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FORMULATION AND EVALUATION OF ANTI DIABETES POLYHERBAL CHURNA

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Abstract

Background: Ayurvedic formulations are used to treat a wide variety of diseases including diabetes mellitus Standardization of herbal formulation is essential in order to assess the quality of drugs.

The present paper reports standardization of eight herbal anti-diabetic drugs–Momordica charantia (seeds), Syzigium cumini (seeds), Trigonella foenum (seeds), Azadirachta indica (leaves), Emblica offi cinalis (fruits), Curcuma longa (rhizomes), Gymnema sylvestre (leaves), Pterocarpus marsupium (heart-wood) individually and in polyherbal marketed samples of Baidyanath Madhumehari Churna Material and Methods: Shivayu Madhuhari Churna, NTIMeghdut Madhushoonya Churna and were compared to the in-house preparation for physicochemical properties.

The limits obtained from the different physicochemical parameters of the individual eight herbal drugs and the marketed formulations could be used as reference standard for standardization of the anti-diabetic drugs in a quality control laboratory.

Key words: Herbal antidiabetic drugs, physicochemical parameters, polyherbal formulation, standardization.

Aim :- To Prepare An Formulation And Evaluation Anti Diabetes Polyherbal

Churna

Objective :-

Five points of management of diabetes are

(a) to follow a healthy diet.

(b) exercise regularly.

(c) take appropriate medications.

(d) undergo investigations.

(e) be educated about this condition.

Literature Review

SuchitaGokhale, et al, June 2020 :-The Anti- diabetes poly herbal churna sector is probably the largest unit sale among the diabetes patient care products since diabetes churna are one of the Herbal products used in daily life. The herbal anti- diabetes was Formulated using natural ingredient like Moringa. Gudmar and karela with proven efficacy of diabetes patient preparation is prepared. The combination of several such ingredient of herbal origin has made it possible to secure highly effective herbal Churna. The formulation at laboratory scale was done and evaluated for number of parameters to ensure its safety and efficacy.

Priya D. Gaikwad et.2018-The objective of this study is to formulate and evaluate polyherbal churna for diabetes patient purpose from herbal ingredients. Gudmar powder , karela ,

Haldi .

(Termeric powder) , Jamun seed with powder ,gudvel powder , vijaysar wood , Babul wood , Maithi beej , bael patra , Amla powder , ,Neem leave , Tulsi leaf powder. .Gudmar powder, karela and Jamun seed powder was procured from localmarket in powdered form also churna form gudmar powder and amla powder is prepared by homemade method, then prepared decoction of these ingredients and mixing with each other and evaluated for it'sorganoleptic and physicochemical characteristics. Herbal churna is used to cleansing of the diabetes churna powder also conditioning. smoothing, of the diabetes surface, good health of body, churna diabetes patient, and Jamun seed and all, it's safety benefits are expected.

Dhayanithi S et. 2021-The aim of the article is to formulate a pure herbal churna and to evaluate its physicochemical properties. The diabetes churna is enriched with herbal extracts

without any synthetic additives. The herbal extracts used in formulation are Sapindusmukorossi,

Glycyrrhizaglabra, Azadirachtaindica, Nardostachysjatamansi, Ocimumtenuiflorum,

Lavendulaangustifolia, Musa acuminate.

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Introduction

In the present era, market of all commodities has become global. Health has been of utmost importance since ancient times for the mankind. Market of health related products has been active and these products are manufactured at different parts of the world and sold all over. Standardization is necessary to make sure the availability of a uniform product in all parts of the world.

Standardization assures a consistently stronger product with guaranteed constituents.

WHO collaborates and assists health ministries in establishing mechanisms for the introduction of traditional plant medicines into primary healthcare programs, in assessing safety and efficacy, in ensuring adequate supplies, and in the quality control of raw and processed materials. Herbal formulations in general can be standardized schematically as to formulate the medicamentusing raw materials collected from different localities and a comparative chemical efficacy of different batches of formulation is to be observed. A preparation with better clinical efficacy has to be selected. The routine physical, chemical, and pharmacological parameters are to be

checked for all the batches to select the final finished product and to validate the whole manufacturing process.

In India, diabetes is a serious disease due to irrational food habits. Most of the hypoglycemic agents and hypolipidemics used in allopathic practice to treat diabetes mellitus and hyperlipidemia are reported to have side effects in long term use. Hence, there is the need to search for effective and safe drugs for these ailments.

