**Chapter one**

**Introduction**

**1.1 Background of the Study**

*Telferia ocidentalis* is a thread like green plants that usually has a big fruit with a hard cover. It has different traditional names, among Igbos, it is known a Ugwu, Iroko or Aporoko in Yoruba, Ubong in Efik, Umee in Urhobo and Umeke in Edo. Sharma *et al.* (2023), reported that the leaves together with the edible shoots contain 85% moisture, 11% crude protein, 25% carbohydrates, 37% oil 11% ash and high content of iron as well as different essential macro and micro elements. The minerals namely Calcium, Potassium, Magnesium, Iron, Sodium and Phosphorus are concentrated in the testa, pulp and husk. The crop is primarily grown as a leaf vegetable and used for human consumption and animal fodder; the high level of iron in *Telferia ocidentalis* (pumpkin) leaves extract seems to provide the basis for the folklore that it can be administered as a blood tank to convalescent persons.

The aqueous extracts of *Telferia Occidentalis* had been reported to reduce blood glucose level and also have antidiabetic effect in glucose induced *hyperglycaemic* and *streptozotocin* (STZ) induced diabetic mice while it did not alter the glucose levels in *normoglyceamic* mice (Gao *et al*., 2023). Recent scientific report note that the aqueous extracts of *Telferia Occidentalis* leaf could assist in the purging of the gastrointestinal tract as revealed by the purgative effect of the aqueous extract of *Telferia Ocidentalis* leaf on isolated guinea pig ileum, and they concluded that there are some pharmacological effects underlying their mode of action (Gao *et al*., 2023).

Plants have been an integral part of human civilization, serving as a vital source of food, medicine, and various industrial products. Among the plethora of plants used for various purposes, the pumpkin (*Telferia* ocidentalis) has gained significant attention due to its multifaceted benefits. Pumpkins are not only cherished for their succulent fruit but also for their leaves, which possess potential therapeutic properties. These leaves have been traditionally used in folk medicine across different cultures to treat various ailments (Sharma *et al.*, 2023).

Medicinal plants are of great importance to the health of individuals and communities. The medicinal value of these plants lies in some chemical substances that produce a definite physiological action on the human body). The most important of these bioactive constituents of plants are alkaloids, tannins, flavonoids, and phenolics compounds. Many of these indigenous medicinal plants are used as spices and food plants. They are also sometimes added to foods meant for pregnant and nursing mothers for medicinal purposes (Ezeifeka *et al*., 2017). Over the years, plant extracts and plant-derived medicines have made immense contributions to the overall health and well-being of human beings. The antimicrobial ability of plant extracts and oils has established a platform for the processing and transformation of these plant products into pharmaceuticals, preservatives and natural medicine. From time immemorial, the use of plants for the treatment of diseases has been widely accepted due to their healing properties. According to World Health Organization, many microorganisms are developing resistance to several drugs which is posing severe threat to the general public health hence requires actions across all sectors to curb this menace (Nduche *et al*., 2018).

Pumpkin is one such plant that is frequently being used as food as well as traditional medicine for long days (Muchirah *et al*., 2018). Cucurbita pepo is an herbaceous plant, belonging to a gourd family, Cucurbitaceae. The plant is good source of nutrients such as vitamin A and C. In many parts of the world, *Telferia ocidentalis* has been used to treat tapeworm infection, hypertrophy of the prostate, urinary problems, and burns Plants are known to contain innumerable biologically active compounds, which possess antibacterial, antidiabetic, anticancer, antioxidant activities. The seeds are used as a vermifuge, treat problem of the urinary system, hypertensions, prevents the formation of kidney stones, alleviate prostate diseases, and enhanced the erysipelas skin infection (Rosa, 2016). One hundred and nineteen secondary plant metabolites derived from plants are used as drugs globally. Therefore, it is imperative and of utmost significance to carry out a screening of these plants in order to validate their use in folk medicine and reveal the active principle by isolation and characterization of their constituents. However, bioactive compounds present in this plant are yet to be identified. Hence, the present study was designed to investigate for the presence of various phytochemicals in the leaf of *Telferia ocidentalis* which evokes various therapeutic effects (Arul & Saravanan, 2017).

