# A Review of Taro Leaves on Its Phytochemical Screening and Approach on Anti-Diabetic Activities on Specific Receptor

**M. Mukherjee[1], B. Sarkar[2], B. Ghosh[3]**

[1,2]Assistant Professor, Birbhum Pharmacy School
[3]Student, Birbhum Pharmacy School

**Abstract:**
Taro, scientifically known as Colocasia esculenta, is a plant that holds considerable nutritional and medicinal importance. Its leaves are structured with multiple layers of palisade and air-filled spongy mesophyll. The vascular traces are surrounded by a ring of vacuolate cells that could extend to both the upper and lower epidermis. The leaves have stomata on both sides, with a higher number on the abaxial side. The stalk of the taro leaf is rich in various compoundssuch as saponins, flavonoids, tannins, alkaloids, steroids, and terpenoids, which have potential medicinal uses, including wound healing and antioxidant properties. An interesting feature of the taro leaf is the presence of water bubbleson its surface, which trap air in the cavity, forming a silvery layer. Although the bundle sheath is present in the taro leaf, there is no definitive proof to suggest thattaro can perform carbon fixation via a C4 pathway. This research offers insights into the morphological characteristics of taro, its culinary uses, cultivation regions, and seasons. It also highlights the genetic variations among different genotypes, which could be useful for breeding programs.

**Keywords**: Colocasia esculenta, Spongy mesophyll, Abaxial Side, Wound healing, Antioxidant properties, C4 pathway, Genotypes.

## Introduction:

Colocasia esculenta, commonly known as taro, is a root vegetable that is plentiful and affordable, yet often overlooked and underappreciated. The leaves of this plant are noteworthy for their substantial nutritional and medicinal properties. They have a unique structure, featuring a multi-layered palisade and air-filled spongy mesophyll. The stalk of the leaf is packed with compounds such as saponins, flavonoids, tannins, alkaloids, steroids, and terpenoids, all of which have potential therapeutic applications[1].The leaves of the taro plant are incorporated into various food items due to their high content of fiber, potassium, vitamin C, protein, and other micronutrients. Despite taro's critical role in ensuring food security, its wide geographical distribution, high nutritional value, and significant trade, there is a scarcity of improved taro genotypes available to farmers. This underscores the need for additional research to uncover the diverse applications of taro and enhance on-farm processing techniques for industrial use[2]