Pharmaceutical research across the world shows that natural products are potential sources of novel molecules for drug development.

Based on the above rationale the present study was undertaken with an aim to standardize some herbal antidiabetic drugs based on their physicochemical characteristics and compare them with marketed formulations and in-house developed formulations.

The present paper reports the standardisation of herbalantidiabetic drugs based on organoleptic characters, physical characteristics, and physicochemical properties.

Ingredients for in-House Formulation as labeled in Shivayu Madhuhari churna

Ingredient

Ingredients	Taken Quantity
1)Gudmar	30 gm
2)Karela	10 gm
3)Haldi	10 gm
4) Jamun seed	10 gm
5) Gudvel	5 gm
6)Vijaysar wood	5 gm
7) Babul	5 gm
8) Maithi Beej	5 gm
9)Bilva patra	5 gm
10)Alma	5 gm
11)Neem patra	5 gm
12)Tulsi leaf	5 gm

MATERIALS AND METHODS:

Different herbs based on exhaustive literature survey were selected and these were authenticated by the Head Department of Pharmacy Barkatullah University Bhopal. Purified water was used in the entire study.

Method of Preparation

1. All the individual drugs were dried using hot air oven at 40ºC for 24 hours.

2. The individual drugs were then crushed using Willing grinder and passed through mesh no. 40.

3. The individual drugs were then weighed as per the quantity required on digital precision balance (Accuracy: 0.1g, Jyoti Scientific, India).

4. The drugs were mixed geometrically using double cone blender (Jyoti Scientific, India; TIP/PCS/DCB/01). The mixed formulation was unloaded in a polythene bag, weighed, labeled and packed in glass bottles. The weight of the formulation was 100 grams. Two formulations with different herbs were prepared. Both the formulations were prepared with same method as reported.

1) Gudmar

Gudmar is a wood climbing shrub whose leaves are used for medicinal purposes. Gudmar or Gudmar is considered to be a magical remedy for diabetic patients as it is highly effective in both type I and type II diabetes mellitus. It reduces blood sugar levels by enhancing the level of insulin in the body. You can also take Gudmar (Gurmar) churna or kwatha with water to help manage cholesterol by reducing the levels of bad cholesterol (LDL)Sannageraseham and increasing good cholesterol (HDL).

Applying Gudmar leaves powder along with coconut oil once a day helps to reduce itching, burning sensations on the skin and also helps in effective wound healing.intak Excessive intake of Gudmar should be avoided as it may cause weakness and excessive sweating with shakiness.

Fig no. 01 Gudmar powder

What are the synonyms of Gudmar?

Gymnema sylvestrae, Mesha-shringi, Madhunashini, Ajaballi, Avartini, Kavali, Kalikardori, Vakundi, Dhuleti, Mardashingi, Podapatri, Adigam, Cherukurinja, Sannagerasehambu.

Properties of Gudmar:

The beneficial properties of gudmar may include:

- It may have a blood sugar lowering effect
- It may have a cholesterol-lowering effect
- It may have anti-inflammatory properties
- It may benefit in maintaining a healthy weight
- It may have antimicrobial activity[1]
- It may have anti-cancer activity
- It may have antioxidant activity
- It may have antiarthritic activity
- It may have an immunomodulatory effect
- It may benefit stomach health
- It may benefit liver health
- It may have anticaries activity (may reduce tooth decay)[3]
- It may have a wound healing effect.[2]

Potential Uses of Gudmar:

Gudmar may have potential uses for various ailments; however, more human studies are needed to support its true scope in humans.

Gudmar may be used as:

- Powder
- Gudmar extract paste
- Crude plant
- Tablet
- Capsule[1]

Botanical name :- Gudmar, also called Gymnema Sylvestre,

family :- Asclepiadaceae.

Biological sources:- Gymnema is a woody climbing plant found in central and southern India, tropical Africa, and Australia. It has been used traditionally in Ayurvedic

medicine for the treatment of "honey urine". Extracts from the leaves contain alkaloids, phenols, tannins, flavonoids, and saponin.

Chemical constituents :- Gymnemic acid is one of the highly effective chemical constituents of Gudmar which acts as a cardiovascular stimulant. Other chemical constituents include tartaric acid, gurmarin, calcium oxalate, glucose, saponins.

