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Review Article

Prospects for fighting food insecurity in sub-Saharan Africa using underutilised crops: the case for fluted pumpkin

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Highlights/Key Messages

- Food insecurity is still prevalent in sub-Saharan Africa
- Fluted pumpkin grows well in the region, and its seeds are a rich source of macro- and micro-nutrients
- Research into agronomic and cultural practices can unlock the potential of fluted pumpkin seeds in contributing to food security

Background
Sub-Saharan Africa is blessed with tropical conditions that support agriculture and food production, yet food insecurity is prevalent in the region. Tackling malnutrition (which results partly from food insecurity) requires improvements in agricultural output and the nutritional quality of the foods consumed. Certain underutilised species of food crops are not just environmentally resilient but also offer opportunities for bridging the nutrient deficit in sub-Saharan Africa. Sadly, the dominance of global food production by the major cereals has diverted attention from indigenous crop species.

Objective
This paper reviews the literature on fluted pumpkin, *Telfairia occidetalis* Hook f., an underutilised species whose seeds are rich sources of nutrients.

Methods
The English language literature available online was mined for published articles on fluted pumpkin, using appropriate keywords. Boolean operators were used to delineate the search output. Identified papers were cross-checked for relevance.

Results
The literature included shows that fluted pumpkin grows well in the tropics, is resilient to climate variability, and requires minimal input after planting. The protein and carbohydrate contents of fluted pumpkin seeds compare favourably with those of soybean, but it has a higher fat content. The seeds are rich in vitamins and minerals. They are therefore a rich source of macro- and micronutrients.

Conclusion
Given the nutritional profile of fluted pumpkin seeds, investing in research to increase their production and utilisation, and adopting favourable policies, will contribute significantly to ensuring food security in sub-Saharan Africa.

Keywords: **fluted pumpkin, food insecurity, malnutrition, sub-Saharan Africa, underutilised crops**

Introduction

The rapid population growth in sub-Saharan Africa, coupled with climate change and low investments in modern agriculture, has resulted in a failure to significantly reduce poverty, wars, and clashes between herders and crop farmers, all of which perpetuate cycles of food insecurity. FAO defines food security as "a condition in which all people, at all times, have physical, social, and economic access to sufficient food to meet their dietary needs for a healthy and active life" (FAO, 2002).

FAO reported that between 713 and 757 million people faced hunger in 2023, and 2.33 billion people experienced moderate to severe food insecurity, with Africa and Asia bearing the brunt of the problem" (FAO, 2024). Certain groups are particularly vulnerable to food insecurity, including low-income pregnant and lactating women, victims of conflict, the ill, migrant workers, low-income urban dwellers, the elderly, and children under five (FAO, 2022). The affordability of nutritious diets is a key driver of food insecurity, with the average cost of a healthy diet in 2021 at $3.57 per person per day, far exceeding the daily income poverty threshold of $2.15. This disparity renders a balanced diet challenging for nearly 78% of Africa's population, resulting in widespread malnutrition and severe micronutrient deficiencies, particularly among children and women (FAO, 2022; ADB, 2023).

WFP defines malnutrition as "a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate bodily processes such as growth, pregnancy, lactation, physical work, and resisting and recovering from disease" (WFP, 2005). WHO reports that globally in 2022, 390 million adults were underweight, and 231 million children under five were undernourished (WHO, 2024). This included an estimated 282 million undernourished people across Africa (FAO 2022; World Hunger, 2022). Sadly, nearly 45% of the deaths of children under 5 years of age are due to malnutrition (WHO, 2024).

Over the years, government policies in sub-Saharan Africa have not adequately expanded agricultural productivity nor reduced poverty. Indeed, there has often been a reduction in spending on agriculture and healthcare (Sanchez and Swaminathan, 2005; Sundberg, 2009). This has led to adverse effects on nutrition, which are felt most by poorer households, especially in rural regions (Pongou et al., 2006).

