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# Phytochemical analysis and Ethno-botanical Uses of *Gongronema latifolium* Benth

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## ABSTRACT
To assess the bioactive components and ethnobotanical applications of the plants, a phytochemical analysis and ethnobotanical uses of the leaves of *Gongronema latifolium* Benth were performed. The existence of flavonoids, saponins, alkaloids, tannins, total phenols, and glycosides was demonstrated by the results. Carbohydrates, protein, amino acids, vitamins, minerals, and lipids are all included in the nutritional profile. The plant has antibacterial, hepatoprotective, hypolipidemic, hypoglycemic, and antioxidant pharmacological effects. The analysis also showed that phenols (53.105 mg/g) and flavonoids (9.635 mg/g), as well as saponins (5.480 mg/g) and tannins (1.175 mg/g), had significant concentrations in the leaves of *Gongronema latifolium* Benth, whereas glycosides (0.240 mg/g) had the lowest concentration. This investigation is feasible and would offer valuable data of commercial relevance to research organizations and pharmaceutical corporations for use in the creation of new medicines.
**Keywords**: Phytochemical analysis, Ethnobotanical uses, Bio-active components, Pharmacological activities.

## INTRODUCTION
A climbing spice or vegetable known as "utazi" is called *Gongronema latifolium* Benth. It has a stem that is hollow, 5 m long, and all over is hairy to glabrous with a wood base and fleshy root. It has latex leaves with a petiole up to 2.5 to 3 cm long and lacks opposite simple and complete stipules. There are 16 species in tropical areas of Africa, subtropical Asia, and Oceania (Ugochukwu *et al*., 2003). Non-woody herbaceous plant *Gongronema latifolium* Benth belongs to the Asclepadiaceae family. With a moderate presence in Northern and South-East Asia, it is common in tropical and subtropical climates, especially in Africa and South America (Offor, 2014).
*Gongronema latifolium* Benth is one of the indigenous vegetable crops grown in the humid area of South-Eastern Nigeria. It is used as a spice in food (soups and salads) or eaten raw for medicinal purposes and has been said to be a source of iron and to encourage pregnancy, according to Okafor and Ejiofor (1996). It is thought to increase breastfeeding mother's return, increase postpartum contraction reduction, and boost hunger. Linoleic acid, a precursor to arachidonic acid and a crucial part of membrane phospholipid, is one of the fatty acids found in *Gongronema latifolium* Benth. Arachidonic acid plays a crucial role in numerous processes because it is converted into different prostaglandins, which control things like blood pressure and gastric acid output.
In West Africa, *Gongronema latifolium* Benth is frequently utilized for nutritional and therapeutic purposes. To cure cough, intestinal worms, diarrhoea, dyspepsia, and malaria, the aerial component is infused. In Sierra Leone, the stem is infused or decocted with lime juice and used as a tonic to

alleviate anorexia. It has reportedly been found to contain saponins, essential oils, and other phytochemicals (Schneieder and Brietmeiere, 2003).

*Gongronema latifolium* Benth, a medicinal plant, has been utilized in Nigerian herbal medicine to treat malaria and diabetes mellitus. The majority of South-south and South-eastern Nigeria is where the plant is grown. The plant is grown at a farm by conventional medical practitioners as a vegetable. It has been heavily utilized in the nation's traditional medicine's herb preparation for therapy (Ahamefule *et al*., 2006).

In Africa, using herbaceous plants to heal illnesses has been a long-standing tradition since the dawn of time. One cannot overstate how much humankind has relied on herbs for their therapeutic and dietary benefits (Ezeonwu, 2011). The practice of using plants for a variety of reasons predates recorded human history and is the source of modern medicine. The usage of plant materials in traditional medicine has not changed, and they are now a valuable source for developing novel medications.

Many of the plants that make up our vegetation have been useful in the creation of medications. Alternative healthcare is still used worldwide even though traditional medicine is universally accepted (Ozulua and Alonge, 2008). Drugs used to treat a variety of illnesses are often derived from medicinal plants. You can use the plants by themselves or in conjunction with other plants. These plants have been linked to dietary and medical advantages (Avwioro, 2010, Oroka and Ureigho, 2015).