International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

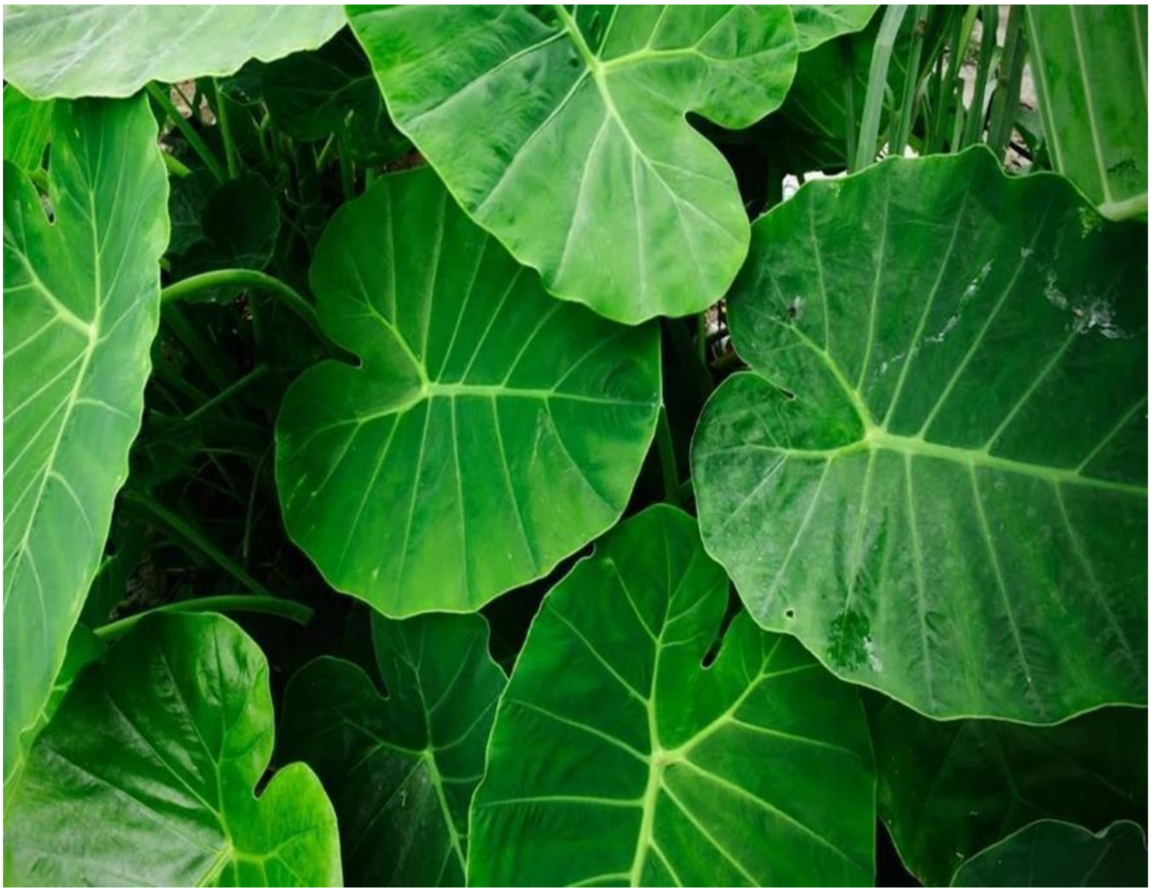

**Fig1 : Taro leaves**

**Epidemiology:**

Taro leaf blight, a significant disease impacting taro plants globally, is attributed to the Oomycete Phytophthora colocasia. The disease has had severe outbreaks, notably in Samoa in 1993 and more recently in Cameroon, Ghana, and Nigeria. These outbreaks have underscored the disease's devastating effects on the livelihoods and food security of small-scale farmers and rural communities reliant on the crop.The disease's migration to new regions poses a considerable risk to neighbouring countries and taro cultivation areas that are currently disease-free. Previous studies, especially those conducted in the Pacific, have indicated that management strategies such as chemical and cultural control are largely unsuccessful. Instead, breeding for disease resistance has emerged as the most sustainable method to manage the disease. In recent times, regional taro networks in the Pacific and Southeast Asia have made significant strides in developing taro cultivars resistant to leaf blight. This progress has been achieved through the enhanced use of taro genetic resources and the close collaboration between farmers and researchers in breeding programs. These initiatives have ensured the preservation of crucial taro genetic resources for future utilization[3].

This review provides a comprehensive overview of the disease, including its symptoms, origin, distribution, epidemiology, management, and global impact. The primary focus is on breeding strategies to combat the disease, encompassing the challenges, opportunities, and constraints. The review also explores how these breeding experiences and outcomes can be expanded to other regions where the diseasehas been newly introduced or is at risk of introduction[4].

**Taxonomical Identification :**

Here's a reworded version of the information:

Taro leaves are derived from the taro plant, known scientifically as Colocasia esculenta. The taxonomicalclassification of taro leaves is as follows:

1. Kingdom: Plantae - Taro belongs to the plant kingdom.
2. Subkingdom: Tracheobionta - Taro is a vascular plant, which means it has specialized tissues for the transportation of water, minerals, and photosynthetic products.
3. Superdivision: Spermatophyta - Taro is a seed-bearing plant.
4. Division: Magnoliophyta - Taro is classified as a flowering plant.
5. Class: Liliopsida - Taro is a monocotyledon, indicating that its seeds have a single embryonic leaf.
6. Subclass: Arecidae
7. Order: Arales
8. Family: Araceae - Taro is a member of the arum family.
9. Genus: Colocasia - Taro is part of the Colocasia genus.
10. Species: Colocasia esculenta - This is the scientific designation for taro.

Initially, Carl Linnaeus described two species, Colocasia esculenta and Colocasia antiquorum. However, subsequent botanists have largely considered them to be variations of a single species, now correctly referred to as Colocasia esculenta.

Studies have been conducted to characterize the morphology of taro leaves, with a focus on their structure and texture. These leaves exhibit a subcoriaceous texture, a basal petiole insertion, a green pseudo-stem at the base with white exudate, and two collector veins. Variations in the growth habits of taro have also beenreported.

Within Colocasia esculenta, eight variants are recognized, two of which are commonly cultivated: Colocasia esculenta (L.) Schott var. esculenta and Colocasia esculenta (L.) Schott var. antiquorum.

**Parts on which the various work has been done [6]& analysis:**

Investigations into taro leaves, or Colocasia esculenta, have spanned several areas. Here are some notableinsights:

**Morphological Analysis**z: Research has been undertaken to comprehend the morphological traits of taro leaves. This includes studying the color variations of the leaf margin, dorsal and ventral blade and veins, petiole, and corm flesh and fiber. Additionally, the position and surface shape of the leaf lamina have beenexamined.

**Nutritional Aspects:** Taro leaves are recognized for their high content of gums (mucilage) and small starch granules, contributing to their high digestibility. They are commonly used in various culinary applications.

**Industrial Use:** Taro leaves, along with the stem and corm of the plant, are noted for their high fiber content and essential nutrients. The starch derived from taro leaves has numerous uses in the food industry,serving as an emulsifier, stabilizer, and prebiotic in the creation of a range of food products.

