathy, 2020). Leafy vegetables promote the growth of beneficial intestinal bacteria (microbiotas), thus forming a healthy gut microbiome.

Previous studies show that sulfoquinose, a sulfonated monosaccharide found in many green vegetables, is a selective but crucial substrate for a small number of widely distributed bacteria in the human gut. This particular type of sugar, which is used as an energy source by beneficial gut bacteria, increases their predominance and prevents harmful bacteria from multiplying in the stomach (Speciale et al., 2016; Hason et al., 2021). Furthermore, as a good source of magnesium, leafy vegetables can help relieve constipation by increasing muscle contractions in our gastrointestinal tract. In addition, they facilitate intestinal transit by increasing the water content in the intestines. They are low in calories and fat, while being rich in dietary fibers and antioxidants. Also, green leafy vegetables strengthen our intestinal health, thus protecting us against gastrointestinal disorders (Mohammed and Sharif, 2011; Sikora and Bodziarczyk, 2012).

Vitamins contribute to the maintenance of healthy vision, immune function, and bone health; cellular integrity helps regulate calcium and phosphorus. Fruits are rich in vitamins C, A, and E. Minerals can reduce the risk of high blood pressure and stroke. For example, copper is necessary for the production of red blood cells (Egbuna and Dable-Tupas, 2020).

In addition to their unsuspected nutritional and medicinal values, fruits and leafy vegetables constitute an important socioeconomic issue because they are part of a profitable and flourishing economic activity, but they are also a source of income and an employment opportunity, especially for farmers, gatherers, transporters, and sellers around the world, both in rural and urban areas. Furthermore, the global trade of fruits and vegetables (75 million tons/year) is in full expansion; it is worth more than 55 million dollars and represents more than 15% of global food trade (Daviron, 1996). According to Keopaseuth et al. (2008), the global trade of fruits and vegetables represents about 50 billion euros per year.

The trade of fruits and leafy vegetables is important, especially for developing countries that seek to diversify their economies in order to improve the fight against poverty, unemployment, and food insecurity. The marketing of fruits and leafy vegetables constitutes one of the rapidly expanding economic activities in sub-Saharan Africa, specifically in the city of Soyo, in northern Angola.

Nowadays, the trade of food products is an activity that contributes to the increase of family income and to the improvement of living conditions and the socioeconomic well-being of farmers, harvesters, transporters, and sellers. Furthermore, the diversity of food products traded in the municipality of Uíge is enormous, including vegetables, fruits, fish, caterpillars, game, and mushrooms (Mawunu et al., 2020b). The sale of food products takes place in urban, peri-urban, and rural markets. Moreover, it is mainly women who engage in this activity more than men (Monizi et al., 2018; Monizi et al., 2019; Mawunu et al., 2020b; Mawunu et al., 2021; Mawunu et al., 2022a).

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Despite the socioeconomic importance of the trade of fruits and leafy vegetables in the city of Soyo, there are no inventory-based and systematic studies on this subtopic in the literature. Furthermore, data on the marketing of food products, namely the trade of fruits and leafy vegetables, are scattered (fragmented) or even nonexistent. On the other hand, the almost complete lack of numerical and reliable data on the market for fruits and leafy vegetables in this part of the country motivated the carrying out of this study. Consequently, the present study aims to inventory, identify, understand the market value, document, and create a database on the fruits and leafy vegetables sold in the markets of the city of Soyo.

MATERIALS AND METHODS

Location of the study area

Soyo, also spelled Soio, is a city and municipality in Angola's Zaire Province, located in the north of the country, near the border with the Democratic Republic of the Congo.

Characterization of the study area

Administrative Division and population

Soyo is located in the north of Angola. According to the 2018 population projections, prepared by the National Institute of Statistics, it has a population of 258,599 inhabitants and covers a territorial area of 5,573 km². It is the only Angolan municipality that is more populous than the capital municipality of its province, surpassing Mbanza Congo (INE, 2014).