The phytochemical properties of herbal remedies and the biochemical function of the drug receptor complex generated determine their affinity for treating illnesses (Udoh, 2007). Depending on the dose given and the toxicological principle that the severity and toxicity of a substance depend on the dose and rate of administration, the oral administration of an extract from the leaf of *Gongronema latifolium* by Benth may pathologically affect the activities of liver enzymes (Sakihama *et al*., 2002).

As a result, frequent oral administration of the ethanolic and aqueous extracts of *Gongronema latifolium* Benth's leaf could negatively impact the liver's biochemical processes. The *Gongronema latifolium* Benth leaf is well known for its use as both a popular vegetable and a medicinal plant (Edim *et al*., 2012).

Phytochemicals are chemical substances that naturally occur in plants, may have health effects, and are not yet recognized as necessary nutrients. In addition to contributing to antioxidant activity, hormonal activation of enzymes, interference with DNA replication, and antibacterial effects, phytochemicals give plants their color, fragrance, and texture (Edeoga *et al*., 2005).

Throughout human history, medicinal plants have been identified and used. Many people around the world, especially those in Nigeria, rely on traditional medicines for their basic medical needs (Nsor *et al*., 2012). According to reports, *Gongronema latifolium* Benth lowers blood sugar levels in experimental mice given diabetes. In addition to being a source of vegetables, *Gongronema latifolium* Benth also has beneficial pharmacological effect (Akah *et al*., 2011).

There have been reports of many phytochemicals' methods of action. They may prevent the growth of bacteria, disrupt certain metabolic processes, or alter signal transduction pathways (Kris-Etherton *et al*., 2002; Manson, 2003; Surh, 2003). Chemoprevention refers to the use of substances to suppress, revert, or delay carcinogenesis. Phytochemicals can be employed as either chemotherapeutic or chemo preventative agents. In this regard, chemo preventative phytochemicals are suitable to cancer therapy since chemoprevention and cancer therapy may share some biological pathways (Sarkar and Li, 2006).

Natural antioxidants are essential for maintaining good health and preventing chronic and degenerative diseases like atherosclerosis, cardiac and cerebral ischemia, cancer, neurological disorders, diabetes pregnancy, rheumatoid arthritis, DNA damage, and aging (Uddin *et al*., 2008; Jayasri *et al*., 2009). Numerous free radical-scavenging compounds, such as phenols, flavonoids, vitamins, and terpenoids with high antioxidant activity, are found in plants (Madsen and Bertelsen, 1995; Cai and Sun, 2003).

Ascorbic acid, vitamin E, caratenoids, flavanols, and phenolic compounds found in many plants, such as citrus fruits and leafy vegetables, have the ability to scavenge free radicals in the human body. Phytochemicals with significant antioxidant activities have been found to be essential for lowering the risk of various diseases (Hertog and Feskens, 1993; Anderson and Teuber, 2001). One of the many phytochemicals with the ability to stop the development of cancer is polyphenols (Liu, 2004). The generation of certain cancer-promoting nitrosamines from dietary nitrites and nitrates is typically greatly reduced by phenolic acids.

Human medicine has found uses for the phyto-constituents used by plants to defend themselves from harmful insects, bacteria, fungi, and protozoa (Nascimento *et al*., 2000). Some phytochemicals, like phenolic acids, work primarily by assisting in the decrease of specific adherence of microorganisms to the cells lining the bladder and the teeth, which in turn lowers the frequency of urinary-tract infections (UTI) and the common dental caries.

According to Andreadi *et al*. (2006), phytochemicals may also affect inflammation, redox signaling, redox-sensitive transcription factors, and transcription factors that are susceptible to oxidative stress. Inflammation-related signaling molecule nitric oxide (NO), for instance, is controlled by plant polyphenols and other botanical extracts (Chan and Fong, 1999; Shanmugam *et al*., 2008). Numerous phytochemicals have been identified as phytoestrogens, and as a result of their health-improving properties, these substances are being sold as nutraceuticals (Moutsatsou, 2007).

Nigeria is not an outlier when it comes to using natural treatments and traditional medicines, according to the WHO (2001). Despite all the developments in conventional and contemporary medicine, traditional remedies have recently regained popularity in Nigerian healthcare facilities. This may be ascribed to a greater understanding of the potential and therapeutic efficacy of alternative medicines, especially in light of the severe drawbacks associated with several manufactured pharmaceuticals. Nigeria is a developing country where the majority of the population experiences poverty. This means that the average person cannot afford both prescription medications from the hospital and a traditional supply of protein (egg, fish, beans, and meat). The normal western diet appears to be containing less naturally occurring plant-based foods and more processed fatty meals.