**Agronomical Features:** Research has also focused on understanding the agronomical characteristics of taro leaves, including the number of active leaves per plant, the length of the petiole, and the maximum horizontal distance.

**Water-Repelling Characteristics:** A study conducted at the Indian Institute of Technology Bombay focused on the unique structure of taro leaves that enables them to repel water. The researchers discovered that the surface of the leaves, characterized by honeycomb-like patterns and a flake-like texture, contributes to their water-repelling or hydrophobic properties. This finding inspired the creation of a hydrophobic surface composed of an epoxy-based polymer imprinted on silicon, which has potential applications in water collection from fog.

**Cardiovascular Health:** Taro leaves, being dark leafy greens, have been linked to a 15.8% decrease in heart disease risk. They are also a source of nitrates, which play a crucial role in blood pressure regulationand heart health maintenance.

**Formulations including Ayurveda, Siddha, Unani[7]:**

Taro leaves, scientifically referred to as Colocasia esculenta, are utilized in several traditional medicinal practices. However, there is no readily available information on specific formulas that incorporate taro leaves in Ayurveda, Siddha, and Unani. Here's a brief overview:

**Ayurveda:** Taro leaves have been traditionally employed for treating conditionssuch as general weakness, constipation, hair loss, mouth inflammation, hemorrhoids, and liver disorders. They are abundant in gums (mucilage) and small starch granules, enhancing their digestibility. Both the leaves and roots of taro are rich in polyphenols, potent antioxidants.

**Siddha**: In Siddha medicine, raw drugs are classified based on their source into plant origin (Mooligaivaguppu), metals and minerals (Thathuvaguppu), andanimal origin (Seevamvaguppu). Although there are no specific formulas mentioned involving taro leaves, it's plausible that they could be incorporated into some Siddha preparations.

**Unani**: The Unani medicinal system also employs herbal medicines, and it's possible that taro leaves might be included in some of their formulas. However, specific Unani formulas involving taro leaves are not readily accessible.

**Phytochemical constituent[8] :**

Taro leaves, also referred to as Colocasia esculenta, are packed with a range of phytochemicals. Here are some primary components:

**Flavonoids**: Predominantly, taro leaves are enriched with flavonoids, specifically luteolin, apigenin, and chrysoeriol glucosides.

**Phenolic Acids**: They possess phenolic acids, mainly derivatives of coumaric, gallic, and caffeicacids.

**β-sitosterol and Steroids**: These compounds are also significant constituents of taro leaves.

**Vitamins and Minerals**: Taro leaves are known for their high content of protein, potassium, calcium, phosphorous, iron, vitamin A, thiamine, niacin, riboflavin, anddietary fiber.

**Gums (Mucilage)**: Taro leaves are abundant in gums, contributing to their high digestibility.

**Polyphenols**: Both the leaves and roots of taro are rich in polyphenols, potent antioxidants.

Taro leaves, also known as Colocasia esculenta, are utilized in traditional medicinalpractices such as Ayurveda, Siddha, and Unani. They have several medicinal uses and pharmacological activities:

1. **Antioxidant**: The antioxidant properties of taro leaves may assist in eliminating free radicals in the body, which can help prevent diseases.
2. **Anti-Inflammatory**: Taro leaves possess properties that can aid in reducinginflammation.
3. **Analgesic**: The analgesic properties of taro leaves can provide pain relief.
4. **Anti-lipid peroxidative activity**: Taro leaves can prevent lipid oxidation,which can lead to cellular damage.
5. **Antidiabetic**: Taro leaves can assist in the management of diabetes.
6. **Anti-carcinogenic**: The properties of taro leaves can aid in cancer prevention.
7. **Hepatoprotective**: Taro leaves can provide protection to the liver.
8. **Immunoprotective**: Taro leaves can enhance the immune system.
9. **Antimicrobial effects**: Taro leaves can combat microorganisms.

**Morphology Of taro leaves[9]:**

Taro leaves, also referred to as Colocasia esculenta, exhibit unique morphologicalcharacteristics. Here aresome primary features:

**Shape and Size**: The leaves of the taro plant are heart-shaped, measuring up to 40 by 25 cm. They display a dark green color on the upper surface and a lighter green on the underside.

**Structure**: The leaf structure comprises a multi-layered palisade and an air-filled spongy mesophyll. Vascular traces are surrounded by a ring of vacuolate cells thatmay extend to both the upper and lower epidermis.

**Stomata**: The presence of stomata is observed on both the abaxial and adaxial surfaces, with the former having a higher count.