A change in focus, including the exploitation of underutilised species, may prove effective in increasing food security in sub-Saharan Africa. Underutilised species, often referred to as orphan crops, are plants traditionally cultivated in specific regions but remain largely unexploited or even completely ignored in modern agricultural systems. These crops are not only environmentally resilient but also offer opportunities to address nutrient deficits in sub-Saharan Africa. However, limited research, inadequate policy support, and low consumer awareness have hindered their mainstream adoption. In view of this, this paper examines the literature and draws attention to the potential of one important underutilised crop, fluted pumpkin *(Telfairia occidentalis* Hook f.) seeds, in contributing to food security.

Methods

A keyword search of the English language published scientific literature published between 1975 and 2025, using Pubmed/Medline, Scopus, and Google Scholar, was independently conducted by the two authors. The PRISMA guidelines were adhered to and medical subject heading (MeSH) terms such as sub-Saharan Africa, 'fluted pumpkin,' *Telfairia occidentalis*, and 'under-utilised species' were searched for, while Boolean operators such as 'AND' and 'OR' were used to streamline the output. The initial output was collated and vetted for content validity by the corresponding author. The reference lists of the selected papers were cross-checked, and useful additional references were identified and obtained. Papers published in journals deemed to be predatory were excluded. Relevant data were mined and extracted from the included papers.

Ethical Information

This study used secondary data. No ethical approval was thus needed or sought.

Results and Discussion

Prospects of Underutilised Species in Fighting Food Insecurity

Underutilised species, also referred to as orphan crops, neglected crops, or minor species, are plants traditionally cultivated in specific regions but remain largely unexploited in modern agricultural systems (Mbosso et al., 2020; Tan et al., 2020). Sub-Saharan Africa is home to numerous underutilised plant species, including indigenous fruits, leafy vegetables, legumes, and grains, which are rich in macro- and micro-nutrients. These crops are often overshadowed by staple crops such as maize, rice, and wheat in terms of research, policy support, and market development (Taylor et al., 2006; Bvenura and Afolayan, 2015; Chivenge et al., 2015; Akinola et al., 2020). Despite their marginalization, underutilised species hold immense potential to address food insecurity and malnutrition.

A defining characteristic of underutilised species is their adaptability to harsh environmental conditions, including drought, low soil fertility, and erratic rainfall patterns. This makes them highly suitable for regions affected by climate change, where conventional crops may struggle to thrive (Mayes et al., 2012; Pichop et al., 2016). Examples of such crops include the African eggplant, Bambara groundnut, and amaranth, all of which have demonstrated resilience and nutritional benefits (Abukutsa-Onyango, 2010; Mabhaudhi et al., 2017; Tan et al., 2020). The ability of underutilised species to grow in marginal environments while requiring minimal external inputs aligns with sustainable agricultural practices, particularly for smallholder farmers with limited access to fertilizers, irrigation, and pesticides (FAO, 2014).
Underutilised species are often rich in essential nutrients, including proteins, vitamins, minerals, and antioxidants. They can play a pivotal role in diversifying diets and addressing micronutrient deficiencies, which remain a persistent challenge in sub-Saharan Africa (Abberton et al., 2022). For instance, crops like Bambara groundnut are high

in protein and energy, while leafy vegetables such as amaranth are rich in iron, calcium, and vitamin A (Chivenge et al., 2015; Maseko et al., 2018). Incorporating these crops into local food systems not only enhances nutritional outcomes but also helps preserve indigenous knowledge and agricultural biodiversity.

Additionally, underutilised species have significant economic potential. By promoting these crops in local and international markets, smallholder farmers can diversify their income sources and reduce economic risks associated with reliance on a few staple crops (Maseko et al., 2018). The development of value chains for underutilised species, including processing, storage, and marketing, can create new opportunities for rural communities while ensuring year-round access to nutritious food (FAO, 2014; Chibarabada et al., 2017; Walker et al., 2021). A major difference between underutilised and highly utilised crops lies in their level of global recognition, commercial utilization, research support, and integration into mainstream agricultural systems (Table 1).