The headquarters is an industrial and port city, known for the important port of Soyo, and for the oil terminals of the Kwanda estuary. During the colonial period, the locality was known as Santo António do Zaire. The municipality of Soyo is administratively divided into two communes, with the headquarters corresponding to the city of Soyo itself, and there is also the commune of Pedra de Feitiço (AMS, 2017).

METHODOLOGY

For the present research, a semi-structured questionnaire and direct observation were used, as well as bibliographic research. The use of more than one market was an appropriate strategy to verify the accuracy of the information received from different informants. In our investigations, the following information was required: the vernacular names of fruits and leafy vegetables found in the market, the modes of sale, the places of sale, among other aspects collected. The method adopted for data collection was the socioeconomic survey applied by Monizi et al. (2019), Monizi et al. (2018a), Monizi et al. (2018b), and Mawunu et al. (2020). It consisted, first, of developing a questionnaire to better understand the trade of fruits and leafy vegetables in the study area.

Collection and Botanical Identification of Plants

For data collection, a non-probabilistic survey was conducted with sellers of fruits and leafy vegetables in the markets of the city of Soyo. The establishment of a reference herbarium is a fundamental basis for any floristic inventory study. After observing and photographing samples of fruits and leafy vegetables during fieldwork, some well-known plants were identified directly on site. The botanical identification of the unidentified samples was carried out by the faculty of the Department of Agronomic Engineering at the Nimi Ya Lukeni Higher University Institute – Soyo and the Higher Polytechnic Institute of Bengo. After the survey, the data were processed with the aid of Excel 2016 software. The data were described in charts and tables.

RESULTS AND DISCUSSION

Sociodemographic Profile of Respondents

The table below shows the sociodemographic profile of the respondents, regarding gender, age group, educational level, and main activity.

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The results obtained in Table 1 show that the majority of fruits and leafy vegetables are sold by female individuals with 62.96% and 37.04% sold by male individuals. Similar results were found by Mawunu et al. (2021) in a study on the sale of *Gnetum africanum* in the City of Uíge. Furthermore, Mawunu et al. (2023) studied the sale of fruits and leafy vegetables in the municipality of Uíge. The sale of fruits and leafy vegetables is carried out by individuals from a diverse age range, with a predominance of individuals aged between 31 and 45 years at 50.62%, followed by those aged ≥ 30 years at 32.10%, and lastly, individuals ≤ 46 years at 17.28%. Regarding educational level, the majority of respondents (55.56%) had secondary education, 24.69% had primary education, and 19.75% were literate. The sellers' main activity is trade at 66.67%, agriculture at 20.99%, and 12.35% are students.

Variables	Parameters	Fa	%
Gender	Female	51	62,96
	Male	30	37,04
Age group	≥ 30 years	26	32,10
	31 to 45 years	41	50,62
	≤ 46 years	14	17,28
School level	Literacy	16	19,75
	Primary	20	24,69
	Secondary	45	55,56
Main activity	Agriculture	17	20,99
	Commerce	54	66,67
	Student	10	12,35

Table 2: List of fruits and leafy vegetables sold in the markets of the City of Soyo

Vernacular names	**Scientific name**	**F. B**	**C. P**	**T. M**	**O. U**	**M. C**	**M. V**
Ananás (Port.)	*Ananas comusus*	Bromeliaceae	Exotic	Herbaceous	Fruits	Raw	Unit
Abacate (Port.)	*Persea americana*	Lauraceae	Exotic	Tree	Fruits, Leaf	Raw	Unit
Manga (Port.)	*Mangifera indica*	Anacardiaceae	Exotic	Tree	Fruits	Raw	Unit
Melancia (Port.)	*Citrullus lanatus*	Cucurbitaceae	Exotic	Creeping	Fruits	Raw	Unit
Tomate (Port.)	*Solanum lycopersicum*	Solanaceae	Exotic	Liana	Fruits	Sauce, Salad	Mount
Melão (Port.)	*Cucunis melo*	Cucurbitaceae	Exotic	Creeping	Fruits	Raw	Unit