**Petioles**: The leaves of the taro plant are characterized by long petioles.

**Variations**: Within Colocasia esculenta, eight recognized variants exist, two of which are commonly cultivated. These include Colocasia esculenta (L.) Schott var. esculenta, characterized by a large cylindrical central corm and only a few cormels, and Colocasia esculenta (L.) Schott var. antiquorum, which has a smallglobular central corm with several relatively large cormels emerging from the corm.

**Microscopical study Of taro[10]:**

Microscopic examinations of taro leaves, also known as Colocasia esculenta,have unveiled several notable characteristics:

**Cellular Structure**: The leaf structure is composed of a multi-layered palisadeand an air-filled spongy mesophyll. Vascular traces are surrounded by a ring ofvacuolate cells, which may extend to both the upper and lower epidermis.

**Stomata**: Stomata are present on both the abaxial and adaxial surfaces, with ahigher count onthe former.

These microscopic features contribute to the unique properties of taro leaves, including their self-cleaning capability and their various industrial applications.Nonetheless, further research is required to fully comprehend the microscopic structure and properties of taro leaves.

**Drug aspects Of taro leaves[11]:**

Taro leaves, also known as Colocasia esculenta, are utilized in severaltraditional medicinal systems and offer potential health benefits:

**Nutritional Benefits:** Taro leaves are packed with nutrients, including vitamins A, B6, C, E, and K, as well as copper, magnesium, potassium, and calcium.

**Disease Prevention**: Taro leaves are a rich source of vitamin C and polyphenols, both of which are common antioxidant compounds. Regular consumption of cooked taro leaves may help in reducing free radicals in the body, thereby aiding in disease prevention.

**Cardiovascular Health**: Consuming dark leafy greens like taro leaves on a regular basis has been linked to a decrease in the risk of heart disease. Taro leavesalso contain nitrates, which are crucial for blood pressure regulation andheart health maintenance.

**Weight Management**: Taro leaves are low in carbs and fats, making them verylow in calories. This makes them an excellent food choice for promoting a healthy body weight.

**Cancer Prevention**: Taro corms are known to contain valuable bioactive molecules that are effective against cancer and cancer-related risk factors.

**Detail regarding Strach[12]:**

Starch, a complex carbohydrate, is a natural constituent of numerous plants,encompassing fruits, vegetables, and grains. Here are some essential detailsabout starch:

**Definition and Structure**: Starch, also known as amylum, is an odorless, white fluffy powder that doesn't dissolve in cold water, alcohol, or other solvents. Thefundamental chemical formula of the starch molecule is $(C_6H_{10}O_5)_n$. Starch isa polysaccharide made up of glucose monomers connected in α 1,4 linkages. It can exist in two forms: amylose, a linear or straight-line polymer, and amylopectin, which forms a branched chain.

**Types of Starch**: Based on its nutritional attributes, starch can be classified intothree groups: Rapidly digestible starch (RDS), Slowly digestible starch (SDS), and Resistant starch (RS). RDS is found in cooked foods and is quickly convertedto glucose. SDS has a complex structure, implying that the body digests it slowly.RS is akin to dietary fiber and can pass through the digestive system without being digested.

**Uses of Starch**: Starch is a primary carbohydrate source for most individuals. Italso offers a variety of vitamins, minerals, fiber, and other nutrients. Starch-richfoods are valuable culinary ingredients as they can thicken soups and sauces without adding fat. Various industries, including pharmaceutical, paper, and food, utilize starch in their manufacturing processes.

**Health Benefits**: Starchy foods play a vital role in a nutritious, balanced diet asthey supply the body with glucose, the main energy source for every cell. Theyalso promote healthy intestinal microflora.

**Extraction and isolation of starch[13] :**

The process of extracting and isolating starch from taro leaves involves severalsteps:

**Cleaning and Peeling**: Initially, the taro is thoroughly cleaned and the outerlayer is peeledoff.

**Crushing**: The peeled taro is then placed in a disintegrator along with a spirit ofsalt that has a pH value ranging between two to three. This results in crushed taro,also known as taro serum.

**Precipitation**: The crushed taro is subsequently precipitated in a container at ambient temperature.

**Separation**: The pH value of the precipitated taro serum is adjusted to fall between two to three. It is then placed into a slurry dregs separator for separation, yielding taro starch liquidand drags.

**Purification**: The taro starch liquid, with a maintained pH value between two tothree, is placed into a centrifuge for precipitation and purification. This separatesthe taro starch from the protein and non-taro starch impurities.

**Drying**: The protein and non-taro starch impurities are removed to obtain wettaro starch, which is then dried in an oven until it reaches a dry state.

**Future Aspects:**

Taro leaves, also referred to as Colocasia esculenta, have several potentialapplications in the future:

**Food Production and Nutrition[14]**:Taro leaves are packed with nutrients and can be incorporated into a variety of food items. They are rich in proteins, minerals, carbohydrates, resistant starch, vitamins, and dietary fibers. Taro starch is widely used in the production of value-added products such as taro paste, taro flour, cereals, bread and cakes, instant dry beverage powders, taro flakes, taro meal, frozen taro, canned taro, taro slices, and taro starch-based extruded foods.