The worrisome statistics on cancer, heart disease, stroke, and other degenerative diseases show the impact of this trend. In addition to these, eating foods based on plants has apparent dietary issues with high fat proteins and simple carbohydrate intake, despite all the health benefits they are known to have. Fewer individuals are aware of the phytochemical compounds that plants contain, despite the fact that consuming foods based on plants provides the diet with much-needed fibre, vitamins, and minerals. Therefore, it is crucial to assess the phytochemical composition of the locally common vegetable *Gongronema latifolium*.

The floras of numerous sections of Nigeria are threatened by rising uncontrolled and indiscriminate exploitation as a result of unscientific, cultural, and agricultural practices. Understanding the many floras, such as *Gongronema latifolium* Benth, could one day result in their being protected by law and being planned for reproduction in the growth of commercial farming. The goal of this inquiry is to review and assess the ethnobotanical applications and phytochemical analysis of the medicinal plant *Gongronema latifolium* Benth, which has the potential to be used to cure a variety of conditions.

## MATERIALS AND METHOD

### Collection of Samples

Farmers in Enugu State provided the *Gongronema latifolium* Benth with their fresh leaves. At the Prince Abubakar Audu University, Anyigba Herbarium of the Department of Plant Science and Biotechnology, the specimens were identified and authenticated. Aluminum chloride, ethanol, potassium acetate, distilled water, saturated sodium carbonate, ammonium hydroxide, acetone, folindenise, tannic acid, sodium carbonate, beaker, filter paper, water bath, and fume cupboard were the chemicals, reagents, and equipment/apparatus utilized.

### Preparation of samples

*Gongronema latifolium* leaves were separated from the stem and cleaned under running water to get rid of any debris. The plant samples were then allowed to air dry at ambient temperature for two weeks, and the dried leaves were then ground into a fine powder, weighed, and stored for analysis in a sterile container. The Biochemistry Laboratory of Prince Abubakar Audu University in Anyigba was the site of the entire analysis.

### Phytochemical Analysis

*Gongronema latifolium* Benth leaf phytochemical examination, including alkaloids, flavoloids, glycosides, glycosides standard curve, saponin, tannin, and phenolic chemicals, was examined using a variety of methods as prescribed by the associations of official analytical chemists' established procedure (A.O.A.C, 1990) detailed in the methodology below:

**Determination of Alkaloids**

5g of the material was weighed and then dissolved in 50ml of an ethanol solution with 10% acetic acid. Before filtering, the mixture was given a vigorous shake and given time to settle for 4 hours. The filtrate should be evaporated to 1/4 of its initial volume. Alkaloids were precipitated with the addition of ammonium hydroxide. The precipitate was rinsed with a 1% NH4OH solution and then filtered using weighted filter paper. A weighted filter paper was used for the filtration. After drying for 30 minutes at 600C in the oven, the precipitate in the filter paper was reweighed.

The weight of the alkaloid was ascertained by weight difference and reported as a percentage of the sample weight examined using the following formula:

$$\% \text{ Alkaloids} = \frac{w_2 - w_1}{W} \times 100$$

W=weight of sample.

$W_1$ =weight of Empty filter paper

$W_2$ =weight of paper plus precipitate

**Determination of Flavonoids**

Following filtration, 25ml of 95 percent ethanol was extracted from 1g of precisely weighed sample under 200 rpm shaking for 24 hours. The filtration volume was then changed to 25ml of 80 % ethanol and the sample was stored in an amber bottle. The Aluminium Chloride colorimetric method was modified from the procedure 80 % ethanol, and then diluted standard solution (0.5 ml) was separately mixed with 1.5 ml of 95 % ethanol, 0.1 m of 10 percent Aluminium Chloride, 0.1 m of potassium acetate, and 2.5 ml of distilled water. After incubation at room temperature for 30 minutes, the reaction mixture's absorbance was measured at 415 nM with a spectrophotometer.