Table 1. Major differences highly utilised and underutilised crop species

Criteria	Underutilised species	Highly utilised species
Research Attention	Limited research and development focus, often restricted to specific regions.	High levels of research, including breeding programs, agronomic practices, and biotechnological advancements.
Commercial Utilization	Low commercial value chains and market availability.	Extensive market presence, with established global value chains.
Nutritional Value	Often rich in unique nutrients (e.g., phytochemicals, antioxidants) but under-recognized.	Recognized for their nutritional value, even when limited, with broad consumer awareness and industrial applications.
Environmental Adaptability	Highly adaptable to harsh conditions such as drought and poor soils.	Low to high adaptability, with specific climatic or soil preferences for optimum growth.
Consumer Perception	Often culturally stigmatized or regarded as "food for the poor," leading to limited adoption, especially in urban areas.	Widely accepted as staple crops globally, perceived as essential for food security and industrial uses, such as production of ultra-processed foods.
Policy and Support	Minimal policy intervention and inclusion in agricultural development and extension programs.	Significant support through global and national agricultural policies, farmer training/extension, subsidies, and funding.

Despite their benefits, underutilised crop species face numerous challenges that hinder their mainstream adoption. These include limited research on agronomy and breeding, inadequate policy support, and low consumer awareness of their nutritional value and even their taste (Bvenura and Sivakumar, 2017). Many underutilised crops have challenges related to storage, stability, and processing. For instance, fluted pumpkin seeds start germinating shortly after harvest, limiting their storage potential (Nkang et al., 2000).

Bambara groundnuts require labour-intensive processing, which discourages large-scale production (Ajayi et al., 2006; Mbosso et al., 2020). Addressing these challenges requires concerted efforts from governments, researchers, policymakers, and development agencies. This includes efforts to promote their nutritional and economic benefits, invest in research and development, improve processing and storage technologies, and build consumer awareness (Ifeanyi-Obi et al., 2013; Osuji et al., 2022). These actions align with Sustainable Development Goal (SDG) 2, which emphasizes ending hunger and achieving food security through sustainable agricultural practices (FAO, 2018).

Thus, to unlock the potential of underutilised crops, concerted efforts are needed to integrate them into mainstream food systems. Fluted pumpkin (*Telfairia occidentalis* Hook f.), a high-protein oilseed, is an example of an underutilised crop that holds promise in combating food and nutrition security, especially in sub-Saharan Africa, where animal protein is often not affordable, animal-rearing is difficult or not sustainable, and energy needs are sometimes unmet.

Fluted Pumpkin (*Telfairia occidentalis* Hook f.)

Fluted pumpkin is a vinous perennial leafy vegetable (genus *Telfairia* Hooker, subfamily Cucurbitoideae, family Cucurbitaceae) native to West Africa. It is an herbaceous dioecious plant that thrives in tropical climates with ample rainfall, making it a staple in the agricultural systems of sub-Saharan Africa (Epenhuijson, 1974; Oyolu, 1978; Okoli and Mbeogu, 1983; Akoroda, 1990). It is known by various local names, such as ugu among the Igbo, ikongubong among the Efik, both in Nigeria, and kwon meko among the Akan in Ghana (Akoroda, 1990; Odiaka et al., 2008).

The fruit weighs between 3 and 5 kg when fully mature (Figure 1). The mature fruit is ribbed, 23 ± 2 cm at mid-length, weighs 3–6 kg, and has a yellow fibrous flesh in which are embedded numerous seeds (Oyolu, 1978; Okoli and Mbeogu, 1983). About 30–70 seeds are produced per fruit, depending on the size of the mature fruit (Epenhuijson, 1974; Akoroda, 1990).