**Climate Resilient Cultivation[15]**: Taro is a tropical tuber crop that can thrive ina wide range of soil types with a pH of 5.5 to 6.5. It favors humid conditions.

However, taro cultivation has been significantly impacted by the emergence oftaro leaf blight (TLB), caused by Phytophthora colocasiae Raciborski. Future research could focus on the development of more resistant taro varieties.

**Health Benefits[15]**: Taro leaves are an excellent source of protein, potassium,calcium, iron, and phosphorus. The corms of taro also contain a fine-grained digestible starch, ash, and lipids content. This positions taro as a potential subject for future research in health and nutrition.

**Value Addition and Commercialization[15]**: There are future prospects foradding value to taro and addressing challenges in taro production andcommercialization. This includes the use of taro in the production of infant flours and taro-based value-added products.

**APPROCHES FOR DIABETIES**:

1. **Bioactive Compounds:** The presence of bioactive compounds such as alkaloids, flavonoids, saponins,tannins, and polyphenols in taro leaves is known to exhibit antidiabetic effects.
2. **Plant-Based Treatment:** A comprehensive review of over 200 research papers has revealed the therapeutic potential of the bioactive compounds present in taro leaves. These compounds have demonstrated anti-diabetic effects both in vitro and in vivo.
3. **Nanophytochemicals:** Recent studies have shifted their focus towards nano- delivery systems like liposomes, niosomes, solid–liquid nanoparticles, nanostructured lipid carriers, nanomicelles, and nanoparticles. These systems aim to enhance the pharmacokinetic properties of the encapsulated phytochemicals, thereby improving their effectiveness in diabetes treatment.
4. **Wound Healing:** Research has also explored the potential of taro leaf extracts in the treatment of wounds associated with diabetes.
5. **Juice Consumption:** In certain regions, taro leaf juice is consumed as a natural preventive measure against diabetes.

**Epidemiology:**

Taro leaf blight, a significant disease impacting taro plants globally, is attributedto the Oomycete Phytophthora colocasia. The disease has had severe outbreaks, notably in Samoa in 1993 and more recently in Cameroon, Ghana, and Nigeria. These outbreaks have underscored the disease's devastating effects on the livelihoods and food security of small-scale farmers and rural communities relianton the crop.The disease's migration to new regions poses a considerable risk to neighbouring countries and taro cultivation areas that are currently disease-free. Previous studies, especially those conducted in the Pacific, have indicated that management strategies such as chemical and cultural control are largely unsuccessful. Instead, breeding for disease resistance has emerged as the most sustainable method to manage the disease. In recent times, regional taro networksin the Pacific and Southeast Asia have made significant strides in developing tarocultivars resistant to leaf blight. This progress has been achieved through the enhanced use of taro genetic resources and the close collaboration between farmers and researchers in breeding programs. These initiatives have ensured the preservation of crucial taro genetic resources for futureutilization.

This review provides a comprehensive overview of the disease, including its symptoms, origin, distribution, epidemiology, management, and global impact. The primary focus is on breeding strategies to combat the disease, encompassingthe challenges, opportunities, and constraints. The review also explores how thesebreeding experiences and outcomes can be expanded to other regions where the disease has been newly introduced or is at risk of introduction.

**MEDICINES PRESENT IN MARKET WITH MECHANISM OF ACTION**:

Several innovative medicines for diabetes are currently available in the market. Here are some examples:

1. **Mounjaro (tirzepatide)**: This first-of-its-kind medication, which received U.S. Food and Drug Administration approval in 2022, activates both the GLP-1 and GIP receptors, leading to bettercontrol of blood sugar levels. It is administered as a subcutaneous injection once a week, with the dosage adjusted as tolerated to achieve blood sugar targets.
2. **Inceptor**: Scientists have identified a new and druggable insulin inhibitory receptor, known as inceptor. Blocking the function of inceptor leads to increased sensitization of the insulin signaling pathway in pancreatic beta cells. This could potentially protect and regenerate beta cells, leading to diabetes remission.
3. **Glucagon-like peptide 1 receptor agonists (GLP1-RA) and sodium-glucose cotransporter type 2 inhibitors (SGLT2i):** These novel medications offer benefits in terms of longevity and protection of the heart and kidneys. They target multiple pathophysiological mechanisms present in type 2 diabetes.
4. **Sulfonylureas:** Sulfonylureas function by prompting the pancreas to secrete insulin. They interact with 'sulfonylurea receptors' (SUR1) located on the membrane of pancreatic β cells, leading to depolarization by decreasing the conductance of ATP-sensitive K+ channels. This process promotes the influx of Ca2+ and the degranulation of insulin. Following prolonged use, sulfonylureas enhance the sensitivity of target tissues, particularly the liver, to insulin. It's important to note that sulfonylureas are only beneficial when there is some remaining activity inthe pancreatic beta cells.
5. **Metformin:** Metformin is a drug that assists in managing blood glucose levels in people with type 2 diabetes. It achieves this by lessening glucose generation in the liver, decelerating glucose absorption in the gut, and heightening the body's receptiveness to insulin, which subsequently