**Determination of Glycosides**

4ml of alkaline picrate was added to 1ml of the sample filtrate in a corked test tube, and the mixture was then incubated in a water bath for 5 minutes. Following the discovery of color development (reddish brown hue), the corked test tube's absorbance at 490 nm was measured using a spectrophotometer. One milliliter of distilled water and four milliliters of an alkaline picrate solution were used as the blank, and their absorbance was measured. A glycoside standard curve was used to extrapolate the cyanide content.

**Preparation of Glycoside Standard Curve**

In a 500ml conical flask, various concentrations of KCN solution containing 5–50ug glycoside were created. NHC (25 ml) was added. In order to create the Glycoside Standard Curve, several concentrations were used.

**Determination of Saponin content**

100ml of isobutyl alcohol (octanol) was added to 2g of sample and mixed evenly for 5 hours to create a homogenous solution. Magnesium carbonate solutions were transferred and saturate the mixture, distilled water was added to the mixture after it had been put into a 100ml capacity flask. The resulting combination was filtered to produce a clear, colorless solution that could be measured at 380 nm by a spectrophotometer. From 1000pm of standard saponin stock solution, approximately 0–5 ppm of standard saponin solution was made, which was then filtered and saturated with magnesium carbonate. For the purpose of determining the gradient of the displayed curve, the absorbance of the saponin standard solution was also measured at 380 ppm.

**Determination of Tannin Content**

Tannin was measured by weighing 0.2g of the sample into a beaker, adding 80ml of acetone, and 20ml of glacial acetic acid, and letting the mixture sit for 5 hours to extract the tannin. To acquire the filtrate, the sample was filtered through a double layer of filter paper after the filtrate had been removed. A series of standard tannin solutions in the range of 0 to 10 ppm was created. At 720 nm, the absorbance of the filtrate and the standard solution were both measured.

**Determination of Total Phenolic Compound**

The sample was ground to a powder with 10 mg of 50% aqueous ethanol and extracted for two hours while being vortexed every fifteen minutes. A 50 ml volumetric flask holding 2.5 ml of the folin-denise reagent and around 25 ml of water at time 0 was filled with the initial extract, 200 ml, and thoroughly mixed. After waiting for three minutes, 5ml of saturated sodium carbonate was added, volume-filled with water, and thoroughly mixed. The absorbance at 760 nm was measured exactly 20 minutes later.

## RESULTS AND DISCUSSION

### Phytochemical Analysis

According to the phytochemical study, phenols (53.105 mg/g), flavonoids (9.635 mg/g), saponins (5.480 mg/g), tannins (1.175 mg/g), and glycosides (0.240 mg/g) were the phytochemicals with the highest concentrations in the leaves of *Gongronema latifolium*. Table 1 shows the mean concentration of the phytochemicals found in *Gongronema latifolium*. The analysis revealed that the mean concentrations of total phenol, flavonoid, saponin, glycoside, and tannin were each 53.105 mg/g, 9.635 mg/g, 5.480 mg/g, and 0.240 mg/g, respectively.

**Table 1 Mean Concentration (mg/g) of Phytochemicals present in *Gongronema latifolium***

| S/N | PHYTOCHEMICALS | CONCENTRATION (mg/g) |
|---|---|---|
| 1. | Tannins | 1.175 ± 0.092 |
| 2. | Glycosides | 0.240 ± 0.000 |
| 3. | Saponins | 5.480 ± 0.014 |
| 4. | Flavonoids | 9.635 ± 0.078 |
| 5. | Total Phenols | 53.105 4.250 |

*Values are expressed as mean ± standard deviation

To assess the bioactive components and ethnobotanical applications of the plant, phytochemical analysis and ethnobotanical uses of the leaves of *Gongronema latifolium* were conducted. The analysis revealed that the mean total phenol concentration was 53.105mg/g. The chemical elements known as phenols, phenols, or polyphenolics (or polyphenol extracts) are widely distributed as natural color pigments that give fruits of plants their color. The enzyme phenylalanine ammonia lyase primarily synthesizes phenolics in plants from phenylalanine (PAL). They serve a variety of purposes and are crucial to plants. The most significant function may be in protecting plants against viruses, herbivores, and predators; as a result, they are used to control human pathogenic diseases. They are divided into three groups: phenolic acids, flavonoid polyphenols (catechins, flavonones, xanthones), and non-flavonoid polyphenols. The most prevalent phenolic component found in plants, caffeic acid, is thought to be followed by chlorogenic acid, which is known to induce allergic dermatitis in people (Kar, 2007).