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Espinafre (Port.)	*Bassela alba*	Basselaceae	Exotic	Liana	Leaf	Boiled	Beam
Gimboa (Port.)	*Amaranthus hibridus*	Amaranthaceae	Exotic	Herbaceous	Leaf	Boiled	Beam
Mamão (Port.)	*Carica papaya*	Caricaceae	Exotic	Tree	Fruits, Leaf	Raw	Unit
Abóbora (Port.)	*Cucurbita moshata*	Cucurbitaceae	Exotic	Creeping	Fruits, Leaf	Heated	Unit
Couve trunhuda (Port.)	*Brassica oleracea*	Brassicaceae	Exotic	Herbaceous	Leaf	Boiled	Beam
Alface (Port.)	*Lactuca sativa*	Asteraceae	Exotic	Herbaceous	Leaf	Salad	Unit
Repolho (Port.)	*Brassica oleracea*	Brassicaceae	Exotic	Herbaceous	Leaf	Salad	Unit
Couve chinesa	*Brassica oleracea*	Brassicaceae	Exotic	Herbaceous	Leaf	Salad	Beam
Pimento (Port.)	*Capsicum annum*	Solanaceae	Exotic	Herbaceous	Fruits	Seasoning	Mount
Quiabo (Port.)	*Albemoshus esculentus*	Malvaceae	Exotic	Herbaceous	Fruits	Sauce	Kilo
Pepino (Port.)	*Cucumis sativus*	Cucurbitaceae	Exotic	Herbaceous	Friuts	Salad	Unit
Berinjela (Port.)	*Solanum melongema*	Solanaceae	Exotic	Herbaceous	Fruits	Sauce	Unit
Rama de batata (Port.)	*Ipomoea batatas L.*	Convulvulaceae	Exotic	Herbaceous	Leaf	Boiled	Beam
Salsa (Port.)	*Petroselinum crispum*	Apiaceae	Exotic	Herbaceous	Leaf	Seasoning	Beam, Unit
Coco (Port.)	*Cocos nocifera*	Arecaceae	Exotic	Tree	Fruits	Raw	Unit
Sapi-Sapi (Port.)	*Annona muricata L.*	Annonaceae	Exotic	Tree	Fruits	Raw	Unit
Laranja (Port.)	*Citrus reticulata*	Rutaceae	Exotic	Tree	Fruits	Raw	Kilo
Fumbua (Kikongo)	*Gnetum africanum*	Gnetaceae	Exotic	Liana	Leaf	Sauce	Mount, beam
Ngai ngai (Lin.)	*Hibiscus sabdarifa*	Malvaceae	Exotic	Herbaceous	Leaf	Sauce	beam
Gindungo (Port.)	*Capsicum frutescens*	Solanaceae	Exotic	Herbaceous	Fruits	Seasoning	Mount
Limão (Port.)	*Citrus limon swing.*	Rutaceae	Exotic	Tree	Fruits	Juice, Seasoning	Mount
Kizaca (Port.)	*Manihot esculenta*	Euphorbiaceae	Exotic	Herbaceous	Leaf	Cooked	Beam