amplifies the absorption and utilization of glucose in the peripheral tissues of the body. Importantly, metformin does not lead to hypoglycemia in individuals with type 2 diabetes or in healthy individuals, unlike sulfonylureas.

6. **Adlyxin:** Adlyxin, or lixisenatide, is a type of medication known as a glucagon-like Peptide-1 (GLP-1) receptor agonist. It functions by simulating the effects of a hormone named glucagon-like peptide 1. As blood glucose levels rise following a meal, Adlyxin prompts the body to produce additional insulin. This surplus insulin aids in reducing blood sugar levels. Furthermore, it enhances insulin secretion dependent on glucose levels, curtails the secretion of inappropriate glucagon, and decelerates the emptying of the stomach. Consequently, it leads to better regulation of blood glucose levels in adults suffering from type 2 diabetes mellitus.s
7. **Levemir:** Livimir, also referred to as insulin detemir, is a long- lasting basal insulin analog. It operates by emulating the function of insulin, a hormone generated by the pancreas' beta cells that facilitates glucose metabolism. As blood glucose levels increase, Livimir enables the cells in skeletal muscle and fat to absorb moreglucose and suppresses the liver's glucose output. This assists in the reduction of blood glucose levels. The extended action ofLivimir is attributed to the slow absorption of insulin detemir molecules from the injection site, the strong self-association of the molecules, and binding to albumin. This permits dosing once daily, typically at bedtime. It is frequently used in conjunction with short-acting "bolus insulin" to replicate the production of endogenous insulin by the pancreas.
8. **Monujaro:** Monujaro, also referred to as tirzepatide, is a dual agonist for the glucose-dependent insulinotropic polypeptide (GIP) and glucagon-like peptide-1 (GLP-1) receptors. It operates by selectively binding to and activating the GIP and GLP-1 receptors. This activation enhances the secretion of insulin during both the first and second phases and diminishes glucagon levels, both in a manner dependent on glucose levels. Consequently, it aids in lowering both fasting and post- meal glucose levels, reducing food intake, and enhancing the control of blood glucose in adults with type 2 diabetes mellitus. The extended half-life of Monujaro permits dosing on a weekly basis.

**NEW ADVANCEMENT OF MEDICATION:**

1. **Tirzepatide:** A novel drug, tirzepatide, has received approval for its ability to enhance the regulation of blood sugar levels in adults diagnosed with type 2 diabetes.
2. **Teplizumab**: In late 2022, teplizumab was sanctioned for its capacity to postpone the development of type 1 diabetes.
3. **Weight Loss**: Medications for Diabetes: Certain diabetes drugs are now being employed not only for weight loss and obesity treatments but also for reducing cardiovascular risk.
4. **GLP-1 Drug Semaglutide:** The SELECT trial demonstrated that using semaglutide to address obesity could decrease the likelihood of subsequent cardiovascular incidents.
5. **Continuous Glucose Monitors (CGMs):** These devices, which perpetually track blood glucose levels and can relay this data to a smartphone app or similar device, have been found to offer numerous advantages, including a reduction in hemoglobin A1C (HbA1c) levels, a key indicator of blood glucose health.

**Discussion:**

Taro leaves, also referred to as Colocasia esculenta, have been the focus of numerous reviews due to their

nutritional benefits and potential health advantages.Here are some primary points from thesereviews:
**Nutritional Value**: Taro leaves are packed with nutrients, including proteins, minerals, carbohydrates, resistant starch, vitamins, and dietary fibers. They are low in calories and high in fiber, making them a nutritious addition to a balanceddiet.
**Health Benefits**: Taro leaves are a rich source of vitamin C and polyphenols, both of which are common antioxidant compounds. Regular intake of cooked taro leaves may help in reducing free radicals in the body, thereby aiding in disease prevention. They are also a good source of fiber and have a high watercontent, which can assist in weight management.
**Cultivation and Challenges**: Taro is a tropical tuber crop that can thrive in a wide range of soil types with a pH of 5.5 to 6.5. However, taro cultivation has been significantly impacted by the emergence of taro leaf blight (TLB), caused by Phytophthora colocasiae Raciborski. Future research could focus on the development of more resistant taro varieties.
**Commercialization and Value Addition**: There are future prospects for adding value to taro and addressing challenges in taro production and commercialization. This includes the use of taro in the production of infant flours and taro-based value- added products.