Phenolics, which can be found in foods like apples, green tea, and red wine, are essentially a variety of natural antioxidants used as nutraceuticals. They have a significant anticancer effect in addition to being thought to significantly reduce the risk of heart disease and occasionally act as anti-inflammatory agents. Flavones, rutin, naringin, hesperidin, and chlorogenic are more examples.

Analyzed *Gongronema latifolium* leaves had a mean content of 9.635 mg/g flavonoids. Among the plant flora, flavonoids are a significant class of polyphenols that are widely dispersed in the leaves. Numerous studies suggest their usage as antioxidants or free radical scavengers since they structurally consist of more than one benzene ring (a variety of $C_{15}$ aromatic compounds) (Kar, 2007). The substances are generated from a parent substance called flavans. It is estimated that there are around 4,000 flavonoids, some of which are pigments in higher plants. Nearly 70% of plant species contain the common flavonoids quercetin, kaempferol, and quercitrin. Along with leucoanthocyanidins, other classes of flavonoids include flavones, dihydroflavons, flavans, flavonols, anthocyanidins, proanthocyanidins, calchones, and catechin.

According to the findings, there were 5.480 mg/g of saponin on average. "Saponaria vaccaria" (Quillaja saponaria), a plant that is rich in saponins and was historically used as soap, is where the word "saponin" originates. Therefore, saponins exhibit "soap-like" behavior in water, producing foam. An aglycone known as sapogenin is generated during hydrolysis. Steroid and triterpenoidal sapogenins are the two varieties. When a sugar molecule is coupled with a triterpene or steroid aglycone, the result is a chemical with a high molecular weight known as a saponin. Steroid saponins and triterpene saponins are two of the main subgroups of saponins. Saponins hydrolyze to produce aglycones, just like glycosides, and are soluble in water but insoluble in ether. Saponins are known to poison cattle and cause blood hemolysis, making them exceedingly poisonous (Kar, 2007).

They taste sour and caustic and irritate mucous membranes in addition to this. They primarily have an amorphous character and are soluble in alcohol and water but insoluble in non-polar organic solvents like benzene and n-hexane. Since saponins are thought to have hypolipidemic and anticancer properties, they are also significant therapeutically. Additionally important for cardiac glycoside action are saponins. Diosgenin and hecogenin are the two main varieties of steroidal sapogenin. In the industrial manufacture of sex hormones for medical purpose, steroidal saponins are employed. Diosgenin, for instance, is used to make progesterone. The most prevalent precursor for the synthesis of progesterone is diosgenin, which was previously obtained from Mexico and is now obtained from China (Sarker and Nahar, 2007). Hecogenin, a precursor substance that may be extracted from the ubiquitous Sisal plants in East Africa, can be used to make other steroidal hormones like cortisone and hydrocortisone (Sarker and Nahar, 2007).

Furthermore, the study found that the mean amount of glycoside concentration was 0.240 mg/g. Glycosides are phyto-constituents that are colorless, crystalline, hydrogen and oxygen-containing (some also contain nitrogen and sulfur), water-soluble, and found in the cell sap. Chemically, glycosides consist of a non-carbohydrate component (aglycone or genin) and a carbohydrate (glucose) (Kar, 2007). Aglycones are represented by ethanol, glycerol, or phenol. Glycosides are reactively neutral and easily hydrolyze into their component parts using mineral acids. Based on the type of sugar component, the chemical makeup of the aglycone, and the pharmacological activity, glycosides are categorized. Glycosides' somewhat archaic or insignificant names typically end in "in," and these names effectively included the source of the glycoside. Strophanthidin from Strophanthus, digitoxin from Digitalis, barbaloin from Aloes, salicin from Salix, cantharidin from Cantharides, and prunasin from Prunus are a few examples (Firn, 2010).

The systematic names, however, are generally created by substituting the "oside" suffix for the parent sugar's "ose" suffix. This class of medications is typically used to increase appetite and facilitate digestion. Though they are chemically unrelated, glycosides—purely bitter particles—are frequently found in plants of the Genitiaceae family and share the same taste—intense bitterness. The bitters act on gustatory nerves, increasing saliva production and stomach emptying. Chemically, the bitter particles contain the lactone group, which can be either triterpenoids or diterpene lactones (for instance, andrographolide) (for example, amarogentin). Due to the presence of tannic acid, some of the bitter particles are also employed as astringents, antiprotozoan agents, or to lower thyroxine and metabolism (Aggarwal and Shishodia, 2006).