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Maracuja (Port.)	*Passiflora quadrangularis*	Passifloraceae	Exotic	Liana	Fruits	Raw	Mount
Kiwi (Port.)	*Actinidia deliciosa*	Actinidiaceae	Exotic	Liana	Fruits	Raw	Kilo
Fruta pinha (Port.)	*Annona squamosa L.*	Annonaceae	Exotic	Tree	Fruits	Raw	Unit
Dendém (Port.)	*Eleais guineensis*	Arecaceae	Exotic	Tree	Fruits	Sauce	Kilo
Makazu (Kik.)	*Cola acuminata*	Malvaceae	Native	Tree	Fruits	Natural	Unit
Banana pão (Port.)	*Musa paradisiaca*	Musaceae	Exotic	Herbaceous	Fruits, Leaf	Raw, Roasted	Mount
Gissangui (Kik.)	*Raphia sp*	Arecaceae	Native	Tree	Fruits	Roasted, boiled	Monte
Maça	*Malus domestica*	Rosaceae	Exotic	Shrub	Fruits	Raw	Unit
Goiabeira	*Psidium guajava*	Myrtaceae	Exotic	Shrub	Fruits	Raw	Mount
Castanha	*Anacardium ocidentale*	Anacardiaceae	Exotic	Shrub	Fruits	boiled, Roasted	Kilo
Múcua	*Adansonia digitata*	Malvaceae	Native	Tree	Fruits	Juice	Bucket, Pile

Legend: Kik**:** Kikongo; Port.: Português; FB: Botanical families; CP: Plant Category; OU: Used organs; TM: Morphological type; MC: Modes of consumption; MV: Sales modes

Floristic diversity of the fruits and leafy vegetables inventoried

Botanical families of the plants inventoried

Figure 1 shows the inventoried botanical families

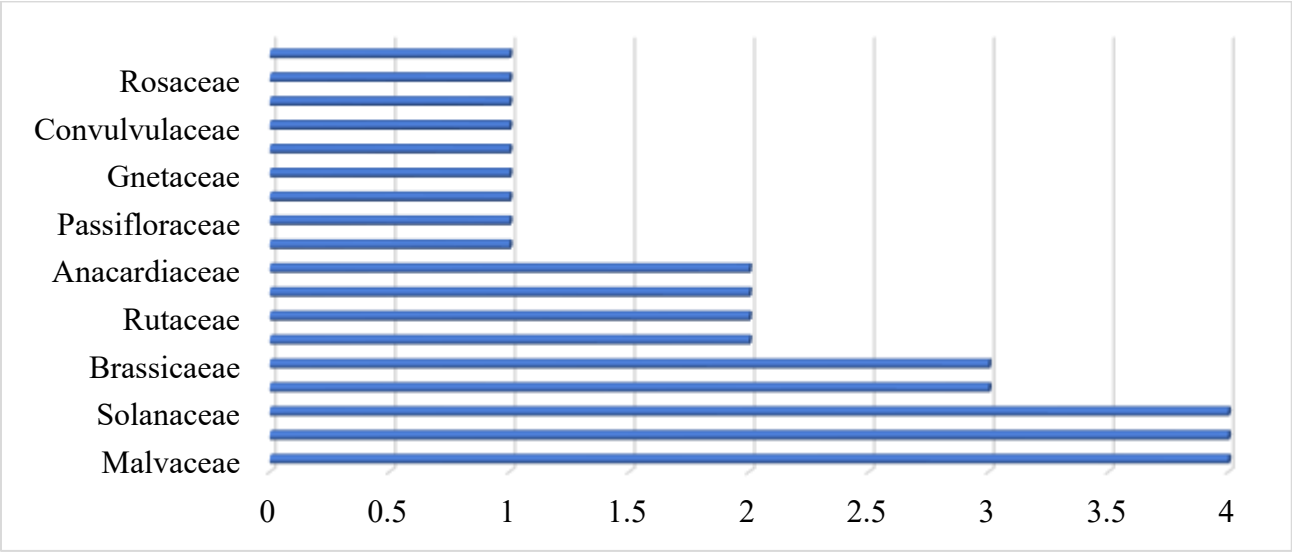

Figure 1 shows the floristic diversity of fruits and leafy vegetables sold in the markets of the city of Soyo. In total, 18 botanical families were identified, with a predominance of Malvaceae with 4 species (*Cola acuminata*, *Adansonia digitata*, *Hibiscus sabdariffa*, and *Abelmoschus esculentus*), Cucurbitaceae (*Cucurbita moschata*, *Cucumis melo*, *Cucumis sativus*, and *Citrullus lanatus*), Solanaceae (*Solanum lycopersicum*, *Solanum melongena*, *Capsicum frutescens*, and *Capsicum annuum*). Next, the families with 3 species were Arecaceae