## Conclusion:

Taro leaves, also referred to as Colocasia esculenta, are a rich source of nutritionand offer potential health advantages. They are packed with proteins,minerals, carbohydrates, resistant starch, vitamins, and dietary fibers.
Consuming cooked taro leaves regularly may assist in reducing free radicals inthe body, thereby aiding in disease prevention. They are also a good source of fiber and have a high water content, which can assist in weight management.
Taro is a tropical tuber crop that can thrive in a wide range of soil types with apH of 5.5 to 6.5. However, taro cultivation has been significantly impacted bythe emergence of taro leaf blight (TLB), caused by Phytophthora colocasiae Raciborski. Future research could focus on the development of more resistant taro varieties.
There are future prospects for adding value to taro and addressing challenges in taro production and commercialization. This includes the use of taro in theproduction of infant flours and taro- based value-added products.
In conclusion, taro leaves are a valuable addition to a balanced diet due to their nutritional content and potential health benefits. They also have significant potential for value addition and commercialization. However, further research is required to fully comprehend and harness the potential of taro leaves.

## References:

1. Yen DE, Wheeler JM. Introduction of taro into the Pacific: the indicationsof the chromosome numbers. Ethnology. 1968 Jul 1;7(3):259-67.
2. Wang JK, Higa S. Taro, a review of Colocasia esculenta and its potentials.
3. Shakywar RC, Pathak SP, Tomar KS, Pathak M, Sen D. Epidemiological Studies of Diverse Taro Genotype against Leaf Blight Caused by Phytophthora Colocasiae Racib. International journal of Bio-resource andStress Management. 2013;4(3):408-11.
4. Syarif Z, Akhir N, Satria B. Identification of plant morphology of taro as apotential source of carbohydrates. Int J Adv Sci, Eng Inf Technol. 2017;7(2):573-9.

5. SURATMAN S, PITOYO A, KURNIASARI S, SURANTO S. Morphological, anatomical andisozyme variation among giant taro. Biodiversitas Journal of BiologicalDiversity. 2016;17(2).
6. Kumar M, Bhardwaj R. Wetting characteristics of Colocasia esculenta (Taro) leaf and a bioinspired surface thereof. Scientific reports. 2020 Jan 22;10(1):935.
7. Prajapati R, Kalariya M, Umbarkar R, Parmar S, Sheth N. Colocasia esculenta: A potent indigenous plant. International Journal of Nutrition, Pharmacology, Neurological Diseases. 2011 Jul 1;1(2):90-6.
8. Mitharwal S, Kumar A, Chauhan K, Taneja NK. Nutritional, phytochemical composition and potential health benefits of taro (Colocasiaesculenta L.) leaves: A review. Food Chemistry. 2022Jul 30;383:132406.
9. Al-Kaf AG, Al-Deen AM, ALhaidari SA, Al-Hadi FA. Phytochemical analysis and antimicrobial activity of colocasia esculenta (taro) medicinal plant leaves used in folk medicine for treatment of wounds and burns in Hufash district al Mahweet Governorate–Yemen. Universal Journal of Pharmaceutical Research. 2019;4(2):32-5.
10. Boampong R, Aboagye LM, Nyadanu D, Esilfie M. Agro- morphologicalcharacterization of some taro (Colocasia esculenta (L.) Schott.) germplasms in Ghana. Journal of Plant Breeding and Crop Science. 2018 Aug 31;10(8):191-202.
11. Harris PJ, Ferguson LR, Robertson AM, McKenzie RJ, White JB. Cell- Wall Histochemistry and Anatomy of Taro (Colocasia esculenta.). Australian Journal of Botany. 1992;40(2):207-22.
12. Armoni M, Meerbaum-Salant O, Ben-Ari M. From scratch to "real"programming. ACM Transactions on Computing Education (TOCE). 2015 Feb 24;14(4):1-5.
13. Moreno-León J, Robles G, Román-González M. Dr. Scratch: Automatic analysis of scratch projects to assess and foster computational thinking. RED. Revista de Educación a Distancia. 2015(46):1-23.
14. Matthews PJ, Agoo EM, Tandang DN, Madulid DA. Ethnobotany and ecology of wild taro (Colocasia esculenta) in the Philippines: Implications for domestication and dispersal. Senri ethnological studies. 2012 Mar 30;78:307-40.
15. Ravi V, Pandey V, Devi A, Giri NA. Prospects of Underutilised Taro (Colocasia esculenta) for Sustainable Biodiversity and Nutritional Security inIndia. Promotion of Underutilized Taro for Sustainable Biodiversity and Nutrition Security in SAARC Countries. 2021;281:61.
16. Chivenge, P., et al., The potential role of neglected and underutilised crop species as future crops under water scarce conditions in Sub-Saharan Africa. International journal of environmental research and public health, 2015. 12 (6): p. 5685-5711.
17. Tadele, Z., African orphan crops under abiotic stresses: challenges and opportunities.Scientifica, 2018.
18. Miyasaka, S. C., et al., Genetic Diversity in Taro (Colocasia esculenta), in Genetic Diversity in Horticultural Plants. 2019, Springer. p. 191-215.
19. Dai, H., et al., Two-step identification of taro (Colocasia esculenta cv. Xinmaoyu) using specific psbE-petL and simple sequence repeat-sequence characterized amplified regions (SSR-SCAR), markers. Genet Mol Res, 2016. 15: p. 1-10.
20. Sarkar, N., N. Adhikary, and J. Tarafdar, Field management oftaro leaf blight using promising germplasm. International journal of current microbiology and appliedscience. 6: 1399, 2017. 1407.
21. Rao, V. R., et al., The Global Diversity of Taro: ethnobotany and conservation. 2010.
22. Parvin, S., et al., Karyotype analysis of seven varieties of taro Colocasia esculenta (L.) Schott. from Bangladesh. Journal of Bio-Science, 2008. 16: p. 15-18.