Phytochemicals, also known as secondary metabolites, are bioactive compounds synthesized by plants that contribute to their medicinal properties. These phytochemicals exhibit a wide range of biological activities, such as antioxidant, anti-inflammatory, anticancer, and antimicrobial effects, making them promising candidates for drug development and functional food ingredients. Several studies have demonstrated the presence of phytochemicals in different parts of the pumpkin plant, including its leaves. According to Akande and Yahaya (2016), pumpkin (*Telferia ocidentalis*) is a widely cultivated and economically important plant belonging to the Cucurbitaceae family. It has a long history of human usage, dating back to ancient times when indigenous populations in the Americas first domesticated and cultivated it for its edible fruits and seeds. Over the centuries, pumpkin cultivation spread across different continents, and it became a staple food in various cuisines due to its nutritional value and versatility in culinary applications (Wu *et al.*, 2022).

In addition to its culinary significance, the pumpkin plant has been traditionally recognized for its medicinal properties. Various parts of the plant, including the leaves, seeds, and fruits, have been utilized in traditional medicine to address a wide range of health conditions. Traditional healers and herbalists have employed pumpkin leaves to treat ailments such as diabetes, hypertension, gastrointestinal disorders, and skin infections. The therapeutic potential of pumpkin leaves is attributed to the presence of diverse phytochemicals. Phytochemicals are secondary metabolites produced by plants, which often serve as defense mechanisms against pests, pathogens, and environmental stressors. Many phytochemicals have demonstrated bioactive properties that can positively influence human health when consumed in appropriate quantities (Udosen, 2022).

Despite the long history of traditional usage and the potential therapeutic significance of pumpkin leaves, there remains a dearth of comprehensive scientific studies focusing on their phytochemical composition. As modern medicine continues to explore natural sources for drug discovery and functional foods, investigating the chemical constituents of pumpkin leaves becomes increasingly relevant. Recent advancements in analytical techniques have enabled researchers to conduct in-depth phytochemical analyses of plant extracts. High-performance liquid chromatography (HPLC), gas chromatography-mass spectrometry (GC-MS), and nuclear magnetic resonance (NMR) spectroscopy are some of the sophisticated methods employed in the identification and quantification of phytochemicals.

**1.2 Problem Statement**

Despite the traditional use of pumpkin leaves (*Telferia ocidentalis*) in various cultures for their medicinal properties, there is a lack of comprehensive scientific data on the phytochemical content of these leaves. While anecdotal evidence and traditional knowledge suggest that pumpkin leaves possess therapeutic benefits, the specific bioactive compounds responsible for these effects remain unidentified and unquantified. This knowledge gap hinders the potential integration of pumpkin leaves into modern healthcare practices and limits their exploration as sources of novel drugs and nutraceuticals.

Although pumpkin leaves have been used as remedies for centuries, the lack of scientific evidence supporting their medicinal value leaves their efficacy and safety largely unverified. Without a thorough understanding of the bioactive compounds present in the leaves, the basis for their traditional therapeutic use remains largely speculative.

As the demand for natural, plant-based nutraceutical products grows, exploring the potential health benefits of pumpkin leaves becomes imperative. The absence of a comprehensive phytochemical profile hinders the development of pumpkin leaf-based functional foods or supplements targeting specific health conditions.

Many conventional drugs have their origins in natural compounds found in plants. Investigating the phytochemicals present in pumpkin leaves may lead to the discovery of novel drug candidates or serve as a source of lead compounds for further optimization. However, without a clear understanding of the leaf's chemical constituents, its potential as a source of pharmaceuticals remains untapped.

The phytochemical composition of plants can vary significantly depending on factors such as plant cultivar, growth conditions, and geographical location. Thus, a standardized analysis of the phytochemical content of pumpkin leaves is essential to ensure consistent and reliable results for scientific investigations. Traditional medicinal practices have been passed down through generations, but with the advancement of modern medicine, there is a risk of losing this valuable knowledge. Scientific validation of the therapeutic potential of pumpkin leaves can help preserve and promote these traditional practices while also making them more widely accessible and accepted.

**1.3 Aim and Objectives of the Study**

**1.3.1 Aim**

The aim of this study is to carry out Phytochemical Screening of Water Extract of Pumpkin Leaves.

**1.3.2 Objectives**

The specific objectives of this study are as follows:

1. To conduct a comprehensive phytochemical screening of the water extract of pumpkin leaves.
2. To identify and quantify the major phytochemical classes present in the water extract.
3. To evaluate the potential biological activities of the identified phytochemicals through a literature review.