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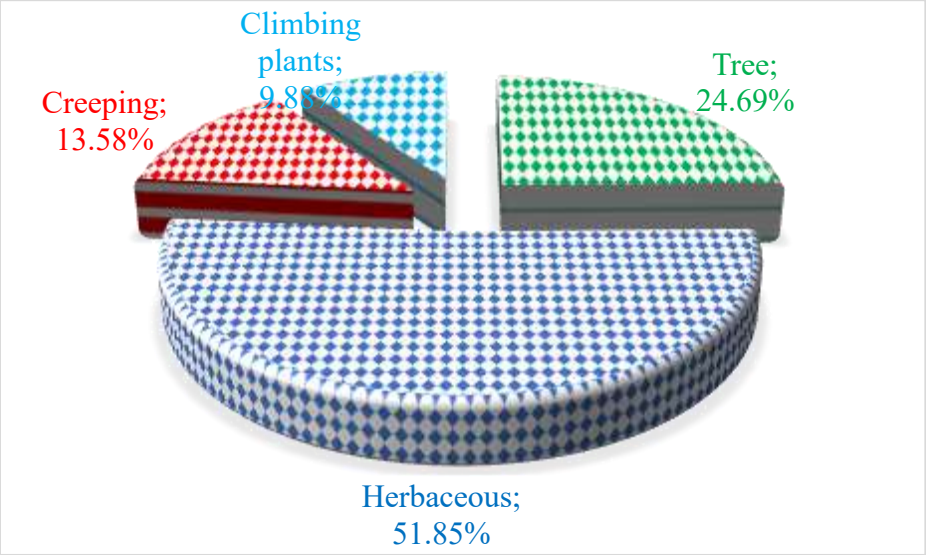
(*Cocos nocifera*, *Elaeis guineensis*, *Raphia sp*) and Brassicaceae (*Brassica rapa* subsp. *Chinensis*, *Brassica oleracea*, and *Brassica oleracea* L. var. truchuda). The families with 2 species, Musaceae (*Musa sapientum*, *Musa paradisiaca*), Rutaceae (*Citrus limon*, *Citrus reticulata*), Annonaceae (*Annona muricata*, *Annona squamosa*), Anacardiaceae (*Mangifera indica*, *Anacardium occidentale*) and the remaining families with 1 species each, Bromeliaceae (*Basella alba*), Passifloraceae (*Passiflora quadrangularis*), Lauraceae (*Persea americana*), Gnetaceae (*Gnetum africanum*), Euphorbiaceae (*Manihot esculenta*), Convolvulaceae (*Ipomoea batatas*), Asteraceae (*Lactuca sativa*), Rosaceae (*Malus domestica*) and Myrtaceae (*Psidium guajava*).