23. Jianchu, X., et al., Genetic diversity in taro (Colocasia esculenta Schott, Araceae) in China: An ethnobotanical and genetic approach. Economic Botany, 2001. 55 (1): p. 14-31.
24. Lebot, V., et al., Characterizing taro using isozymes and morpho-agronomic descriptors. The Global Diversity of Taro,2010: p. 39.
25. Manzano, A. R., et al., Morphological and isoenzymevariability of taro (Colocasia esculenta L. Schott) germplasm in Cuba. Plant genetic resources newsletter, 2001: p. 31-40.
26. Beah, A. A., et al., Assessment of agro-morphological diversityand affinities in cocoyam species from Sierra Leone. International Journal of Biodiversity and Conservation, 2015. 7(10): p. 408- 419.
27. Bhattacharjee, M., J. Tarafdar, and R. Sadhukhan, Assessment of genetic diversity of some indigenous collections of upland taro Colocassia esculenta var. antiquorium (L.) Schott for selection of genotypes aiming at improvement in breeding programme. IOSR Journal of Agriculture and Veterinary Science, 2014. 7 (7): p. 31-43.
28. Orji, K. and P. Ogbonna, Morphological Correlation Analysis On Some Agronomic Traits Of Taro (Colocasia esculenta) In The Plains Of Nsukka, Nigeria. Journal of Global Biosciences, 2015. 4 (1): p. 1120-1126.
29. Singh, D., et al., Taro leaf blight—a threat to food security.
30. Agriculture, 2012. 2 (3): p. 182-203.
31. Sthapit, B., V. R. Rao, and H. A. Lamers, Feasibility of Conservation of Horticultural Genetic Resources in In Situ/On Farm, in Conservation and Utilization of Horticultural Genetic Resources. 2019, Springer. p. 49-76.
32. Alcantara, R. M., W. A. Hurtada, and E. Dizon, The nutritional value and phytochemical components of taro [Colocasia esculenta (L.) Schott] powder and its selected processed foods. J Nutr Food Sci, 2013. 3 (207): p. 2.
33. Lewu, M. N., P. O. Adebola, and A. J. Afolayan, Effect of cooking on the mineral and antinutrient contents of the leaves of seven accessions of Colocasia esculenta (L.) Schott growingin South Africa. Journal of Food, Agriculture & Environment, 2009. 7(3&4): p. 359- 363.
34. Savage, G., et al., Effect of cooking on the soluble and insolubleoxalate content of some New Zealand foods. Journal of Food Composition and Analysis, 2000. 13 (3): p. 201-206.
35. Gouveia, C. S., et al., Quantitation of oxalates in corms and shoots of Colocasia esculenta (L.) Schott under drought conditions. Acta physiologiae plantarum, 2018. 40(12): p. 214.
36. Oscarsson, K. and G. Savage, Composition and availability of soluble and insoluble oxalates in raw and cooked taro (Colocasia esculenta var. Schott) leaves. Foodchemistry, 2007.101 (2): p. 559-562.
37. Mgbedike, N., et al., Strategies for Improving Cocoyam Production among Farmers in Anambra State, Nigeria. 2017.
38. Owusu-Darko, P. G., A. Paterson, and E. L. Omenyo, Cocoyam (corms and cormels)—An underexploited food and feed resource. Journal of Agricultural Chemistry and Environment, 2014. 3 (01): p. 22.
39. Yazid, N. S. M., et al., Application of starch and starch-based products in food industry. Journal of Science and Technology,2018. 10 (2).