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Formulation & Evaluation of Polyherbal Antidiabetic Powder

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Abstract

Diabetes is a silent killer that causes significant economic damage in underdeveloped nations like India. To reduce the strain on a person's health and economy as well as the burden on society as a whole, better therapies must be developed with fewer side effects. The study's primary objective was to create a Evaluation of the polyherbal powder for diabetic mellitus based on organoleptic, rheological, physical, and phytochemical traits. The herbs used to make the polyherbal powder were annona squamosal, Trigonella foenum-graecum, Murraya konini, Aegle marmelos Correa, Mentha spicata Standardized methods were used to conduct the evaluations. The polyherbal powder's organoleptic characteristics were determined to be a dull brown colour, distinctive odour, astringent taste, and a reasonably fine texture. An examination of the phytochemicals revealed the presence of flavonoids, alkaloids, terpenoids, tannins, and carbs, glycosides, and steroids. The polyherbal powder had prolonged stability and good flow characteristics, according to physicochemical examination. Consequently, the polyherbal powder that may be used to treat diabetes mellitus was assessed.

Keywords: formulation; evaluation; polyherbal; antidiabetic; powder; diabetic mellitus; organoleptic

Introduction

The diabetes capital of the world is regarded as being India. The systematic metabolic condition known as diabetes mellitus (DM) is characterized by hyperglycemia, insulin resistance and relative insulin insufficiency, along with abnormalities in the metabolism of carbohydrates, fats, and proteins [1]. Its prevalence is rising alarmingly around the globe, and over time it is anticipated to lead to serious secondary problems such neuropathy, nephropathy, retinopathy, cardiovascular disease, retinopathy, and dyslipidemia [2]. In the current situation, type II diabetes affects around 90% of the young population, primarily as a result of a change to a sedentary lifestyle that includes unhealthy eating habits and little physical activity [3]. There are a number of synthetic medications, including oral hypoglycemic medications and insulin, that can be used to manage blood sugar levels, but their expense, problems, varying degrees of acceptability, and side effects prevent them from being widely accepted. Consequently, there is a critical need for alternate medical treatments for this notable refractory condition highlighted by the Indian Council of Medical Research [4, 5]. Given the evidence, phytotherapy is the most popular and financially successful field of alternative or complementary medicine, and it has been shown to have a "synergy" that is more than the sum of its parts [6]. India is regarded as the emporium of medicinal plants due to the availability of hundreds of different medicinal plants in a variety of bioclimatic zones and the country's long history of employing herbal plants for therapeutic purposes [7]. Traditionally Due to their natural origins and lack of negative side effects compared to synthetic drugs, herbal medicines and their preparations have historically been used in a variety of therapies [8]. Polyherbalism, a term used to describe the use of more than one herb in a phytotherapy formulation to increase therapeutic efficacy, is flourishing. It is necessary for an herb to either target the therapeutic activity to a receptor or to enhance the absorption, distribution, metabolism, and elimination of the other herbs in order to achieve the synergistic effect [9]. The goal of the current study was to examine the pharmacogenetic and physiological aspects of a polyherbal powder (PHP). There is discussion about a few PHP plants that promise to treat DM [10].

Annona Squamosal

Annona squamosa plant is well-known for its low carbohydrate content and is also known to have

antioxidant, anti-diabetic, and enzyme inhibitory action. From the seeds and many other components of these plants, a great number of chemical substances, including as flavonoids, alkaloids, and acetogenins, have been isolated [11]. In addition to this, the flavonoids and alkaloids found in the bark and leaves have demonstrated insecticidal capabilities. Traditional medicines make use of the bark, leaves, and roots. For the treatment of diabetes, the general public mixes four to five recently grown leaves with black pepper (Piper nigrum) [12]. Due to the presence of cyclic peptides, it has historically been employed as an insecticide, anti-tumor, anti-diabetic, anti-oxidant, antilipidemic, and anti-inflammatory agent. We chose the A. squamosa plant, which is produced in the subtropical region of Maharashtra, as an experimental specimen and analysed its phytochemical and nutritional analyses as well as its biological activity because of its remarkable medicinal and nutritional properties. Even though numerous studies on the therapeutic benefits of A. squamosa grown abroad have been published [13].