2) Karela

Karela Churna is enriched with goodness of Karela.Karela is enriched with Vitamins and nutrients which help in protecting us from harmful diseases.It helps in regulating blood sugar level and is very beneficial for people suffering from diabetes.It is enriched with antioxidants and helps in boosting immunity.

It reduces the blood glucose levels in both type I and type II diabetes.
Key Ingredients:
Karela Extract
Key Benefits:

- Helpful in treatment of Diabetes mellitus
- Beneficial for healthy functioning of liver
- Helps in improving digestion
- Aids in maintaining healthy hair and skin
- Promotes weight lolos

Fig no. 02 karela powder

Synonym:- Bitter melon

Family :- Cucurbitaceae

Biological sources:- The plant is cultivated as medicinal as well as vegetable crop widely in India, China and South East Asia (Behera).

Chemical constituents:- The main constituents of bitter melon (Karela) are triterpene, protein, steroid, alkaloid, inorganic, lipid, and phenolic compounds 5. Momordica charantia (Karela) consists the following chemical constituents those are alkaloids, momordicin and charantin.

Uses :- It reduces the blood glucose levels in both type I and type II diabetes. Consuming a glass of karela juice is so effective that diabetes patients need to reduce the dosage of their medicines. In fact, it can also help manage gestational diabete

3) Haldi (Termeric powder)

Given turmeric's properties, some researchers believe that turmeric could help people with diabetes in several ways. A review paper published in the journal Evidence-Based Complementary and Alternative Medicine in 2013 focused on more than 200 research papers that linked turmeric and curcumin with diabetes. The takeaways? Turmeric, or curcumin, might help with:

- Managing blood sugars
- Reducing insulin resistance
- Preventing fatty liver disease
- Lowering total and LDL (bad) cholesterol levels
- Possibly preventing complications of diabetes, such as neuropathy and kidney disease

Turmeric can interact with some medications. For example, it can enhance the effect of blood thinner medications, increasing the risk of bleeding. If you take diabetes medication, turmeric may increase the risk of low blood sugar. And turmeric may interact with other medications, such as antidepressants, antibiotics, and chemotherapy treatments. Be sure to talk with your health care provider before taking turmeric or curcumin supplements. Avoid taking them if you are pregnant or breakbeat.

Turmeric is a common spice that's widely used in Indian cuisine. It is not just food turmeric is used in; however, there are various other uses that you might not know about, such as cosmetics and religious ceremonies. Because of its bright yellow colour, turmeric is also known as the 'Indian saffron' or the 'the golden spice'. With more than 100 chemical compounds present in it, turmeric is often called a miraculous spice.

Fig. no. 03 Haldi (Termeric powder)

Turmeric and its ingredient curcumin may assist in controlling diabetes. Studies have shown that it can reduce blood sugar levels, increase insulin sensitivity, and prevent weight gain.

Advantage :-

Turmeric and its ingredient curcumin may assist in controlling diabetes. Studies have shown that it can reduce blood sugar levels, increase insulin sensitivity, and prevent weight gain. Always talk to your doctor before starting a supplement to ensure it's safe for you.

Disadvantaged :- Turmeric usually does not cause significant side effects; however, some people can experience stomach upset, nausea, dizziness, or diarrhea. In one report, a person who took very high amounts of turmeric, over 1500 mg twice daily, experienced a dangerous abnormal heart rhythm.

Synonym Haldi :- curcuma longa, Haridra, Curcuma, Haldi , Halada

Family :- Zingiberaceae

Biological sources :- Turmeric is a product of Curcuma longa, a rhizomatous herbaceous perennial plant belonging to the ginger family Zingiberaceae, which is native to tropical South Asia.

Chemical constituents :- Curcumin is a bright yellow chemical produced by plants of the Curcuma longa species.

4) Jamun seed

Take a glass of water and add one teaspoon of jamun powder to it. Stir well and drink this mixture first thing in the morning to reap its benefits. Alternatively, you may also consume it with low-fat dairy milk or almond milk before meals to maintain healthy blood sugar levels.

The dried and powdered seed of the Jamun is frequently used in India to manage diabetes .For years, Jamun seed powder has been used as a natural way to maintain a healthy blood sugar level, as well as treat cardiovascular and gastrointestinal

problems. Clinical nutritionist Dr. Lovneet Batra suggests that you can dry the seeds of jamun and create a powder from it. Consume half a teaspoon of it with water on an empty stomach daily to deal with diabetes.