**1.4 Significance of the Study**

The significant of the study include providing valuable insights into the potential pharmacological effects of pumpkin leaves. Understanding the bioactive compounds present can facilitate the development of plant-based drugs and nutraceutical products. The medicinal properties of pumpkin leaves may help address various health issues, promoting natural and sustainable healthcare practices. Utilizing pumpkin leaves for their medicinal value can encourage sustainable resource management, reducing waste and promoting the use of a byproduct that is often discarded. This research will contribute to the scientific understanding of the phytochemical composition of pumpkin leaves, adding to the body of knowledge on plant-based medicine.

**1.5 Scope of the Study**

This study will focus on the phytochemical screening of the water extract of pumpkin leaves from the species *Telferia ocidentalis*.The water extract will be subjected to various qualitative and quantitative analyses to identify the presence of major phytochemical classes, including but not limited to alkaloids, flavonoids, phenolics, terpenoids, and saponins.

**Chapter two**

**Literature Review**

**2.1 Introduction**

This chapter presents a comprehensive literature review on the phytochemical composition of pumpkin leaves (*Telferia ocidentalis*) and related studies exploring their potential therapeutic applications. The review focuses on recent research and publications that shed light on the bioactive compounds present in pumpkin leaves, their health benefits, and their relevance to modern medicine and nutraceutical industries. The collected evidence serves as a foundation for the current study and provides insights into the potential uses of pumpkin leaves in healthcare.

**2.2 Phytochemical Profile of Pumpkin Leaves**

Pumpkin leaves (*Telferia ocidentalis*) are known to contain a diverse array of phytochemicals, which contribute to their potential medicinal properties. Recent research has shed light on the specific bioactive compounds present in these leaves, revealing their significance as a source of valuable phytochemicals. Numerous studies have investigated the phytochemical composition of pumpkin leaves to elucidate the specific bioactive compounds responsible for their medicinal properties. Gao *et al.* (2022), conducted a comprehensive review on the phytochemical profile of pumpkin leaves and reported the presence of various classes of secondary metabolites, including alkaloids, flavonoids, phenolic compounds, terpenoids, and saponins. These bioactive compounds are known for their diverse biological activities, such as antioxidant, anti-inflammatory, antidiabetic, and antimicrobial effects.

A comprehensive review by Gao *et al.* (2022), summarized the phytochemical profile of pumpkin leaves, highlighting the presence of various classes of secondary metabolites. These include alkaloids, flavonoids, phenolic compounds, terpenoids, and saponins. Alkaloids are nitrogen-containing compounds known for their potential pharmacological effects, and they have been detected in pumpkin leaves, although specific alkaloids may vary depending on the pumpkin species.

Flavonoids are a major class of bioactive compounds in pumpkin leaves. They encompass a wide range of compounds such as quercetin, kaempferol, and rutin. Flavonoids are potent antioxidants with anti-inflammatory properties, making them important candidates for various health applications.

Phenolic compounds are another significant group of phytochemicals found in pumpkin leaves. These include phenolic acids, such as caffeic acid and ferulic acid, and other polyphenols. Phenolic compounds are well-known for their antioxidant and anti-inflammatory activities, and their presence in pumpkin leaves contributes to their potential health benefits.

Terpenoids, including carotenoids, and saponins are also detected in pumpkin leaves. Carotenoids are responsible for the vibrant orange color of pumpkins and possess antioxidant properties that are beneficial for human health. Saponins, on the other hand, exhibit diverse biological activities, including antimicrobial and anti-inflammatory effects.

Kaur *et al.* (2023) conducted a study focusing on Cucurbita maxima, which included an analysis of the phytochemical content in its leaves. The researchers identified specific flavonoids, such as quercetin and kaempferol, along with phenolic acids. These compounds were found to contribute significantly to the antioxidant capacity of the leaves, underscoring their potential health-promoting effects.

Understanding the phytochemical composition of pumpkin leaves is vital for exploring their potential therapeutic applications. These bioactive compounds contribute to the leaves' antioxidant, anti-inflammatory, and antimicrobial properties, making them valuable candidates for various health-related uses.

The presence of such diverse phytochemicals in pumpkin leaves not only makes them suitable for traditional medicinal applications but also positions them as promising sources for drug development and nutraceutical formulations. Further research into the individual bioactive compounds and their specific mechanisms of action may unlock the full potential of pumpkin leaves as a valuable resource in modern medicine and functional food industries.

**2.3 Antioxidant Activity**

Antioxidants play a crucial role in protecting the body against oxidative stress, which occurs when there is an imbalance between reactive oxygen species (ROS) and the body's antioxidant defense mechanisms. Excessive ROS can damage cellular components, including lipids, proteins, and DNA, leading to various diseases and aging processes. Therefore, the antioxidant activity of plant-derived compounds, including those found in pumpkin leaves (*Telferia ocidentalis*), has garnered significant attention in recent years.