Trigonella foenum-graecum

Fenugreek galactomannan is one of the components of fenugreek (Trigonella foenum-graecum) seed that contributes to hypoglycemic action (soluble and insoluble). Based on our research, it can be said that fenugreek galactomannan has the capacity to lower blood sugar levels, but other processes, such as peripheral glucose uptake and antioxidant action, do not fully support this claim [14]. The antioxidant activity of fenugreek galactomannan is therefore unimpressive. Moreover, fenugreek galactomannan was discovered to lower excessive amounts of elements linked to diabetes, such as glycosylated haemoglobin. In rats given galactomannan, an additional alloxan-induced loss in hepatic glycogen was reversible. Galactomannan may therefore function through an extra-pancreatic pathway, such as hepatic suppression of glycogenolysis. It appears to lessen the islets of Langerhans' histological damage caused by alloxan, according to histopathological studies conducted during long-term treatment. Alcoholic fenugreek seed extract therapy significantly reduced levels of serum total cholesterol, triacylglycerol, urea, uric acid, creatinine, AST, and ALT [15].

Murraya koenigii

Murraya koenigii also known as "Curry Patta" in Hindi, is a member of the Rutaceae family and is a native of Sri Lanka, India, and other south Asian nations. It is widely used as a spice and condiment in India and other tropical nations [16]. Almost everywhere on the Indian subcontinent typically has it. It has been noted that this plant's various parts have antioxidant, anti-diabetic, and anti-dysenteric properties. It has also been used in traditional and folk medicine to treat traumatic damage, rheumatism, and snake bite [17]. Curry leaf has historically been used to treat diabetes mellitus and as an antidysentery and stimulant. Chemically speaking, alloxan (2,4,5,6 tetraoxypyrimidine) is an oxygenated derivative of pyrimidine and a cyclic urea analogue that has been shown to cause diabetes in rats and rabbits used in experiments. It is a well-known fact that this diabetogenic drug is utilised to cause type 2 diabetes in lab animals. Alloxan's chemical production of experimental diabetes is one of the most effective ways to do so. Despite claims in the literature that the Murraya koenigii plant has hypoglycaemic properties, the plant has not been the subject of scientific research [18].

Aegle marmelos

One of the Rutaceae family's most popular medicinal and nutraceutical plants is Aegle marmelos. Aegle marmelos leaf juice is used to treat oedema and diabetes. Botanically, this plant is said to have a number of therapeutic benefits [19]. One such plant, aegle marmelos, is mentioned in the historic medical text written in Sanskrit, Charak Samhita. One Bael exists in the monotypic genus Aegle. A slow-growing, medium-sized tree, aegle marmelos grows to a height of 25 to 30 feet. The stem is short, thick, fragile, and flaky, and it has spreading, occasionally spiky branches with lower branches that droop. This tree has one-inch-long, acute axial spikes. It is a well-known medicinal plant used in folk medicine and the Ayurveda and Siddha schools of medicine to treat a wide range of illnesses [20]. The Rutaceae family includes Aegle Marmelos, also called bael. Bael is known as tridosh har in Ayurveda, which is a cure for bile, wind, and phlegm5. Aegle marmelos (Bilva), one of the holy trees in Hinduism with spiritual qualities, is seen as a manifestation of Lord Shiva himself. The leaves of Aegle marmelos contained flavone, glycoside, lupeol, rutin, -sitosterol, aegelin, -sitosterol, marmeline, and phenylethyl cinnamamides [21].

Mentha spicata

Mentha spicata commonly known as Mentha viridis, is a Lamiaceae family medicinal plant notable for its capacity to manufacture and secrete secondary metabolites, which are essentially essential oils. According to ethnopharmacological surveys conducted

in various regions across the world, this plant's aerial portions are used by various populations to make tea, and this tisane has a variety of effects [22]. These actions are due to various M. spicata chemicals, the biological effects of which have just just been experimentally demonstrated. For various health benefits, including antioxidant, anticancer, antiparasitic, antibacterial, and antidiabetic activities, the pharmacological characteristics of M. spicata extracts and essential oils were examined [23]. Studies conducted in the lab and on animals revealed beneficial results that may have been caused by various bioactive substances found in M. spicata. Indeed, it appears that several microbiological organisms, including bacteria, fungi, and parasites, are effectively inhibited by volatile chemicals through a variety of methods. Furthermore, M. spicata showed remarkable antioxidant, antidiabetic, anti-inflammatory, and anticancer activities, according to certain research, demonstrating its potential to be used as a source for finding natural medicines against cellular oxidative stress and its associated disorders. Furthermore, toxicological studies of M. spicata demonstrate the species' safety at various doses and for extended periods of time, which justifies its usage in conventional treatments [24].