Jamun seeds contain alkaloids, which convert starch into energy and helps in reducing diabetes symptoms like constantly feeling thirsty and frequent urination. Jamun seeds, in powdered form can help in reducing blood sugar levels.

synonym: Syzygium jambolana, Eugenia jambolana.

family :- Myrtacea

Biological sources :-

Jamun is native to the Indian Subcontinent and other regions of Southeast Asia that includes Sri Lanka, Myanmar and the Andaman Islands.

It is commonly known as Indian blackberry or Jamun.

Fig no. 04 Jamun seed with powder

Advantage :- Take a glass of water and add one teaspoon of jamun powder to it. Stir well and drink this mixture first thing in the morning to reap its benefits. Alternatively, you may also consume it with low-fat dairy milk or almond milk before meals to maintain healthy blood sugar levels.

Disadvantaged :- As reported in the literature, flatulence, delayed digestion, laryngitis, inflammation in the lungs, and emphysema are all possible side effects of jamun.

Benefits :- Because of its low glycemic index, diabetic patients should consume Jamun during the summer. It alleviates diabetic symptoms such as excessive urination or pushing. The extracts of the leaves, seeds, and bark are very successful in treating diabetes.

5) Gudvel

Gudvel is mainly used for fever, hay fever, small cuts, diarrhoea, acidity, bloating, flatulence, anaemia, jaundice, and urinary tract infections. It also has anti-cancer, anti-diabetic, anti-depressant, learning and memory-enhancing, anti-osteoporotic and anti-arthritic properties which need more research.

Benefits powder of Guduchi for diabetes It regulates the blood sugar level by reducing oxidative stress, enhancing insulin release, and reducing the production and breakdown of glucose in the body. Guduchi is especially useful for type 2 diabetes.

Synonyms :- Gilo, Giloe, Guduchi

Family :- Menispermaceae

Biological sources :- Giloy (Tinospora cordifolia)

Chemical constituents :- Major constituent of Tinospora cordifolia: terpenoid, alkaloid, lignans, steroids.

Fig no. 05 gudvel powder

6) Vijaysar wood

Vijaysar is widely used in Ayurveda as a “Rasayana” (rejuvenating) herb. The bark of Vijaysar has significant importance in Ayurveda in managing diabetes and is also known as “The miracle cure for Diabetes” mainly due to its Tikta (bitter) nature. Vijaysar helps to manage blood sugar levels by preventing the damage to pancreatic cells and promoting insulin secretion due to its antioxidant and anti-inflammatory activity. Drinking water kept overnight in glasses made of Vijaysar wood is an age old practice for keeping blood sugar levels in control.

Taking 1-2 Vijaysar capsules twice a day is also good for diabetes and weight loss Vijaysar protects the liver against cell damage caused by free radicals due to its antioxidant activity. Vijaysar is effective in improving heart health by decreasing the production of bad cholesterol and fatty acids and also keeps a check on body weight due to its antioxidant and anti-inflammatory properties. Vijaysar might be beneficial for managing diarrhea by decreasing the frequency of stools due to its antidiarrhoeal property and also helps to expel intestinal worms due to its anthelmintic activity. Vijaysar powder along with water can be applied on the skin to manage skin problems like inflammation and infections due to its antibiotic and anti-inflammatory properties. Applying Vijaysar leaf juice along with honey on wounds promotes wound healing.

Fig. no 06 vijaysar wood

7) Babul wood

The powder form of flower, leaves, bark, pod, and wood may be used for leucorrhoea. Chewing babool bark and a decoction of the bark may be useful in cough.

Advantage of babul wood

Potential Uses of Babool for diabetes

The results showed that the babool extract might have a blood glucose lowering effect. It exhibited a reduction in blood glucose, triglycerides, and cholesterol. This means it may help lower the risk of heart diseases as well.

Disadvantaged of babul wood

The ingestion of any parts of the babul tree can lead to digestive problems. Ingestion is harmful in many other ways and is thus not recommended. Some individuals are also allergic to this plant due to the presence of gum or resin. They may develop an allergic reaction in the form of skin rashes or wheezing.

Synonym :- gum arabic tree, babul, Egyptian acacia or thorny acacia

family :- Fabaceae.

Biological sources :- It is native to Africa, the Middle East and the Indian subcontinent.

Chemical constituents :- Gum of the tree contains calcium, magnesium and potassium, malic acid, sugar. Bark and pods contain a large quantity of tannins.