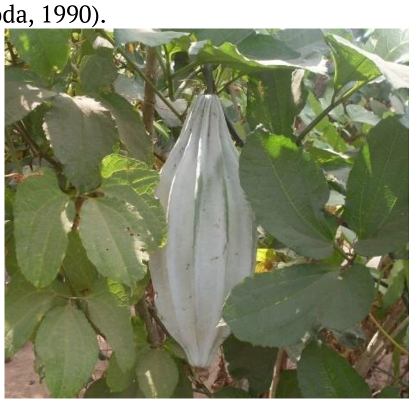

Figure 1. Fluted pumpkin fruit and leaves

The plant is naturally resistant to many common pests and diseases, requiring minimal use of chemical inputs such as pesticides, which are often inaccessible to smallholder farmers due to high costs (Ebert et al., 2014; Ashagidigbi et al., 2018; Osuji et al., 2022). The plant's deep taproot system enables it to access water from deeper soil layers during dry periods, making it a viable option for regions prone to seasonal droughts or erratic rainfall patterns (Mbosso et al., 2020). It is primarily propagated by seeds, which germinate readily under favourable conditions. Once established, the crop requires minimal maintenance. This, along with its natural resilience, enhances its suitability for resource-poor farming systems (Odiaka et al., 2008; Akoroda, 2008; Abukutsa-Onyango, 2010; Prakash-Singh et al., 2018).

Fluted pumpkin is a high-protein oilseed crop. Though it is the most widely cultivated leafy vegetable crop in West Africa, it also produces edible oil-bearing seeds. It is the seeds that are truly underutilised. The seeds are notable for their large size, weighing between 0.15 g and 12.50 g—approximately 80 times the weight of melon seeds (Odiaka et al., 2008). The seeds have high protein and fat contents and are good sources of minerals such as iron, phosphorus, magnesium, and calcium (Longe et al., 1983; Asiegbu, 1987; Egumgbe et al., 2022). The nutritional quality (amino acid composition, protein digestibility, and protein efficiency ratio) of fluted pumpkin seed is similar to that of soybean (Longe et al., 1983; Achinewhu, 1986). The seeds are also rich in essential vitamins (A, C, and E) (Ebert, 2014).

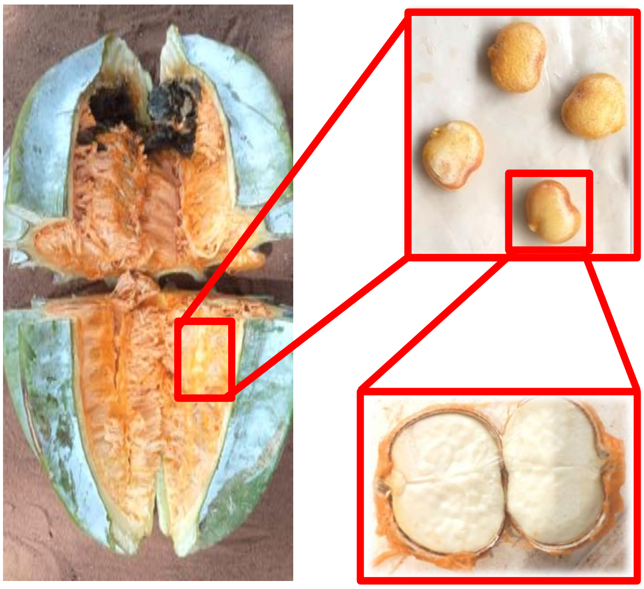

Figure 2. Fluted pumpkin fruit and seeds

Despite its good nutritional composition and its cultivation for its seeds since ancient times, fluted pumpkin seeds have not yet become a popular part of the local diet of Nigerians and sub-Saharan Africans. Hooker, in describing the plant in the nineteenth century, noted that "it was cultivated for its seeds, which the negroes boil and eat" (Hooker, 1871). The lack of widespread use of the seeds may be due to difficulty obtaining a steady supply, resulting from biological disequilibrium caused by excessive harvesting of edible foliage from plants that could potentially bear fruit (Akoroda, 1990). The seeds are recalcitrant and viviparous and therefore cannot tolerate drying and begin germinating within the pod shortly after maturity. These characteristics limit the storage potential of the seeds, as they decompose or germinate inside the pods within 3 to–4 months post-harvest (Nkang et al., 2000; Ajayi et al., 2006; Sakpere et al., 2020). Consequently, farmers often experience significant losses, as planting is typically restricted to the rainy season and many seeds begin to germinate before the rains commence.