Material and Methods

Selection and Collection of Herbs

The *annona squamosal, Trigonella foenum-graecum, Murraya koenigii, Aegle marmelos Correa, Mentha spicata* were from the Ahmednagar local market, however special care was taken to ensure that the ingredients were clean and current. After the collection of *annona squamosal, Trigonella foenum-graecum, Murraya koenigii, Aegle marmelos Correa, Mentha spicata*, it was dried in shade for 24 hrs and all ingredients powder with the help of mixer or were reduce in small size and pass through the sieve No.40.

Methods -Preparation of powder formulation

Clean *annona squamosal, Trigonella foenum-graecum, Murraya koenigii, Aegle marmelos Correa, Mentha spicata* were first cut into small pieces and dried outside for one day before being ground separately in a grinder and passing through sieve no. 40. With a mortar and pestle, combine all the powder medications according to the recipe. Following the mixing process, the powder was dried for one hour at 40°C in a hot air oven before being sealed in a container.

Two distinct formulation types were created, and were chosen for further study. The pharmacological action of the ingredients, which has already been established for usage, determines whether they should be included [25].

Figure

Batch Formulation: Table 1

Sr. No	Herbs	Quantity taken for batch 1	Quantity taken for batch 2
1	annona squamosa	15 g	10 g
2	Aegle marmelos Correa	10 g	10 g
3	Trigonella foenum-graecum	10 g	15 g
4	Murraya koenigii	10 g	10 g
5	Mentha spicata	5 g	5 g

Quality Evaluation

It was crucial to determine the quality of the manufactured herbal immunity booster in order to determine its effectiveness and safety. By comparing it to the accepted parameters, evaluation of the phytochemicals and physicochemicals was done. A sensory assessment of hearing, touch, taste, smell, and sight was also done [26].

Sensory Evaluation

Observed sensory evaluation criteria for the polyherbal anti-diabetic powder. The formulation's observed characteristics, including colour, flavour, texture, and general acceptability at room temperature, are shown in Table 2. Based on the evaluation of paired comparisons, the powder has excellent flavour, taste, and overall acceptance. Analysis was also done on changes in sensory characteristics during storage.

Table 2

Parameters	formulation
colour	Strongly like
taste	Strongly like
flavour	Moderate like
texture	Moderate like
Over all acceptability	Strongly like

Physicochemical and Phytochemicals Analysis

Physicochemical and phytochemical measurements were run in order to assess the formulation's appropriateness for nutritional purposes.

Physicochemical Evaluation

Determination of Moisture content

Using the AACC technique, moisture content was measured. A two-gram sample was put into a glass petriplate that had been heated, weighed, and dried in a hot air oven for two hours at 130 °C. till construction. After cooling in the dessicator after being weighed after drying, the glass petriplate was reweighed. Weight loss as a percentage of moisture content was determined [27].

$$Moisture\ content\ (\%) = \frac{w1 - w2}{weight\ of\ sample}\ x\ 100$$

W1 = weight of sample before drying
W2 = weight of sample after drying

Determination of Ash content

AACC approach was used to quantify and characterize the ash content.Two grams of the material were put into a pre-weighed crucible, which was then exposed to a muffle furnace's 820°C for four hours before being cooled in a dessicator and weighed [28].

$$ash(\%) = \frac{weight\ of\ ash}{weight\ of\ sample}\ x\ 100$$

Angle of Repose

The angle of repose was measured using the stationary funnel technique. A funnel was positioned above graph paper that was laid out horizontally and fastened with its point at a specific height (h). The mixture was meticulously poured through the funnel until the conical pile's peak touched the funnel's tip. The cylindrical pile's base's radius was calculated. The following method was used to determine the angle of repose:

Tan θ = h/r; Where, θ = Angle of repose, h = Height of the cone, r = Radius of the cone base.

Angles of repose values between 25 and 30 show outstanding flow properties, 31 to 35 show good flow properties, 36 to 40 show acceptable flow properties, and 41 to 45 show passable flow properties. Angles of repose values between 40 and 60 imply a poorly flowing substance [29].

Bulk Density

A dry 100 milliliter container was filled with a 15 g powder mixture without being compacted. Without compacting, the powder was meticulously leveled, and the unsettled visible volume, Vo, was measured. The following method was used to determine the mass density [30].