A study conducted by Almeida *et al.* (2022), investigated the antioxidant potential of Cucurbita pepo L. leaves, a close relative of the pumpkin species. The researchers evaluated the leaves' ability to scavenge free radicals and assessed their total antioxidant capacity using various in vitro assays. The results revealed significant antioxidant activity, attributed to the presence of various phytochemicals, including phenolic compounds and flavonoids.

Gao *et al.* (2022), reviewed the literature on pumpkin leaves and highlighted their antioxidant properties. The review reported that pumpkin leaves contain a wide range of antioxidants, such as carotenoids, flavonoids, and phenolic compounds, which contribute to their free radical-scavenging abilities. These antioxidants are essential in neutralizing ROS and preventing oxidative damage to cells, thereby conferring potential health benefits.

The antioxidant activity of pumpkin leaves has implications beyond their role in traditional medicine. As consumers increasingly seek natural alternatives to synthetic antioxidants, plant-derived antioxidants have gained attention in the food and cosmetic industries. Pumpkin leaf extracts have shown promise as natural antioxidants for use in food preservation and skincare products due to their effectiveness in inhibiting lipid oxidation and protecting against UV-induced skin damage (Sharma *et al.*, 2023).

The presence of potent antioxidants in pumpkin leaves not only supports their traditional medicinal uses but also makes them valuable candidates for functional foods and nutraceutical formulations. Incorporating pumpkin leaf extracts into diets or dietary supplements may help combat oxidative stress-related diseases and promote overall health and well-being.

**2.4 Anti-Inflammatory Properties**

Inflammation is a complex biological response triggered by the immune system to protect the body from harmful stimuli, such as pathogens and tissue damage. While acute inflammation is a necessary defense mechanism, chronic inflammation can lead to various chronic diseases, including cardiovascular disorders, autoimmune conditions, and certain cancers. Therefore, identifying natural compounds with anti-inflammatory properties, such as those found in pumpkin leaves (*Telferia ocidentalis*)has become a subject of great interest in medical research.

A recent review by Khan *et al.* (2023), highlighted the anti-inflammatory potential of pumpkin leaves based on existing research. The review emphasized the role of specific bioactive compounds, particularly *cucurbitacins* and quercetin, in modulating inflammatory responses. *Cucurbitacins* are triterpenoids known for their anti-inflammatory effects by inhibiting pro-inflammatory enzymes, cytokines, and transcription factors. Quercetin, a flavonoid, exerts anti-inflammatory actions by blocking signalling pathways involved in inflammation.

Another study by Almeida *et al.* (2022), investigated the anti-inflammatory activity of *Telferia ocidentalis* leaves, which are closely related to pumpkin leaves. The researchers utilized in vitro assays to evaluate the leaves' ability to suppress the production of inflammatory mediators. The results demonstrated significant inhibition of inflammatory markers, indicating the potential of pumpkin leaves in mitigating inflammation.

Furthermore, the anti-inflammatory properties of pumpkin leaf extracts have implications beyond their traditional use. Research has suggested their potential as ingredients in topical formulations for skin conditions characterized by inflammation, such as eczema and psoriasis. Sharma *et al.* (2023), evaluated the antioxidant and anti-inflammatory activities of water extracts from Cucurbita maxima leaves. The study revealed not only potent antioxidant activity but also significant anti-inflammatory effects, supporting their application in skincare products.

The anti-inflammatory properties of pumpkin leaves can be attributed to the synergistic actions of multiple phytochemicals present in the leaves. These compounds work collectively to suppress inflammatory pathways and cytokine production, making pumpkin leaves promising candidates for managing inflammation-related disorders.

**2.5 Antimicrobial Activity**

The emergence of drug-resistant microbes has prompted the search for alternative antimicrobial agents. Several studies have investigated the antimicrobial potential of pumpkin leaves. Sharma *et al*. (2023), evaluated the antimicrobial activity of water extracts from Cucurbita maxima leaves against various pathogens. The study demonstrated significant inhibitory effects against both Gram-positive and Gram-negative bacteria, as well as certain fungi. The antimicrobial activity was attributed to the presence of alkaloids and saponins in the extracts. Antimicrobial activity refers to the ability of a substance to inhibit the growth or kill microorganisms such as bacteria, fungi, and viruses. The search for natural antimicrobial agents has gained prominence due to the rise of antibiotic resistance and the need for alternative strategies to combat infectious diseases. Pumpkin leaves (*Cucurbita spp*.) have been investigated for their potential antimicrobial properties, and research in this area has yielded promising results.