Apart from being fermented and used as a flavouring ingredient (ogiri) or as a protein supplement in some local foods (Achinewhu, 1986; Akwukwaegbu, et al., 2020), there is limited food application of fluted pumpkin seed compared with other major oilseeds. Yet protein concentrates, edible oils, and confectionery from fluted pumpkin seeds are possible methods of introducing it into the human diet.

Nutritional Composition and Properties of Fluted Pumpkin

Fluted pumpkin, traditionally regarded as a backyard crop, can be transformed into a commercially viable agricultural product due to its exceptional nutritional properties and adaptability (Nwauwa and Omonona, 2010). The leaves, which are used as culinary vegetables, are highly nutritious, containing abundant minerals such as iron, magnesium, potassium, sodium, and phosphorus. They are rich in antioxidants, phytochemicals (e.g., phenols), and vitamins such as ascorbic acid, riboflavin, nicotinamide, and thiamine (Odiaka et al., 2008; Kayode and Kayode, 2011). With a protein content of approximately 22%, the leaves outperform many other commonly consumed leafy vegetables in tropical regions (Eseyin and Rathore, 2014). Decoctions of the leaves are thought to have medicinal properties and are utilised in folkloric medicine for treating anaemia, and some other conditions (Akoroda, 2008; Ugwu et al., 2010; Akpasi et al., 2023).

The seeds of fluted pumpkin are large and non-endospermic, and are consumed after various forms of processing, including roasting, boiling, or fermentation to make traditional condiments such as "ogiri" (Nwokolo and Sim, 1987; Giami and Barber, 2004). The seeds have a robust amino acid profile, including nine essential amino acids (histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine), as well as non-essential amino acids (Kayode and Kayode, 2011; Eseyin and Rathore, 2014; Anyasor et al., 2010; Bello et al., 2011; Monica, 2024). Fluted pumpkin seeds also contain a rich profile of essential fatty acids and micronutrients such as iron, magnesium, and calcium (Odiaka et al., 2008). The seeds' high protein content, coupled with their essential amino acids, positions them as an excellent alternative or supplement to conventional protein sources such as meat, eggs, and milk, which are often unaffordable for many households (Miteu and Ezeh, 2022). The seeds also contain phytochemicals such as cyanogenic glycosides (Chuku and Chinaka, 2021), saponins, flavonoids, and alkaloids (Egumgbe et al., 2022).

A comparison of the proximate composition of fluted pumpkin and soybean (Glycine max), which is widely cultivated and researched, and extensively used as plant protein, shows that the seeds compare favourably (Table 2).

Table 2 Proximate composition of fluted pumpkin seeds and soybeans

Nutrient	Fluted Pumpkin Seeds						Soybean Seeds
	Asiegbu (1987)	Fagbemi (2007)	Kuku *et al.* (2014)	Alozie *et al.* (2017)	Echioda *et al.* (2018)	Chuku and Chinaka (2021)	Lisanti and Arwin (2019)
Moisture (%)	5	6	49	3	9	1	8
Crude Protein (%)	30	30	28	10	29	35	38
Crude Fat (%)	47	50	18	36	28	33	15
Ash (%)	3	5	2	5	3	4	5
Crude Fibre (%)	NR	NR	1	4	16	16	15
Carbohydrates (%)	15	11	2	42	15	11	27

NR: Not reported. N/B: The figures presented are rounded off to the nearest whole number. The original sources have both means and indicators of dispersion for three or more measurements per variable. The sums may therefore marginally exceed 100% in some cases.