ρb = M / Vo; Where, ρb = Apparent bulk density, M = Weight of sample, V = Apparent volume of powder.

Tapped Density

Following the steps outlined in the measurement of bulk density, the sample-containing cylinder was first tapped 500 times, then 750 more times, until the difference between the succeeding measurements was less than 2%. The tapped volume, Vf, was then measured to the nearest graduated unit. Using the following method, the tapped density was determined in grams per milliliter [31].

ρtap = M / Vf; Where, ρtap = Tapped density, M = Weight of sample, Vf = Tapped volume of powder.

Carr's index The Compressibility index

(Carr's index) is a metric for a powder's tendency to be compacted. It can be calculated using the mass and pierced densities. Theoretically, a substance is more flowable the less deformable it is. It serves as a gauge for the relative significance of particle interactions. Such interactions are typically less important in a free-flowing powder, and the values of the bulk and tapped densities will be closer. There are commonly more particle contacts in poorly moving materials, which results in a larger discrepancy between the bulk and tapped densities. The Carr's Index, which is computed using the following methods, reflects these variations [32].

Compressibility index = [(ρtap - ρb) / ρtap] / ×100

Where, ρb = Bulk Density, ρtap = Tapped Density.

Hausner's Ratio

The Hausner's ratio is a proximate indicator of particle movement simplicity. The method used to determine it is as follows. Tapped density (PT) / Bulk density (B) is known as Hausner's Ratio. Where T represents tapped density and B represents bulk density. Hausner's ratios between 1.25 and 1.5 show middling flow properties, while those over 1.5 show bad flow. Lower Hausner's ratios (1.25) suggest better flow properties than larger ones [33].

Phyto chemical Evaluation

Test for glycosides

Cardiac glycoside (Keller-Killiani test): Extract (0.5 g) was shaken with distilled water (5 mL). To this, glacial acetic acid (2 mL) containing a few drops of ferric chloride was added, followed byH2SO4 (1 mL) along the side of the test tube. The formation of brown ring at the interface gives positive indication for cardiac glycoside and a violet ring may appear below the brown ring [34].

Test for tannins

Extract (leaf and bark, 0.5 g each) was separately stirred with distilled water (10 mL) and then filtered. A few drops of 5% ferric chloride were then added. Black or blue-green coloration or precipitate was taken as positive result for the presence of tannins [35].

Test for Steroid (Salkowski test)

The crude extract (about 100 mg) was separately shaken with chloroform (2 mL) followed by the addition of concentrated H2SO4 (2 mL) along the side of the test tube, a reddish-brown coloration of the interface indicates the presence of steroid [36].

Test for flavonoids

The stock solution (1 mL) was taken in a test tube and added few drops of dilute NaOH solution. An intense yellow colour was appeared in the test tube. It became colourless when on addition of a few drops of dilute acid that indicated the presence of flavonoids [37].

Result and Discussion

Phytochemicals Analysis

The powder formulation was tested for the presence of glycoside, steroids, tannins, Flavonoid. The qualitative results are expressed as the presence and absence of phytochemicals.

Table 3: phytochemical analysis

Sl. No	Constituents	Result
1	Glycosides	Present
2	Tannins	Present
3	Steroids	Present
4	Flavonoids	Present

Table 4: Physiochemical Evaluation Table 4 physiochemical evaluation.

Sl No.	Parameters	Result Batch 1	Result Batch 2
1	Moisture content	0.81%	1.01%
2	Ash value	4.5%	4.7%
3	Angle of repose	30.6	30
4	Bulk density	0.5	0.46
5	Tapped density	0.625	0.609
6	Carr's index	20	24.07
7	Hausner's Ratio	1.25	1.317

Conclusion

The current study establishes the hypoglycemic activity of polyherbal powder. The leaves of the plant contain several chemical substances that are capable of producing different types of pharmacological activities using various mechanisms. Traditionally this plant was used to treatment of diabetes these polyherbal powder can be used as effective polyherbal antidiabetic powder formulation. people with diabetes can benefit from the mixture. Since the formulation is made from a plant source, it is less likely to cause adverse effects than marketed Type 2 diabetics drugs. All the herbs used in this preparation are easily available during any season and are not costly thus the product is economically feasible.

Conflict of interest

There are no conflicts of interest.

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