Fig no. 07 Babul wood

8) Maithi beej

Fenugreek seeds may be helpful for people with diabetes. The seeds contain fiber and other chemicals that may slow digestion and the body's absorption of carbohydrates and sugar. The seeds may also help improve how the body uses sugar and increases the amount of insulin released.

uses of Methi in diabetes

Methi may be helpful in diabetes as it increases insulin sensitivity by controlling the glucose transporters and signaling transduction in the liver and adipose tissue. According to animal studies, intake of Methi increased the levels of glucose transporter-2 and 4 in the liver and adipose tissue. Methi might help improve the condition of insulin resistance. It may also help the liver to perform better.[2] Diabetes is a serious health condition that requires you to adhere to a doctor's advice and treatment.

Fig no. 08 Maithi beej

Synonyms :- Methinl, deepanl

Family :- Fenugreek

Biological sources:- Fenugreek (Trigonella fornum graecum)

Chemical constituents :- steroids sapogenins, isoleucine, and galactomannans.

9) Bilva patra

The bark and branches of bael are rich with a compound-Feronia gum that reduces the elevated blood glucose level. In Ayurveda, bael is an essential remedy for diabetes. Bael stimulates the pancreas and helps them to produce insulin that controls sugar levels in the blood.

¼ to ½ teaspoon with warm water, once or twice daily, or as directed by your health practitioner. Please consult with your health care practitioner prior to the use of this product if you are pregnant or nursing, taking medications, or have a medical condition. Keep out of the reach of children.

Fig no. 09 bael patra

Synonyms :- Shandilya, shailusha, malura, shreephala

Family :- Rutaceace

Biological source :- Bael (Aegle marmelos (L.) Corr.) is an important medicinal plant of India. Leaves, fruits, stem and roots of A.

10) Amla powder

Amla Churna is made from amla or gooseberry which is a rich natural source of vitamin C and has a multitude of other benefits. Divya Pharmacy brings to you Amla Churna to aid in digestion, to detoxify your system, to help you fight respiratory problems and boost your immunity.

Most health experts also suggest eating amla or Indian gooseberries to manage blood sugar levels. Amla is known for its immunity-boosting properties and is known to be a great remedy for diabetes.

Benefits churna

- Immunity: ...
- Fights Infections and Prevents Chest Congestion: ...
- Prevents Constipation: ...
- Aids Weight Management: ...
- Acts as a Natural Blood Purifier: ...
- Helps Manage Chronic Conditions: ...
- Improves Eyesight: ...
- Relief

Family :- Euphorbiaceae

Biological sources :- Dried ripe fruits of Embelica officinalis.

Chemical constituents :- Ellagic acid, emblicanineA, emblacani, gallic acid, phyllatine. Uses- it increases blood glucose metabolism, lowers blood sugar levels, and avoids toxin buildup.

Fig. no10 Amla powder

11) Neem leave

The bitter leaf of neem is an effective remedy for treating diabetes as they are loaded with flavonoids, triterpenoid, anti-viral compounds and glycosides, which may help manage blood sugar levels. To make neem powder, take some dried neem leaves and grind them in a blender until smooth.

Neem leave for good diabetes patient

Since neem is a bitter food, it is touted as a good choice for diabetics. Dr Jaina recommends chewing 4 leaves of the herb every morning to control blood sugar levels. "It induces the production of insulin that lowers blood sugar and treat diabetes," she added.

Benefits of Neem patra churna

Neem leaf powder purifies the blood, battles free radical damage, flushes out toxins, treats insect bites and cures ulcers. Furthermore, the powerful anti-fungal, anti-bacterial properties of neem leaf powder facilitates in treating worm infestation, burns, skin disorders and triggers the immune system.

Fig no. 11) Neem leave

Synonyms :- Neem tree, Nimb, limba, Nim tree

Family :- Miliaceae

Biological sources :- It consist of dried powder of the leaves of the plant Azadirachta

Chemical constituents :- Nimbin, Nimbidinin, Nimbandiol.

Plant part used :- leave

12) Tulsi leaf

Synonyms :- Tulsi, Holy basil, padina Pavonica.

Biological sources :- It consists of dried powder of the leaves of the plant ocimumsantum.

Family :- Lamiacea

Plant part used :- leaves

Chemical constituents :- Eugenol , tannin, vitamin C, tarteric acid ,volatile oil, Carvacrol, fixed oil, alkaloids.