Vegetative forms of the inventoried plants

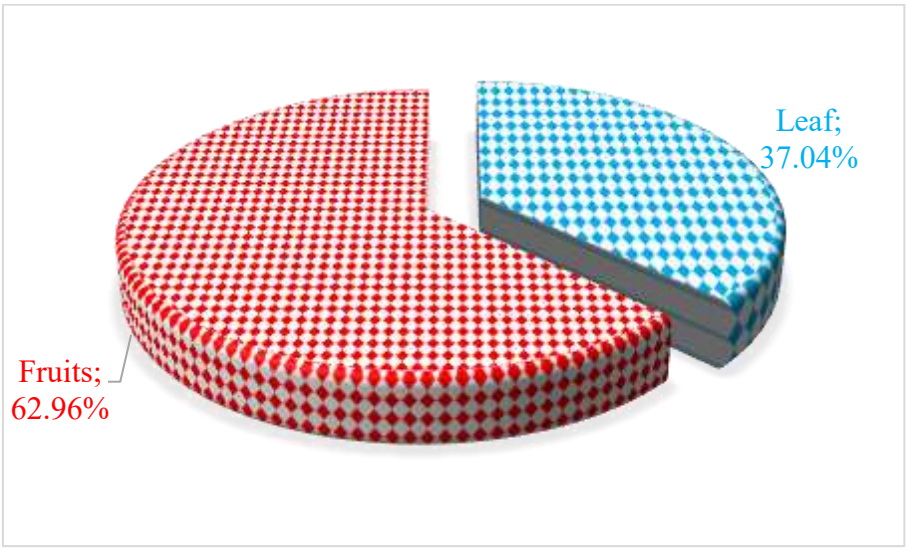
Figure 2 shows the vegetative forms of fruits and leafy vegetables sold in the markets of the city of Soyo.



The results of figure 2 show that the fruits and leafy vegetables sold in the markets of the city of Soyo come from herbaceous plants (51.85%). Next are trees with 24.69%, creeping plants with 13.58%, and climbers 9.88%. These results show that fruits and leafy vegetables come from plants with different vegetative forms.

Edible plant organs marketed

Figure 3 shows the plant organs sold