A study conducted by Sharma *et al.* (2023), evaluated the antimicrobial activity of water extracts from Cucurbita maxima leaves. The researchers performed in vitro assays to test the extracts against a panel of bacteria and fungi. The study revealed significant inhibitory effects against both Gram-positive and Gram-negative bacteria, including Staphylococcus aureus and Escherichia coli, as well as certain fungi, such as Candida albicans. The findings suggest that pumpkin leaves possess broad-spectrum antimicrobial activity, making them potentially valuable in addressing infectious diseases caused by various pathogens. Furthermore, pumpkin leaves have been investigated for their potential as natural preservatives in food and beverages. The presence of antimicrobial compounds in the leaves can help inhibit the growth of spoilage microorganisms, extending the shelf life of perishable foods. This has implications for food safety and sustainability in the food industry (Sharma *et al.,* 2023).

The antimicrobial activity of pumpkin leaves can be attributed to the presence of various bioactive compounds, including alkaloids, flavonoids, and saponins. These compounds are known for their ability to disrupt microbial cell membranes, interfere with microbial enzyme systems, and inhibit microbial growth (Gao *et al.,* 2022).

Moreover, pumpkin leaf extracts have also shown potential as natural antiviral agents. In a preliminary investigation, pumpkin leaf extracts demonstrated inhibitory effects against certain viruses, suggesting their potential use in viral infection management (Gao *et al*., 2022). Pumpkin leaves exhibit significant antimicrobial activity against a wide range of bacteria and fungi. Their potential as natural antimicrobial agents hold promise for applications in both traditional medicine and modern industries, such as food preservation and antiseptic formulations. The research on antimicrobial properties of pumpkin leaves highlights their multifaceted benefits and their potential as a sustainable and eco-friendly alternative to conventional antimicrobial agents.

**2.6 Other Potential Health Benefits**

In addition to antioxidant and anti-inflammatory properties, pumpkin leaves (*Telferia ocidentalis*) have been associated with several other potential health benefits. Research in this area has explored various aspects of their medicinal properties, revealing promising findings.

A comprehensive review by Gao *et al.* (2022), highlighted the potential antidiabetic effects of pumpkin leaves. The review discussed the presence of bioactive compounds in the leaves that may contribute to improved glucose metabolism and insulin sensitivity. Several studies have reported the hypoglycemic properties of pumpkin leaf extracts, making them of interest for managing diabetes and related metabolic disorders.

Moreover, pumpkin leaves have shown promise in addressing parasitic infections. Khan *et al.* (2023), presented a review on the medicinal potential of pumpkin leaves, emphasizing their possible antiparasitic effects. Extracts from pumpkin leaves have demonstrated inhibitory activity against certain parasites, suggesting their use as a natural alternative for managing parasitic infections.

Furthermore, pumpkin leaves have been evaluated for their potential cardiovascular benefits. The presence of phytochemicals, such as flavonoids and phenolic compounds, supports their use in promoting heart health. These bioactive compounds have been associated with reducing blood pressure, improving lipid profiles, and protecting against oxidative stress, all of which contribute to cardiovascular well-being (Gao *et al.*, 2022). The nutritional composition of pumpkin leaves also makes them valuable as a source of essential nutrients. Pumpkin leaves are rich in vitamins, including vitamin A, vitamin C, and vitamin K, as well as minerals like iron and calcium. These nutrients play crucial roles in various physiological processes, supporting overall health and immune function (Khan *et al.*, 2023).

Preliminary studies have also suggested potential anticancer properties associated with pumpkin leaves. Some bioactive compounds present in the leaves have been investigated for their cytotoxic effects on cancer cells. However, further research is needed to elucidate the mechanisms and explore their potential applications in cancer treatment (Gao *et al.*, 2022). The diverse array of beneficial properties exhibited by pumpkin leaves makes them an intriguing subject for further research and applications in traditional medicine, functional foods, and nutraceutical industries.

The literature review reveals that pumpkin leaves are a rich source of diverse phytochemicals with potential therapeutic properties. Their antioxidant, anti-inflammatory, and antimicrobial activities, along with other potential health benefits, highlight their relevance in modern medicine and nutraceutical applications. The findings from these studies provide a solid foundation for the current research, which aims to conduct a comprehensive phytochemical screening of the water extract of pumpkin leaves and further explore their potential as natural sources of therapeutic agents.

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