It is also good for diabetes as it possesses hypoglycaemic properties which are known to help lower blood sugar levels. It is recommended to include tulsi in your diabetic diet plan.

It is said that having two-three tulsi leaves on an empty stomach in the morning can amplify its benefits. Most people grow tulsi at home but tulsi needs to be consumed the right way for the right effective.

Fig no. 12) Tulsi leaf

Evaluation Test

1. **Water soluble extractives**

Five grams of coarsely powdered air-dried drug was macerated with 100 ml of water in closed conical flask for 24 hours, shaken frequently for the first 6 hours and allowed to stand for 18 hours. This was filtered through Whatman filter paper grade no.100. Twenty-five milliliters of the filtrate was evaporated to dryness in petri dish, dried at 105 °C, and weighed. Percentage of water soluble extractive with reference to air-dried material was calculated.

2. **Alcohol soluble extractives**

Five grams of air-dried and coarsely powdered drug was macerated with 100 ml of 70% ethanol in a closed conical flask for 24 hours, shaken frequently during the first 6 hours, and allowed to stand for 18 hours. This was filtered rapidly taking precaution against loss of ethanol. Twentyfive milliliters of the filtrate was evaporated to dryness in a petri dish, dried at 105° C, and weighed. Percentage of alcohol soluble extractive was calculated with reference to air-dried drug.

3. **Ether soluble extractives**

Five grams of air-dried and coarsely powdered drug was extracted with ethyl ether in a soxhlet extractor for 20 hours. The ether extract was transferred in a petri dish and allowed to evaporate. It was dried at 105° C to constant weight. Percentage of ether soluble extractive was calculated with reference to air-dried drug.

4. Physicochemical properties

Physical characteristics like moisture content, bulk density, tap density, angle of repose, Hausner ratio, and Carr's index were determined for different formulations.

5.Moisture Content

The shade-dried drug was grounded in a mixer grinder. The powder passed through #40 and retained on #120. Accurately weighed 10 g of # 40/120 drug powder was kept in a tared evaporating dish. This was dried at 105°C for 5 hours in tray drier and weighed. The drying was continued and weighing was done at one-hour interval until difference between two successive weighings corresponds to not more than 0.25 percent. Drying was continued until a constant weight was reached with two successive weighings after drying for 30 minutes and cooling for 30 minutes in a desiccator was showing not more than 0.01 g difference.

6. Carr's Index

Carr's index has been used as an indirect method of quantifying powder flowability from bulk density; this method was developed by Carr. The percentage compressibility of a powder is a direct measure of the potential powder arch or bridge strength and stability, and is calculated according to following equation.

Carr's index (% compressibility) = 100 × (1 - Db / Dt)

Where Db = Bulk density, Dt = Tapped density

Hausner Ratio Hausner ratio has been also used as indirect method of quantifying powder flowability from bulk density.

Hausner ratio = Dt / Db. Where Db = Bulk density and Dt = Tapped density.

7. pH of suspension of the drugs

pH of freshly prepared 1% w/v suspension and 10% w/v suspension in distilled water was determined using simple glass electrode pH meter.

8. Ash values Total ash

Two grams of grounded air-dried material was accurately weighed in a previously ignited and tared silica crucible. The drug was gradually ignited by raising the temperature to 450°C until it was white. The sample was cooled in a desiccator and weighed. The percentage of total ash was calculated with reference to air-dried drug.

9. Acid Insoluble ash

The ash was boiled with 25 ml of 2 M hydrochloric acid for 5 minutes, the insoluble matter was collected on an ash less filter paper, washed with hot water, ignited, cooled in a desiccator, and weighed. The percentage of acid insoluble ash was calculated with reference to the air-dried drug.

RESULTS :

The formulation showed potential for its use in anti diabetic Formulated in the sense that the in house prepared formulation possesses a comparable activity when compared to that of the marketed formulation.

Conclusion

In the present study it was concluded that the physicochemical parameters such as the water-soluble, alcohol-soluble, and ether-soluble extractive values, moisture content, bulk density, tapped density, Carr's index, Hausner's ratio, pH, water-soluble ash, acid-insoluble ash, and organoleptic characteristics can be efficiently used for standardization of herbal anti-diabetic drugs individually and in a polyherbal formulation. The results obtained from the study could be utilized as a reference for setting limits for the reference standards for the quality control andquality assurance of anti-diabetic drugs.

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