The results obtained from the survey conducted (Figure 3) on fruits and leafy vegetables sold in the markets of the City of Soyo show that fruits were the most abundant (62.96%) and leaves 37.04%. The results of this research are similar to Mawunu et al. (2023) who worked in the municipality of Uíge, finding fruits as the most sold edible plant organs.

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Modes of sale of the surveyed products

Figure 4 presents the modes of sale of fruits and leafy vegetables sold in the markets of the city of Soyo.

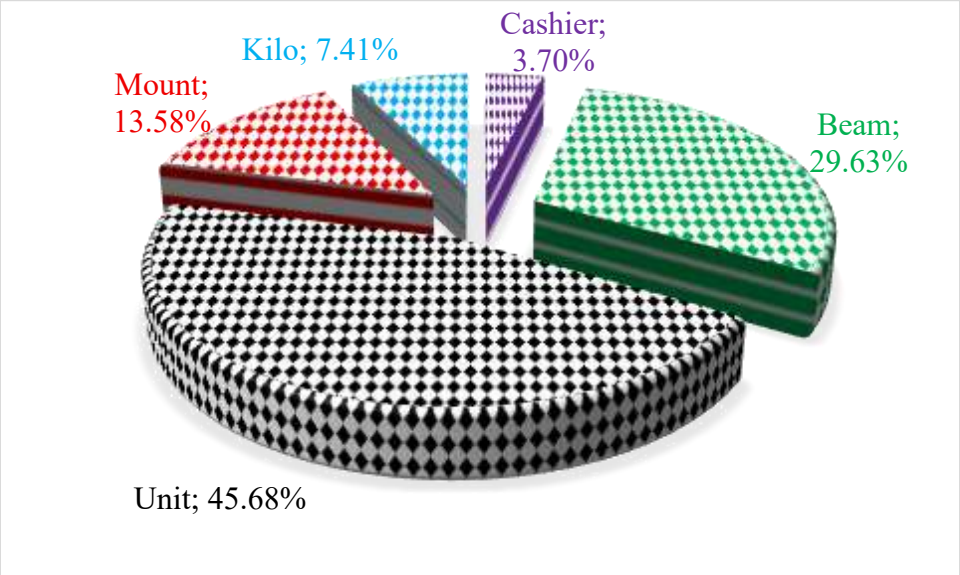
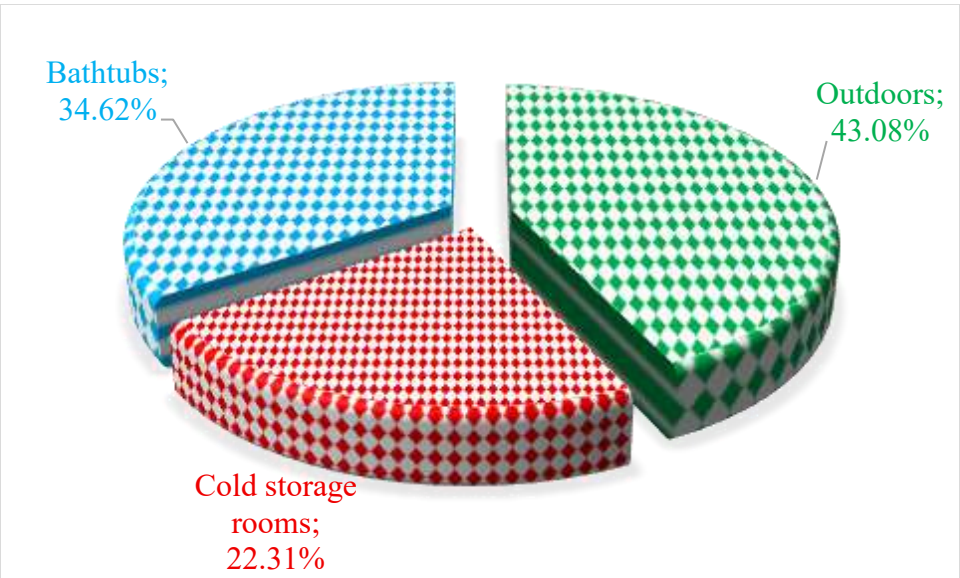