Examples include chalcone glycoside (anticancer), amarogentin, gentiopicrin, andrographolide, ailanthone, and polygalin. Cardiac glycosides (acts on the heart) and anthracene glycosides (purgative and for treating skin problems) are more examples. According to Sarker and Nahar (2007), cyanogenic glycoside-containing plant extracts are employed as flavoring components in a variety of pharmacological compositions. Amygdalin has been utilized as a cough suppressant in a variety of preparations as well as in the treatment of cancer (HCN released in the stomach kills malignant cells). Consuming cyanogenic glycosides in excess might be fatal. If not handled appropriately, certain foods that contain cyanogenic glycosides might result in poisoning (severe gastrointestinal irritations and damage) (Sarker and Nahar, 2007).

The findings also revealed a mean tannin concentration of 1.175 mg/g. Plants contain a variety of tannins. They are highly molecular-weighted phenolic compounds. The root, bark, stem, and outer layers of plant tissue all contain tannins, which are soluble in both water and alcohol. Tannins are known for their ability to tan, or turn objects into leather. They react acidically, and the presence of phenolics or carboxylic groups is thought to be the cause of the acidic reaction (Kar, 2007).

They combine to form complexes with alkaloids, gelatin, proteins, and carbohydrates. Condensed tannins and hydrolysable tannins are the two types of tannins. When hydrolyzed, hydrolysable tannins yield gallic acid and ellagic acid; depending on the kind of acid generated, the hydrolysable tannins are referred to as gallotannins. They become pyrogallic acid when heated. Tannins have a phenolic group, which gives them their antibacterial properties. Aflavins (from tea), daidezein, genistein, and glycitein are typical examples of hydrolysable tannins. Numerous diseases are treated with medicinal plants high in tannin. Leucorrhoea, rhinnorhoea, and diarrhea have all been treated with Ayurvedic formulas made from tannin-rich plants (Sarkar and Nahar, 2007).

**Ethnobotanical uses of *Gongronema latifolium* leaves**

*Gongronema latifolium* Benth is widely utilized in the West African region for both therapeutic and dietary purposes. To cure cough, intestinal worms, diarrhoea, dyspepsia, and malaria, aerial parts are infused. Additionally, it is used as a tonic to alleviate appetite loss. As a laxative, the boiled fruits in the soup are consumed. Diabetes and high blood pressure are routinely treated with a decoction of leaves or stems with leaves on them. Patients with asthma who are wheezing should chew fresh leaves. Asthma can also be treated with a cold maceration of the root. They are commonly used as a leafy vegetable and as a spice for sauces, soups, and salads. They are sharp-bitter and sweet. Locally made beer is spiced with the leaves.

The fact that *Gongronema latifolium* Benth is primarily medical means that its health advantages cannot be overstated. Researchers concur that these plants' many parts, including their fruits, seeds, leaves, roots, and bark, contain the essential components utilized for therapeutic purposes. You can extract the essential medicinal components from the various plant leaf parts by blending the fresh leaves or by chewing the seeds, leaves, or fruit. For instance, the leaves can be infused with hot water and left to cool before drinking, while the fresh leaves can be chewed. The roots, on the other hand, cannot be eaten but must be decocted.

## CONCLUSION

*Gongronema latifolium* Benth's leaves are a source of phytochemicals, including tannins, glycosides, flavonoids, phenolic compounds, and flavonoids. These plants have the potential to be quite helpful in preventing a number of ailments. Due to the presence of the aforementioned phytochemical substances, this plant has anti-diuretic, anti-inflammatory, anti-analgesic, anti-cancer, anti-viral, anti-malarial, anti-bacterial, and anti-fungal properties. It is believed that these plants will be beneficial for identifying the phytochemical components that are crucial for the creation of novel medications. The phytochemical analysis of *Gongronema latifolium* Benth is feasible and would offer beneficial information of commercial relevance to research organizations and pharmaceutical companies for the creation of new medications that may be used to treat a variety of illnesses and ailments.

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