Table 3. Fatty acid content of fluted pumpkin seeds

FATTY ACIDS (%)	Samuel *et al.* (2018)	Alademeyin and Arawande (2016)	Adejumo and Adekoya (2023)	Fagbemi (2007)	Akinnifesi *et al.*, (2017)
Myristic (C14:0)	0.1	0.1	NR	NR	5.4
Palmitic (C16:0)	17.5	10.8	1.9	16.1	0.6
Palmitoleic (C16:1)	1.2	NR	0.8	NR	1.4
Stearic (C18:0)	0.8	0.2	1.6	14.2	14.5
Oleic (C18:1)	14.1	47.4	NR	40.4	56.5
Linoleic (C18:2)	62.4	26.4	NR	27.5	21.0
Linolenic (C18:3)	NR	0.01	1.6	NR	0.4
Arachidic (C20:0)	NR	1.2	2.2	NR	0.2
Eicosenoic (C20:1)	2.0	NR	0.7	NR	NR
Eicosatrienoic (C20:3)	0.3	NR	1.9	NR	NR
Behenic (C22:0)	NR	0.4	NR	NR	NR
Total saturated fatty acids	19.9	12.8	NR	30.3	NR
Total unsaturated fatty acids	80.1	73.8	NR	67.9	NR

NR stands for not reported. Values are reported to the nearest one decimal place.

The high caloric density, amino acid profile, and mineral composition make the seeds potential raw materials to produce functional food for improving human health outcomes (Afolabi et al., 2018). Furthermore, the seeds' versatility allows them to be incorporated into various food products, including baked goods/snacks and traditional condiments like *ogiri,* as well as soup thickeners, making them accessible across different cultural diets (Ladeji et al., 1995; Fasoyiro et al., 2006). Experimental studies on the nutritional value of the seeds indicate that they supported excellent growth in rats when incorporated into diets at 5-10% levels (Ejike et al., 2010a) and did not result in any toxicities or deleterious alterations in lipid and glucose metabolism in test rats (Ejike et al., 2010b). The seeds of fluted pumpkin are rich in minerals, including potassium, phosphorus, magnesium, and iron (Table 4).

Table 4: Mineral composition of fluted pumpkin seeds

Mineral (mg/100g)	Ladeji *et al.* (1995)	Lopez *et al.* (2002)
Potassium (K)	594.0	632.0
Phosphorus (P)	1020.0	954.0
Magnesium (Mg)	100.0	89.0
Calcium (Ca)	144.0	80.9
Sodium (Na)	9.0	24.8
Iron (Fe)	12.0	9.82
Zinc (Zn)	5.0	7.80
Copper (Cu)	ND	1.38

ND stands for not detected

Beyond nutrition, the seeds of fluted pumpkin have been reported to have applications in traditional medicine. They are useful in (among others) preventing and managing experimental benign prostate hyperplasia in the murine model (Ejike and Ezeanyika, 2011a; Ejike and Ezeanyika, 2011b).

Limitations in the Use of Fluted Pumpkin Seeds

Fluted pumpkin seeds, as noted earlier, are cooked and eaten or used as an ingredient in a variety of local foods (Achinewhu, 1986; Barber et al., 1989; Lopez et al. 2002). Furthermore, the development of value-added products from fluted pumpkin seed has been recommended to expand the utilization of the seed in the tropics (Giami and Bekebain, 1992; Giami and Isichei, 1999). However, the usefulness of fluted pumpkin seeds as a protein source for human food is limited by the presence of so-called anti-nutrients, particularly phytic acid (Giami and Isichei, 1999; Akwaowo et al., 2000), which have been shown to lower the bioavailability of minerals in humans and to inhibit the digestibility of plant proteins (Banigo and Akpapunam, 1987; Chen and Xu 2023). Despite this former conception, modern research has shown that many of these types of substances, including phytic acid, have numerous beneficial health effects (Chen and Xu 2023). Appropriate processing techniques can also reduce or eliminate the anti-nutrients. Germination, for example, is known to lower the anti-nutrient contents of food crops and improve their functional properties (Ohanenye et al., 2020).

Fagbemi (2007) reported that processing altered the gross energy value of fluted pumpkin seeds only slightly (Table 3). Cookies supplemented with concentrates from germinated seeds at 15–25% levels were nutritionally comparable to diets based on casein, but at the expense of acceptability (Giami and Barber, 2004; Giami et al., 2005). The use of the seeds often imparts a brownish-green colouration that negatively affects acceptability. This colour change is likely due to its oil-rich nature, which makes rapid drying difficult.