Figure 4 shows the modes of sale of fruits and leafy vegetables in the city of Soyo, with a predominance of unit sales (45.68%), bunch (29.63%), heap (13.58%), kilogram (7.41%), and box (3.70%). This indicator shows that the products are sold using different modes of sale depending on the type of product. According to Mawunu et al. (2020), there are no standardized units of measurement used in the commercialization of edible non-timber forest products in the municipality of Uíge. The same authors state that the local population uses a variety of improvised local units or measuring instruments that vary according to the nature and physical state (solid or liquid) of the food products.

Conservation methods of inventoried fruits and leafy vegetables

Figure 5 shows the different conservation methods of the inventoried products



The leafy fruits and vegetables sold in the markets of the City of Soyo (figure 5) are preserved using various techniques to extend the consumption period of the products. Most (43.08%) of the leafy fruits and vegetables are preserved outdoors. Next are plastic tubs with 34.62% and cold storage rooms with 22.31%. The predominance of outdoor preservation is justified by the fact that the markets do not have storage facilities for the products; on the other hand, this preservation can be one of the means of transmitting some diseases caused by bacteria or viruses, and consuming these foods ends up harming human health. Similar results were found by

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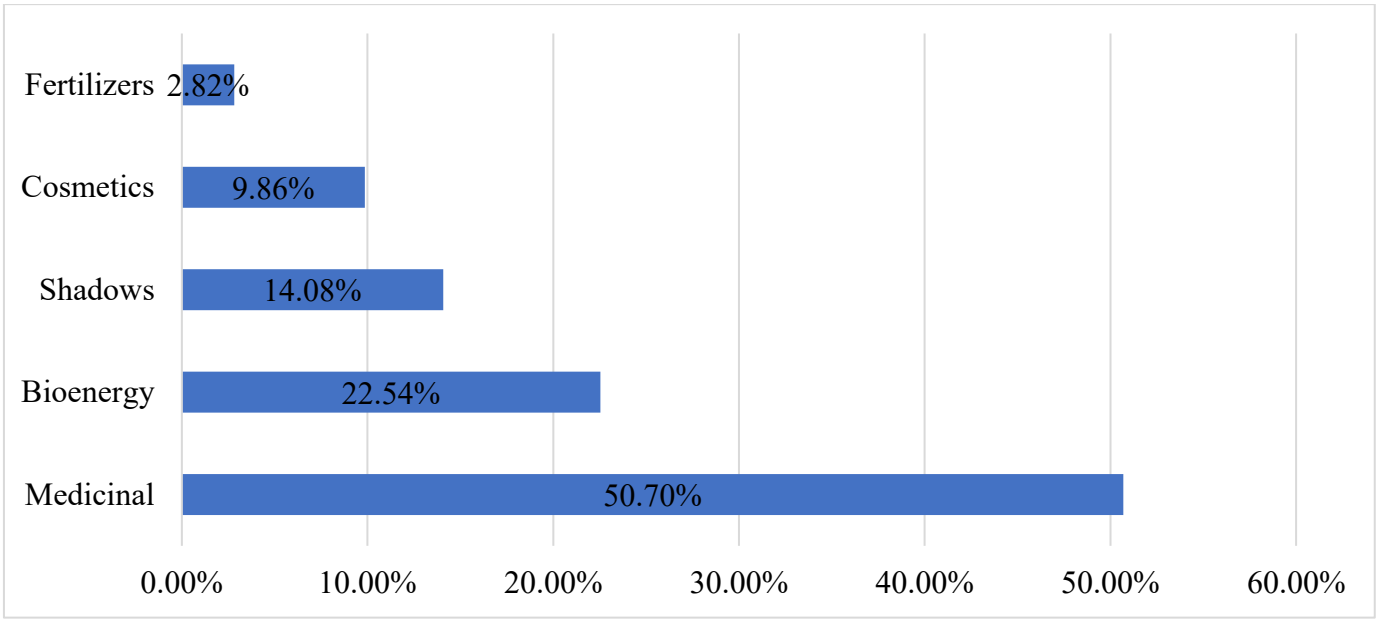
Mawunu et al. (2023) in the municipality of Uíge, and Mukendi et al. (2018) in the Democratic Republic of Congo, showing that most of the inventoried products are preserved outdoors.

Other uses of the inventoried fruits and leafy vegetables

Figure 6 shows the other uses of those inventoried in the study area



Regarding the other uses (figure 6), the results show that the majority (50.70%) of leafy fruits and vegetables are used as medicinal for the treatment of diseases. Next are firewood (22.54%), shade (14.08%), cosmetics (9.86%), and fertilizers (2.82%). These results are similar to those found by Mawunu et al. (2022 e 2023) in the municipality of Uíge, where most of the inventoried products are used for the treatment of diseases, firewood, among other uses. In turn, Garcia et al. (2025) e Mawunu et al. (2024), who worked on edible fruit plants in the city of Uíge, found that the inventoried plants also have various uses, such as medicinal, bioenergy production (firewood), herbal teas, among others, with a predominance of plants used for the treatment of diseases.

CONCLUSION

The present research aimed to document information on the floristic diversity and socioeconomic value of fruits and leafy vegetables sold in the markets of the city of Soyo. The results obtained show that there is a great floristic diversity of fruits and leafy vegetables sold in the region of Angola. The ethnobotanical inventory allowed the identification of a total of 36 species of fruits and leafy vegetables, distributed across 33 genera and 18 botanical families. The most represented families are Malvaceae, Cucurbitaceae, and Solanaceae (4 species), Arecaceae, Brassicaceae (3 species). Fruits are more abundant (62.96%) than leaves (37.04%). Most of the leafy fruits and vegetables (93.83%) documented in this study are cultivated, with only 6.17% being native. It is recommended that scientific research related to this topic be carried out throughout the entire Angolan territory, in order to better document all the different leafy fruits and vegetables produced nationally and to establish economic policies that allow their export, thus contributing to the country's economic diversification. Finally, it is also recommended to carry out economic studies to assess the quantities produced and harvested annually.

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