Table 5. Energy value of processed full fat fluted pumpkin seed flour as reported by Fagbemi (2007)

	Gross energy (KJ/g)	Total Unsaturated Fatty Acid (TUFA) (%)	Total Saturated Fatt Acid (TUFA) (%)
Raw Dried	29.5	68.0	30.3
Boiled	26.6	63.4	32.1
Fermented	30.1	65.5	25.5
Germinated	28.1	57.4	38.5

N/B: The figures presented are rounded off to the nearest one decimal place. The original sources have both means and indicators of dispersion for three or more measurements per variable.

Recommendations for the Future

To fully exploit the potential of underutilised species such as fluted pumpkin seeds, the challenges of limited agronomic and processing research investment, cultural perceptions regarding its consumption, and low market presence need to be addressed (Bvenura and Sivakumar, 2017). There is a need for governments and funding agencies to deliberately fund research focused on improving current agronomic practices to develop new varieties with higher yields, greater nutrient density, and greater pest resistance. Sustainable seed storage technologies, processing, and value chain development and improvement of products derived from seeds also require research and funding. Research is also needed to improve processing technologies (which will reduce anti-nutrients, make desirable nutrients more bioavailable, and prevent colour deterioration) and to develop value-added products such as protein concentrates, nutritional and industrial oils, fortified flours, and ready-to-eat snacks from fluted pumpkin seeds. This will increase acceptability and demand for the seeds and ultimately their market value, both of which will help in reducing poverty, especially among rural dwellers. Furthermore, research into ways of making the seeds culturally acceptable and the education of the population on the nutritional and economic benefits of fluted pumpkin seeds through data-driven campaigns and training programmes will be helpful.

Deliberate government policies can trigger the utilization of the seeds and encourage farmers to grow the plant for its seeds. Currently, farmers grow the plant for its leaves. Fluted pumpkin seeds should be included in national agricultural and nutrition programmes, such as school feeding programmes, to promote their cultivation and consumption. Government policies that promote the use of seeds or products containing them will improve the ecosystem around fluted pumpkin production and marketing.

The integration of fluted pumpkin seeds into broader food security strategies is a sure means of contributing to achieving the Sustainable Development Goals, especially SDG 2, which aims to end hunger and promote sustainable agriculture (FAO, 2018; FAO 2022).

Policy Implications

Promoting fluted pumpkin seeds requires a multifaceted approach involving governments, researchers, and development agencies. Governments in sub-Saharan Africa should prioritize the inclusion of fluted pumpkin seeds in national agricultural and nutrition policies. This could include providing subsidies for farmers who cultivate fluted pumpkin, funding research on improved agronomic practices, and developing value chains for fluted pumpkin products. Additionally, governments should integrate fluted pumpkin seeds into school feeding programmes and public health initiatives to promote their consumption among vulnerable populations. International organisations and NGOs also play a critical role in promoting underutilised crops such as fluted pumpkin. By providing technical and financial support, these organizations can help to build the capacity of smallholder farmers to cultivate and process fluted pumpkin seeds. Furthermore, international organisations can facilitate knowledge and best-practice exchange across sub-Saharan Africa, enabling countries to learn from each other's experiences in promoting underutilised species.

Conclusions

The challenge of food insecurity requires a variety of sustainable approaches. Under-utilised species such as fluted pumpkin, *Telfairia occidentalis* Hook f., seeds are nutrient-dense and can be exploited to enhance food security (SDG goal 2), especially in tropical regions of the world where they are naturally adapted to thriving. Investments are, however, required to improve agronomic practices and improve yield, develop better storage and processing technologies, and identify culturally acceptable, value-added products that can be developed from the seeds.

Author Contributions

CECCE was responsible for conception, design and vetting of included literature; and contributed to manuscript writing. OOI was responsible for the initial literature search and contributed to manuscript writing. All authors read and approved the final version of the paper and consented to its publication.

Declaration of Generative AI and AI-Assisted Technologies in Scientific Writing

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All relevant data are available within the manuscript

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Conflict of Interest

The authors declare that they have no conflicts of interest.

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